give us no scientific insights on questions of what to do, what not to do, or why to do things.

The youth of today and mature scientists in increasing numbers are turning to meditation, oriental religions, and personal use of psychedelic drugs. The phenomena encountered in these ASC's provide more satisfaction and are more relevant to the formulation of philosophies of life and deciding upon appropriate ways of living, than "pure reason" (*17*). My own impressions are that very large numbers of scientists are now personally exploring ASC's, but few have begun to connect this personal exploration with their scientific activities.

It is difficult to predict what the chances are of developing state-specific sciences. Our knowledge is still too diffuse and dependent on our normal SoC's. Yet I think it is probable that state-specific sciences can be developed for such SoC's as auto-hypnosis, meditative states, lucid dreaming, marijuana intoxication, LSD intoxication, self-remembering, reverie, and biofeedback-induced states (*18*). In all of these SoC's, volition seems to be retained, so that the observer can indeed carry out experiments on himself or others or both. Some SoC's, in which the volition to experiment during the state may disappear, but in which some experimentation can be carried out if special conditions are prepared before the state is entered, might be alcohol intoxication, ordinary dreaming, hypnogogic and hypnopompic states, and high dreams (*18*). It is not clear whether other ASC's would be suitable for developing state-specific sciences or whether mental deterioration would be too great. Such questions will only be answered by experiment.

I have nothing against religious and mystical groups. Yet I suspect that the vast majority of them have developed compelling belief systems rather than state-specific sciences. Will scientific method be extended to the development of state-specific sciences so as to improve our human situation? Or will the immense power of ASC's be left in the hands of many cults and sects? I hope that the development of state-specific sciences will be our goal.

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# PaleoIndian Settlement Technology in New Mexico

## Both intercultural and intracultural variations in settlement are defined by an archeological survey.

W. James Judge and Jerry Dawson

The portion of the central Rio Grande Valley dealt with in this article comprises some 3000 square miles of relatively unbroken plains and plateau-type terrain near Albuquerque, New Mexico (Fig. 1A). Long the scene of both professional and amateur archeological activity, the valley is known to have been occupied continuously for at least 12,000 years. Recently, a formal archeological survey was conducted to investigate evidence of variation in the settlement locations of the PaleoIndians who occupied the area some 7,000 to 10,000 years ago. The boundaries of the region are well-defined topographically by mesas and mountain ranges, which facilitates its study as a geomorphologic and ecological entity.

Evidence derived from surface collections made prior to the formal survey indicated occupation of the area by at least four PaleoIndian cultures: Clovis, Folsom, Belen, and Eden (Cody complex). The Clovis, Folsom, and Eden manifestations closely parallel those found elsewhere in the Plains area (*1*). The Belen type appears to be related to the "parallel-flaked" Plano horizon, specifically to the Milnesand and Plainview projectile point types, and may be a local variant of this generalized category (*2*).

Because of the considerable size of the central Rio Grande Valley, and its potential for providing information regarding PaleoIndian settlement patterns, it was necessary to employ a survey

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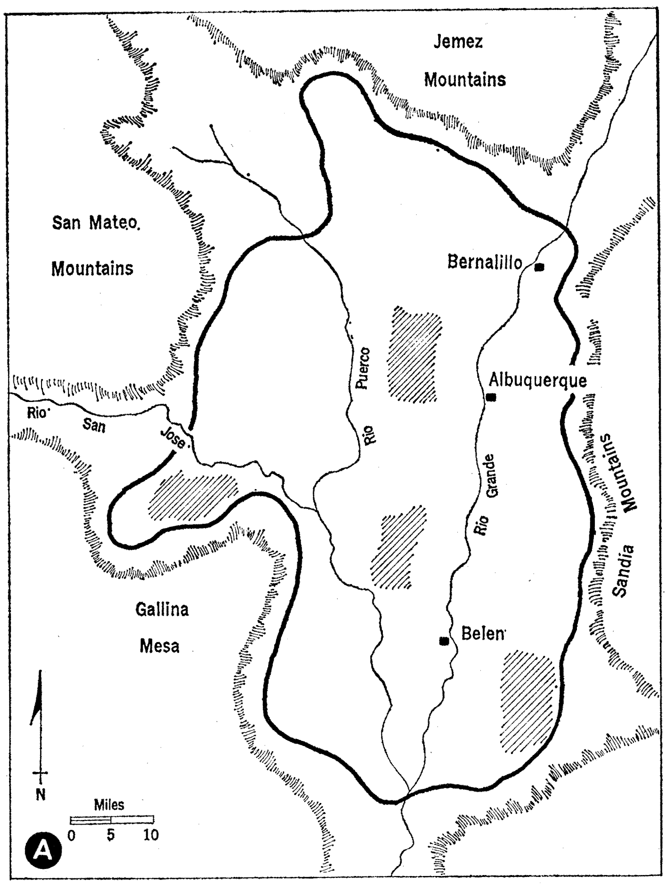


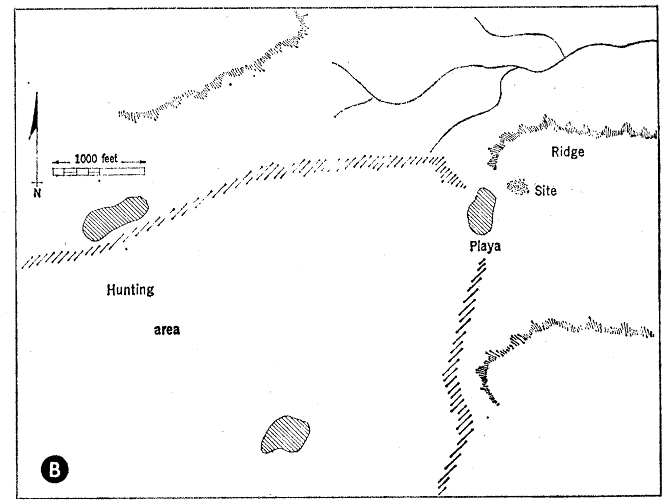


Fig. 1. (A) General map of the central Rio Grande Valley showing the major drainages and surrounding mountainous topography. The area surveyed is described in heavy outline. Shaded portions represent the major hunting areas. PaleoIndian sites tend to be concentrated at the northeast ends of these. Minor hunting areas (not shown) are dispersed throughout the region. (B) Map of one of the Folsom base camps that is typical of the basic PaleoIndian settlement pattern of the area. It can be seen that, although other playas were available, the one with the overview and drainage components nearby was selected for utilization as a site location.

technique that would provide the most reliable sample of sites possible. The technique adopted, site pattern recognition, had been employed informally with considerable success for a number of years by J. D. Baker and by E. Baker of the Albuquerque Archeological Society. Basically, the technique involves recognizing, from known site locations, the key environmental criteria employed by PaleoIndian groups in their selection of sites and applying these criteria formally to the interpretation of aerial photographs of the area to be surveyed (*3*).

The basic pattern with which our survey was initiated involved a particular combination of selected environmental components focusing on extinct Pleistocene playas or ponds, which are abundant in the central Rio Grande Valley. Investigation of settlement data from the known Folsom sites in the area revealed that these sites were generally found on the slopes of low, stabilized dunes located northeast of the playas. Generally, the sites had a well-developed drainage in the vicinity (*4*). Further, those playas selected for occupation were generally situated near broad, open areas, which would have been suitable as rangeland for megafaunal populations. We have termed such areas hunting areas and have arbitrarily divided them into the categories major and minor on the basis of relative size. In each instance the dune ridge on which the site was found commanded an excellent view of both the playa and the hunting area. We have termed these ridges overviews for purposes of analysis. This constellation of environmental components (playa, overview, drainage, hunting area), which constitutes the basic PaleoIndian settlement pattern in the survey region, is illustrated in Fig. 1B. The formal survey technique involved locating this array of environmental features on aerial photographs or topographic maps, or both, listing the potentially suitable site areas, and then surveying these areas for surface indications of PaleoIndian cultural material.

Although the literature on North American PaleoIndians is quite extensive (*5*), most of this information has been derived from the analysis of kill sites, and only limited data on PaleoIndian campsites have been available. This has obviously lent a bias to the interpretation of early cultural behavior. Our survey of the central Rio Grande Valley has helped counteract this bias by providing information on 59 PaleoIndian occupational loci, of which a total of 33 were campsites. The remaining 26 have been classified as localities (for example, loci where limited or specialized activities took place). No kill sites were encountered during the survey. As indicated in Table 1, Folsom and Belen assemblages dominate the survey sample, followed by Eden and Clovis.

All the sites located are surface manifestations, exposed through eolian deflation, which has taken place recently in the survey area. The sites were identified by the presence of lithic tools and flakes similar to those found in excavated PaleoIndian sites on the Great Plains and elsewhere in the Southwest (*1*). Artifacts commonly encountered included preforms, scrapers, knives, drills, gravers, and spokeshaves. The sites were defined as belonging to a specific cultural period on the basis of complete or fragmentary projectile points found in association with the other artifacts. All visible artifacts were collected each time a site was visited.

The number of implements varied considerably from site to site, from a minimum of 13 to a maximum of 230. No actual count was made of the total number of lithic waste flakes encountered, nor were these systematically collected from the surface, since the

Table 1. Summary of the PaleoIndian occupational loci of the survey area.

| Cultural type | Sites (No.) | Localities (No.) |
|---|---|---|
| *Classified PaleoIndian* | | |
| Clovis | 1 | 1 |
| Folsom | 15 | 14 |
| Belen | 9 | 4 |
| Cody complex | 5 | 4 |
| Subtotal | 30 | 23 |
| *Other data* | | |
| Proto-Folsom | 1 | 0 |
| Mixed assemblages | 1 | 2 |
| Unclassified PaleoIndian | 1 | 1 |
| Total | 33 | 26 |
| Total occupational loci: | 59 | |

majority of the sites showed evidence of rather extensive erosion, which, in addition to livestock grazing, has in all probability physically displaced the lithic material from its original context. For the same reason, no individual implement locations were considered reliable enough to record for analysis of intrasite clustering of artifacts.

The archeologists' general problem, determining the degree of artifact concentration that constitutes a site, was perhaps less pronounced in our survey area, where flake concentrations were quite distinct. Such an area was considered a tentative site until diagnostic PaleoIndian artifacts were discovered (on subsequent visits, in many instances), at which time the area was designated a site and given a number. When the survey was complete, sites which each yielded less than 2 percent of the total number of artifacts per culture were arbitrarily classified as localities, and these are not included in the present analysis.

Although in the absence of controlled, and often extensive, excavation no archeological site can be classified definitely as an unmixed assemblage, it was felt that if frequent visitation yielded evidence of only one PaleoIndian projectile point type, a site could reliably be considered as representing a single culture. The few sites that revealed occupation by more than one PaleoIndian culture are not included in the analysis.

Due to the characteristic minimal depth of the sites in the area and their probable disturbance by erosion and grazing, the value of future controlled excavation is questionable. It thus became necessary to maximize the interpretative potential of the archeological survey itself as a primary analytic tool. To this end, methods of collecting data in the field were oriented toward a thorough recording and interpretation of the lithic and environmental variables relevant to determining the settlement technology of prehistoric occupants. Here settlement technology is defined as the primary medium of articulation between a cultural system and its environment, a concept comprising, in effect, all the cultural and environmental variables that a group of people consider relevant in determining the actual location of a habitation site or area of special activity. This involves the interaction of key cultural components of social organization, material culture, and subsistence strategy with selected components of the physical, natural, and social environments. It was found that an understanding of a specific settlement technology was best achieved by analyzing its cultural and environmental components independently, and then examining the articulation of the two together. Variations in settlement technology could then be defined in terms of differential constellations of cultural and environmental subsystem components.

In interpreting the cultural component of the survey data, a total of 1486 artifacts from the 30 single-component campsites were submitted to extensive qualitative and quantitative analyses. In addition, data on 18 independent environmental variables were processed in a similar manner. An initial understanding of the lithic technology of the four cultures was thus achieved, and this in turn permitted the isolation of the key lithic variables which, in articulation with selected environmental components, served to define the various PaleoIndian settlement technologies.

As a result of this type of analysis, both intercultural and subcultural variations in settlement technology were found to exist in the PaleoIndian cultures represented by the survey sample.

## Intercultural Variation

Intercultural variation in settlement technology was defined on the basis of the data derived from the Folsom, Belen, and Eden materials. The Clovis data, drawn from a single campsite, were not comprehensive enough to permit generalization.

Of the many environmental variables possible, the PaleoIndian occupants of the central Rio Grande Valley selected three which they evidently considered essential as minimal requisites for the establishment of campsites: water, overview, and hunting area. Analysis of data from each PaleoIndian assemblage revealed a number of significant intercultural variations, based primarily on the distances from the sites to each of these three basic environmental variables (Table 2). Intercultural variation was then expressed in terms of distinctive constellations of these selected components.

Of the environmental requisites, the necessity for water was certainly anticipated, but the overview-hunting area combination is to our knowledge not reported elsewhere. It is possible that this combination may have special reference only to the survey region in the central Rio Grande Valley, but it might

Table 2. Environmental data summarized by culture, based on analyses of 30 campsites. Frequency of occurrence is given as percentage of the total per culture.

| Cultural assemblage | Nearest water source | | | | | Overview | | | Hunting area | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Frequency of type (%) | | | Average distance (feet) | | Frequency of type (%) | | Average distance (feet) | Frequency of type (%) | | Frequency of direction (%) | | Average distance (feet) |
| | Playa | Stream | Spring | Horizontal | Vertical | At site | On ridge | | Major | Minor | NE | SW | |
| Folsom | 73 | 27 | | 109 | 15 | 40 | 60 | 73 | 66 | 34 | 20 | 80 | 1290 |
| Belen | 67 | 22 | 10 | 160 | 30 | 56 | 44 | 53 | 45 | 55 | 34 | 66 | 1395 |
| Cody | 20 | 60 | 20 | 444 | 61 | 40 | 60 | 80 | 60 | 40 | | 100 | 2550 |

prove beneficial to search for this pattern in other regions also. An outline of the particular settlement pattern basic to each cultural phase is given below and in Table 2, and is followed by a discussion of the general trends in settlement technology suggested by the analysis.

1) *Folsom.* As shown in Fig. 2A, the basic Folsom pattern involves a combination of playa, ridge, and drainage in the configuration represented. Less evident in the illustration is the strong tendency on the part of Folsom to locate sites toward the northern ends (possibly downwind) of major or relatively large, hunting areas. On the average, Folsom sites are closer to these hunting areas than are the other PaleoIndian sites. The distinctiveness of the Folsom pattern, however, lies in the close proximity (vertically and horizontally) of the sites to water and in the key role of the playas as sources of water. As indicated, Folsom sites are generally situated farther from overviews than are the Belen sites, and at about the same distance as Eden sites. These distinctions become more obvious when the basic Folsom pattern is compared with those derived from the remaining PaleoIndian data.

2) *Belen.* The Belen sites (Fig. 2B) are generally found farther from water than are Folsom sites, but most distinctive is a concern with the overview as a key component in the locational pattern. The Belen pattern exhibits the highest percentage of sites located at overviews and the closest mean distance for those sites not actually situated on the overview itself (Table 2). A unique feature of the Belen pattern is the consistent selection of a flat landform for the site location. The sites not on ridge tops were located on flat shelves of the ridge slopes. Also, the Belen sites are generally farther away from hunting areas and somewhat more laterally located with respect to these areas than the Folsom sites are. Sites located near minor (smaller) hunting areas outnumber those near the major ones.

3) *Eden.* Significant to the Eden pat-

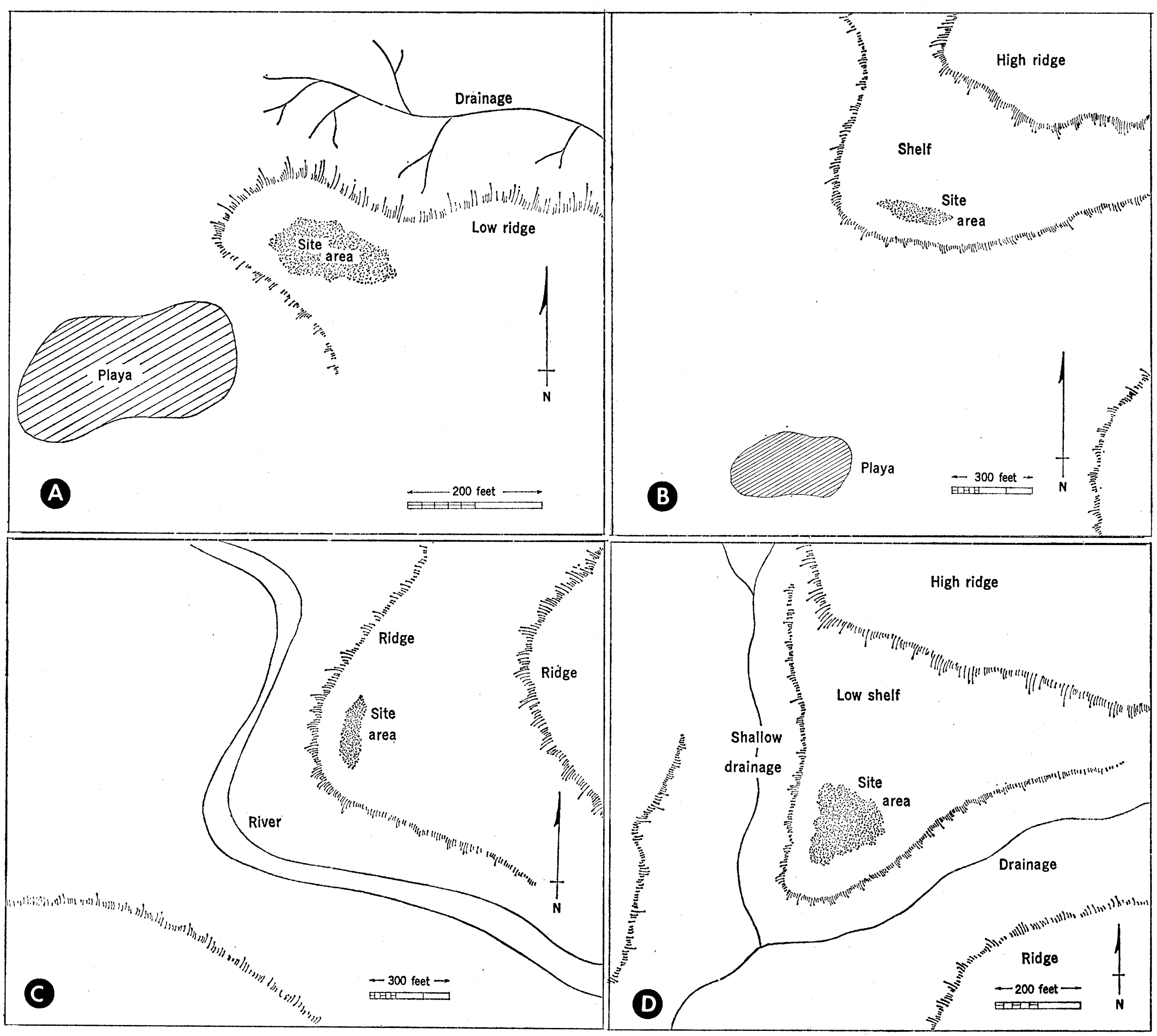


Fig. 2. Diagrams of specific site locations with settlement patterns typical of PaleoIndian cultural phases (scale varies as indicated). The variation in the locations of water sources and overviews with respect to the sites can be seen. In each case the hunting area lies off the map to the southwest of the site location. (A) Folsom, (B) Belen, (C) Eden, (D) Clovis.

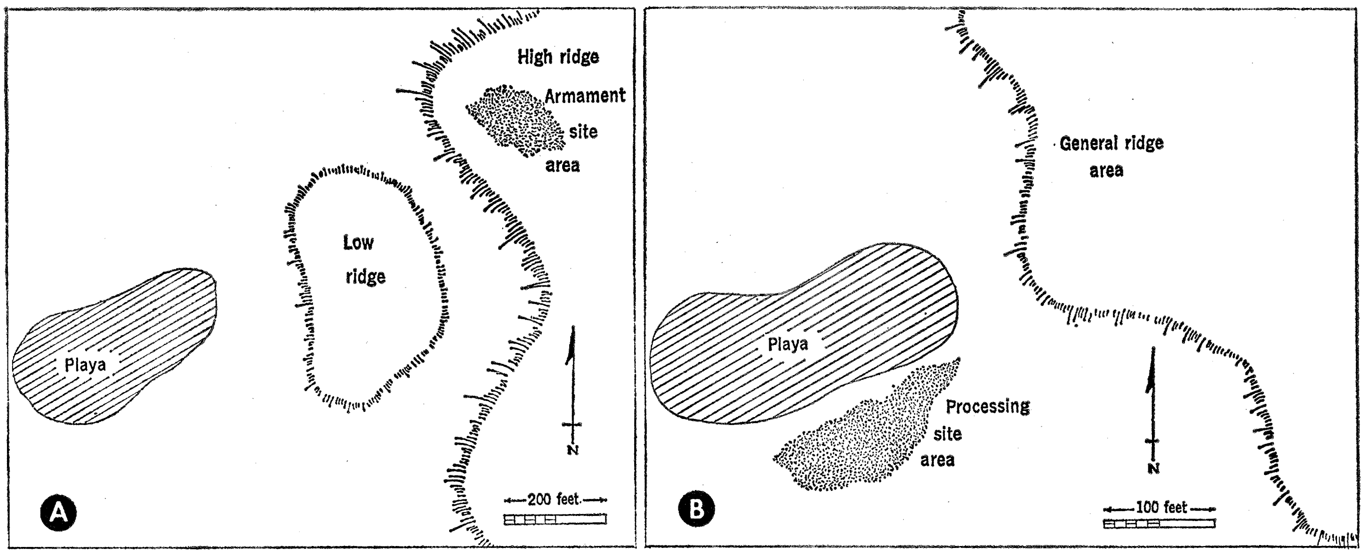


Fig. 3. Subcultural variation in Folsom site patterns as suggested by a functional analysis of lithic implements recovered. (A) Armament activities are inferred at these ridge sites from evidence of projectile point manufacture. (B) Processing activities are suggested near playa edges, based on analyses of microscopic wear patterns of tools.

tern (Fig. 2C) is the location of campsites in areas of much more pronounced topographical relief than those associated with the other PaleoIndian patterns. This is reflected in the average distance from Eden sites to water, which was the greatest of all, and in the distance to the hunting area, which was the greatest. Furthermore, there is a strong de-emphasis of the playa as a key environmental component. Instead, most of the nearest sources of water were streams (Table 2). As indicated, the data for the overview variable are quite similar to those of Folsom, but this apparent similarity is conditioned considerably by the distinctive topography resulting from the increased distance to water and hunting areas characteristic of the Eden pattern.

If the above assemblages are viewed as representing a temporal progression within the PaleoIndian tradition, several apparent trends in PaleoIndian settlement technology emerge. First, there is a general progression from the Folsom emphasis on proximity to a major hunting area with very specific locational relationships to it, to the Eden pattern of increased distance from the hunting area with much less concern for specific directional relationships. Second, there is a general increase through time in the distance from a site to the nearest water, and the playa itself becomes increasingly less important as a source of water. Finally, there is a general increase in the elevation of the sites relative to the water source and an accompanying emphasis on the proximity to the overview. Although generalizations about Clovis settlement technology cannot be made on the basis of the limited data available, it is interesting to note that the single Clovis site fits well into the early end of this sequence (Fig. 2D). The site is in close proximity to a water source, which would have been quite reliable during the climatic conditions prevalent in Clovis times, and is approximately the same distance from a hunting area as the average Folsom site.

General trends defined by these variations in settlement technology cannot be considered valid for the PaleoIndian tradition as a whole, since they may be related specifically to ecological and physiographic conditions peculiar to the central Rio Grande Valley. However, based on these data, some explanations can be suggested which may have bearing on the interpretation of sites encountered elsewhere, in other environmental contexts.

We believe that the key to the explanation of the intercultural variation in PaleoIndian settlement technology in the survey area lies in the critical environmental component of water. This is not necessarily water required to satisfy human needs, since humans are quite flexible in this respect. However, animals, specifically large herbivores, cannot get along well without a constant supply of water. Under modern conditions, for instance, cattle cannot survive in the grazing areas of the survey region without artificial water sources.

If we assume that in early PaleoIndian times environmental conditions were such that playas were good sources of water, the hunting areas of the central Rio Grande Valley could have supported numerous animals dependent on these playas for water supply. Such conditions would explain the Folsom capability of exercising a good deal of selectivity in choosing the environmental components most favorable to both human encampment and game capture. By Eden times, however, the amount of effective moisture might well have deteriorated to the extent that the playas themselves were no longer adequate sources of water for the animal population. The animals would then seek out grazing areas located closer to streams, rivers, and springs, which would serve as more reliable water sources. By the same token, human groups at this time would select areas near the game supply for their campsite locations. Indeed, all of the Eden sites in our sample were found near sources of water which are still running today.

The Belen occupation might well represent an intermediate stage. Playas evidently still contained water at that time, although perhaps only intermittently. The impression one gets from an analysis of Belen settlement technology is one of an adaptation quite similar to that of Folsom, but with a less abundant supply of game. Such a situation might well result from a relative decrease in the amount of moisture, which would affect floral coverage, water availability, and, ultimately, the location and structure of the megafaunal population.

The point is that the intercultural variability manifest in the data derived from the survey is apparently a function of a PaleoIndian strategy involving adaptation to a megafaunal water source. In other words, water was a variable critical to PaleoIndian settlement technology only in the sense that it conditioned the location of large herbivores.

## Intracultural Variation

Subcultural variation in settlement technology was found in both the Folsom and Belen assemblages. Presumably, it also exists in Clovis and Eden assemblages, but we lack sufficient data to permit reliable generalization about these two at the intracultural level.

1) *Folsom.* As noted above, the basic settlement pattern involved the selection of a specific array of environmental variables. Further analysis revealed that, within the general requisites for Folsom site location, more particular constellations of features were chosen for the loci of specific kinds of activity. These loci are interpreted as armament sites, processing sites, and base camps. These types of sites were distinguished on the basis of variations in the lithic components that were found in articulation with the specific environmental variables. The interpretation was facilitated considerably by an understanding of the particular lithic technologies involved, derived through an intensive analysis of the artifacts represented. The importance of such analysis cannot be overemphasized (*6*), since an understanding of the technology is crucial to the proper interpretation of artifact function and, ultimately, of site utilization.

Folsom lithic technology focused around the production of the bifacial projectile point preform and involved very efficient utilization of raw material (*7*). With few exceptions, most Folsom tools served many functions, a fact appropriate to the interpretation of variation in the Folsom settlement subtypes.

The armament sites (Fig. 3A) have yielded primary evidence of processing the Folsom preform, as determined by a thorough functional analysis of the lithic material recovered. As indicated in Fig. 3A, this activity took place most frequently in locations offering a good view of the surrounding terrain, particularly the hunting areas. Proximity to water was not a key variable for these task locations. It is suggested that these sites may have been centers of male-associated activities, either in preparation for a hunt or, perhaps, in post-hunt weapon renewal.

Table 3. Test of association between Folsom scraper wear and selected environmental components, distance to overview and distance to nearest water. (O) Observed value, (E) expected value.

| Scraper wear | More than average distance (No.) | | Less than average distance (No.) | | Total observed (No.) |
|---|---|---|---|---|---|
| | O | E | O | E | |
| | *To overview* | | | | |
| Hard | 25 | 33.8 | 25 | 16.1 | 50 |
| Soft | 55 | 46.1 | 13 | 21.8 | 68 |
| Total | 80 | | 38 | | 118 |
| | $\chi^2 = 12.476$; d.f. = 1; $P < .01$ | | | | |
| | *To nearest water* | | | | |
| Hard | 33 | 25.9 | 18 | 25.1 | 51 |
| Soft | 27 | 34.1 | 40 | 32.9 | 67 |
| Total | 60 | | 58 | | 118 |
| | $\chi^2 = 6.964$; d.f. = 1; $P < .01$ | | | | |

Proximity to water was a key attribute of the processing sites, which were generally found near or at the edges of the playas (Fig. 3B). Analyses of microscopic wear patterns on tools from these sites revealed a high incidence of polished, rounded working edges, indicating that they were probably used on soft materials such as hides rather than for cutting and shaping bone, antler, or hardwoods. A test of association between the occurrence of "soft" wear scrapers and distance to water indicates that the correlation is significant (Table 3). Although there is evidence of limited weapon renewal in the form of projectile point bases, the lower number of preforms and higher incidence of transverse scrapers at these sites indicate that implement production was focused primarily on nonweaponry (utility) artifacts. It is suggested that the sites were possibly post-hunt in nature and that the selection of key environmental variables was connected with female-associated activities. They are termed processing sites on the basis of evidence of hide-working and general maintenance and utility functions, including, perhaps, butchering activities.

Table 4. Test of association between Belen scraper wear and selected environmental components, distance to overview and distance to nearest water. (O) Observed value, (E) expected value.

| Scraper wear | More than average distance (No.) | | Less than average distance (No.) | | Total observed (No.) |
|---|---|---|---|---|---|
| | O | E | O | E | |
| | *To overview* | | | | |
| Hard | 7 | 13.8 | 52 | 45.1 | 59 |
| Soft | 13 | 06.1 | 13 | 19.8 | 26 |
| Total | 20 | | 65 | | 85 |
| | $\chi^2 = 14.538$; d.f. = 1; $P < .1$ | | | | |
| | *To nearest water* | | | | |
| Hard | 46 | 36.0 | 13 | 22.9 | 59 |
| Soft | 6 | 15.9 | 20 | 10.0 | 26 |
| Total | 52 | | 33 | | 85 |
| | $\chi^2 = 23.219$; d.f. = 1; $P < .1$ | | | | |

The sites termed base camps (Fig. 2A) were evidently multiple-activity locations of more intensive occupation. Three Folsom base camps were found in the area surveyed, and over 60 percent of the Folsom artifacts were derived from these sites. All three are strategically located with reference to major hunting areas, playas, and overviews. However, the key variable common to all of the Folsom base camps is the proximity to a source of fresh water in the form of a stream. This certainly suggests selection of a location with relatively more permanency in mind. Whether this means extended occupation by a single group or multiple occupations by a number of groups remains one of the problems to be solved through continued research.

2) *Belen.* With regard to the Belen occupation, a subcultural pattern quite similar to the Folsom pattern was revealed by further analysis of the Belen data. The distinction between Belen and Folsom at this level is a function of the fact that Belen sites fall within the range of variation of the basic Belen pattern (Fig. 2B). Correlations between scraper wear and the distances to water and the overview proved significant in the Belen assemblages (Table 4), and the same settlement taxonomy utilized in the Folsom situation was applied.

This particular taxonomy (armament, processing, and base camps) is suggested solely for the purpose of illustrating the extent and nature of the subcultural variation that exists in the PaleoIndian assemblages of the central Rio Grande Valley. In no way are these categories or labels proposed as final; they are offered instead as hypotheses which merit testing elsewhere in other environmental circumstances.

## Conclusions

We suggest that intercultural variation in PaleoIndian settlement technology, as found in the survey of the central Rio Grande Valley, can be most easily explained in terms of the PaleoIndian adaptation to a megafaunal water source. Site locations were selected which would take fullest advantage of the megafaunal dependence on water. As the character of these water sources changed during the early postglacial period, PaleoIndian site situations were altered to adapt to these changing circumstances. Although there has been some debate about the nature and extent of the altithermal period (*8*), there is little doubt that, in general, postglacial climatic conditions were somewhat drier than those of terminal Wisconsin times (*9*). It is suggested that this gradual change toward increasing dryness may explain much of the intercultural variation in PaleoIndian settlement technology within the survey area.

Further, it was noted that significant intracultural variation in PaleoIndian settlement technology can be documented for the Folsom and Belen assemblages on the basis of variations in activities performed as evidenced by specific articulations of selected environmental and lithic components. More adequate data for Clovis and Eden would undoubtedly permit the recognition of similar variation in these cases also. The subcultural patterns were found to be quite similar for Folsom and Belen. For both cultural phases, base camps represent multiple activities, while the two other types of settlement loci represent activities of a more specific nature. Armament sites were used primarily for the production of weaponry and are located in strategic overview situations that permit visual reconnaissance of the hunting area. Processing sites were used for hide-working and other maintenance tasks and are located close to sources of water. It is suggested as a hypothesis that a sexual division of labor may be involved in the distinction between the two task locations.

It is hoped that other regions will yield PaleoIndian data of a comparable nature so that similar analyses can be undertaken. If so, the information derived from this survey may prove helpful in the framing of questions appropriate to attaining a better understanding of the adaptive strategies of early hunting groups on this continent.

**References and Notes**


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**NEWS AND COMMENT**

# Rainmaking: Rumored Use Over Laos Alarms Arms Experts, Scientists

For the past year, rumors and speculation, along with occasional bits of circumstantial evidence, have accumulated in Washington to the effect that the military has tried to increase rainfall in Indochina to hinder enemy infiltration into South Vietnam—in effect, using the weather as a weapon of war. But Pentagon officials have been extremely tight-lipped about it, even to prominent members of Congress, and it appears that the old saying is now turned around: The generals are probably doing something about the weather, but nobody's talking about it. *The Pentagon Papers* makes references to such activities as having been successfully carried out in Laos, and a Jack Anderson column in the Washington *Post* a year ago described a top-secret operation over the Ho Chi Minh trail.

The only denial so far has come from Department of Defense (DOD) Secretary Melvin R. Laird in congressional testimony. However, all Laird denied was the use of weather control "over North Vietnam," and, since the Anderson column and *The Pentagon Papers* concern Laos and the Ho Chi Minh trail, which runs through Laos and Cambodia, no real answers to the speculations have been provided.

The DOD has admitted that various forms of climate modification have been considered by the military for more than 20 years. A well-known geophysicist formerly with DOD's Institute for Defense Analyses, Gordon J. F. MacDonald (who now sits on the Council for Environmental Quality), wrote a Cassandra-like chapter on potential geophysical warfare in 1968, which described control of rainfall, drought, earthquakes, and even possible tinkering in the Arctic.* The Indochina allegations are limited to charges that the DOD has augmented rainfall to muddy up trails, thus hindering the flow of men and vehicles to the south, but some scientists and arms experts regard even this limited activity as a camel's nose under the geophysical tent.

The issue has an important scientific dimension, too, for meteorology is one of the most internationally minded of all scientific fields. Many prominent U.S. meteorologists have for years favored a ban on military uses of weather control. Describing their reactions even to the possibility that these techniques have been used, they use such words as "distressed," and "appalled." They add that weather control in Indochina could hurt international, peaceful weather research. Hence, the issue of whether the DOD has been, or might be, seeding clouds over Asia holds implications beyond the horizons of Indochina alone.

The only direct evidence that

* G. J. F. MacDonald, "How to wreck the environment," in *Unless Peace Comes: A Scientific Forecast of New Weapons*, Nigel Calder, Ed. (Viking Press, New York, 1968).