Palynological Records of
Joe's Valley Alcove:
A Multicomponent Site in
Southeast Utah

by
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Pollen analysis of a series of eighteen samples from Joe's Valley Alcove was undertaken between January and April, 1974, at the Palynology Laboratory of the Department of Anthropology at Arizona State University. Pollen was extracted from six sediment samples removed from archaeological contexts at two other sites in the district but no analysis has yet been undertaken on that series. The extraction of pollen followed the routine procedure of this laboratory, which is essentially the procedure published by Mehringer (1967a). Additional extraction of woody tissues and charcoal was required, however. The objectives of the research were two-fold: to determine the feasibility of palynological research in these deposits, and to identify similarities and differences of any pollen record from the Joe's Valley locality to those of localities of similar age elsewhere in the Southwestern or Western regions.

The palynological record of the Joe's Valley Alcove deposits (Figure 1) may be recognized as breaking down into a series of categories:

Category 1: This is represented by the 3 samples collected from the modern surface on the talus slope east of the cave. Arboreal Pollen values for this group are moderately high, reaching values equivalent to those of surface samples indicative of greater than normal effective moisture values from archaeological sites on the Colorado Plateau (Schoenwetter, 1970). Juniper pollen constitutes a significantly substantial portion of the AP, and grass pollen values are not significant. Mormon tea pollen occurs only in this category of samples. The single pollen spectrum from the Fremont cultural horizon is also a member of this pollen category. This indicates that environmental conditions occurring at Joe's Valley Alcove during Fremont times were essentially as they are observed today.

There is a substantial, and I believe particularly significant, difference between the pollen records of Category 1 and those of any other category. Principally, this is expressed in the relationship of juniper to pine pollen as contributors to the AP frequency. It is also expressed in the persistence, despite the occurrence of relatively high AP values, of a variety of Non-Arboreal Pollen types. The pollen records of Category 1 have a distinctive "feel", of the magnitude of difference normally judged significant for zonation of a pollen sequence. I interpret the records of Category 1 as indicative of a climatic condition distinct from that indicated by the records of the other pollen categories.

Category 2. This category incorporates samples having Arboreal Pollen values between 22.0 and 58.5 percent. Such AP values are indicative of "normal" effective moisture values at most archaeological sites on the Colorado Plateau, though at Joe's Valley Alcove they represent an environment drier than occurs at the present time. The sample collected from the culturally sterile deposit intermediate between the Fremont and the Archaic Horizons is one member of this category. Other members of this group are the sample from level 3 at Profile 235, the sample from
level 1 at Profile 235, and the upper two samples collected from level 1 at Profile 186. It is not unlikely that the sample from the culturally sterile layer represents a distinct sub-category, since all of the other members of the group contain much higher percentages of grass pollen. However, I am reluctant to identify a sub-category on the evidence of a single pollen record. Pollen Category 2 represents environmental conditions substantially drier than occur today or occurred during the Fremont occupation in the Joe's Valley Alcove area.

Category 3. The samples of this category have AP values statistically equal to those of specimens from the Colorado Plateau indicative of higher moisture values than occur in that region today. Juniper pollen contributes no significant proportion to the AP record of samples of this category, and pollen of oak and sagebrush contributes less to the pollen spectrum than is characteristic of samples of Category 1. Two samples of this group were collected from level 2 of Bed 1; the third sample derives from the base of level 1 at Profile 186, at the interface with level 0. Samples of this category represent an environment significantly wetter than occurs today at Joe's Valley Alcove.

Category 4. Samples of this category contain less than 22% AP; in this regard they are similar to samples from the Colorado Plateau indicative of low effective moisture values. One sample of this group was obtained from level 3 at Profile 186, another came from the middle portion of level 1 at Profile 186; and the third was recovered from level 0 at that profile. It is not unlikely that the samples from the middle portions of level 1 at Profile 186 which yielded insufficient pollen for analysis would prove to be members of this category if analyzed. The samples of Category 4 represent very dry conditions of environment. Such dry conditions could reduce pollen rain by affecting the reproductive strength of the pollen producers of an area, and at the same time be responsible for a greater rate of aeolian deposition at the site. Both effects could result in a lowered frequency of pollen per unit number of volume of deposit, which would be observed by us as an insufficiency of pollen for analysis.

The specimen from level 3 might represent a distinctive subcategory, since it contains a significantly great amount of sagebrush pollen and quite little grass pollen. In these regards it is unlike any of the other samples from Bed 1. In any case, the specimen allows recognition that the very dry conditions of level 3 were not essentially like those which occurred during the depositions of levels 0 and 1. Probably, they involved the establishment of a substantially different flora.
<table>
<thead>
<tr>
<th>Provenience</th>
<th>Pollen Category</th>
<th>Inferred Climate</th>
<th>BP</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>1</td>
<td>Moderately Wet</td>
<td>0</td>
<td>1973</td>
</tr>
<tr>
<td>Fremont</td>
<td>1</td>
<td>Moderately Wet</td>
<td>c. 775</td>
<td>c. 1200</td>
</tr>
<tr>
<td>Sterile</td>
<td>2</td>
<td>Dry</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Profile 186 level 3</td>
<td>4</td>
<td>Quite Dry (+ cool?)</td>
<td>6200±190</td>
<td>4250</td>
</tr>
<tr>
<td>Pr. 235 level 3</td>
<td>2</td>
<td>Dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>both Pr. level 2</td>
<td>3</td>
<td>Very Wet</td>
<td>6760±180</td>
<td>4810</td>
</tr>
<tr>
<td>both Pr. upper level 1</td>
<td>2</td>
<td>Dry</td>
<td>7670±210</td>
<td>5720</td>
</tr>
<tr>
<td>Pr. 186 lower level 1</td>
<td>4</td>
<td>Quite Dry</td>
<td>7770±230</td>
<td>5820</td>
</tr>
<tr>
<td>Pr. 186 base of level 1</td>
<td>3</td>
<td>Very Wet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pr. 186 level 0</td>
<td>4</td>
<td>Quite Dry</td>
<td>8210±220</td>
<td>6260</td>
</tr>
</tbody>
</table>

Table I. Summary of the Joe's Valley Alcove palynological record.

Correlations

The inferred paleoclimatic chronology from Joe's Valley Alcove would be much substantiated if it could be determined that other locales provide similar paleoclimatic data for the same temporal horizons. That is, a consistency of paleoclimatic reconstruction for a number of sites could provide a biostratigraphic correlation that would lend credibility to the conclusions drawn solely from the Joe's Valley data. Unfortunately, relatively few locales in the West and Southwest provide paleoclimatic reconstructions for the periods involved. Some that provide them appear to show corroborative data while others do not.

At the broadest geographic level, a paleoclimatic model of "quasi steady" climatic conditions in the North American postglacial, proposed by Bryson, Baerreis and Wendland (1970), should be applicable. This model identifies no major paleoclimatic change occurring during the period of deposition of Bed I; all of the Bed I deposition would be recognized as of "Atlantic" paleoclimatic conditions. Sub-episodes of fluctuation in climatic conditions would be recognized as initiated at the approximate dates of 8450 BP, 7730 BP and 5980 BP. Ignoring the question of the nature or directions of paleoclimatic change for the moment, this model
would predict that the paleoclimatic conditions expressed in the level 0 and lower level 1 samples would be similar to each other but different from the samples from other Bed I deposits. Similarly, the samples from the upper deposits of level 1 would be distinctive from any others. The samples from levels 2 and 3 would be similar to each other, but unlike the samples from other levels of Bed I.

There is no palynological evidence that would indicate that climatic changes equivalent in magnitude to that differentiating the Bed I and the Fremont or Modern samples occurred during the deposition of Bed I. Thus the Bryson, Baerreis and Wendland model (based on the Blytt-Sernander model) seems to accurately retrodict a lack of major climatic change during the period of Archaic occupancy of the site. Similarly, it appears to accurately retrodict a climatological distinction between the Fremont and the Archaic Horizons, but no climatic distinction between Fremont and modern Horizons. However, it does not accurately retrodict the periodicity of sub-episodal changes in climatic variables. The fluctuation recorded in the difference of pollen content of levels 2 and 3 (which occurs at both profiles and thus is not to be construed as an accident of sampling), is of sub-episodal scale, as is the fluctuation at the base of level 1. Unless the radiocarbon assays are completely out of line in dating of these horizons, there is no correlation between the sub-episodal paleoclimatic events evidenced during the Archaic in the Joe's Valley deposits and those posited by the model of Bryson et al.

However, the Blytt-Sernander and the Bryson et al models were developed as syntheses of paleoclimatic evidence from the temperate zones of North America and Europe. Much of the evidence which supports the model refers to patterns of glacial advance and retreat. There is general recognition that the Western and Southwestern portions of North America may constitute a significant exception to such a model. Martin (1963) flatly denied any significant climatic fluctuation over the past 10,000 years in the Sonoran desert grassland region, and the conclusion of Martin and Mehringer (1965:443) was that the general pattern of palynological evidence from the Southwest suggested only minor vertical displacements of vegetation zones over the past 12,000 years. It has also been long recognized (Porter & Denton, 1967) that patterns of "neoglacial" in the Western U.S. are broadly synchronous with those from other parts of the world, but are different to varying degrees.

Correlation of the wet episodes of the Joe's Valley Bed I sequence and the record of Cordilleran Glaciation is encouraging. There is apparent synchrony between the wet horizons of levels 2 and basal I with the Pinedale V and IV glaciations, respectively. The latter, correlative with the Cochrane-Coburn glacial advance in eastern Canada, has been dated 6270 B.C. ± 260 (GX-1435) in Montana and is widespread in the Cordillera. The former, which is well evidenced only in the Sierra Nevada north of Lake Tahoe (Birkland, 1964), dates in the 4-5,000 B.C. range. It is represented by an unnamed till which predates the Recess Peak till and...
post-dates the Hildegard till. These are the only Cordilleran two

glacial events evidenced for the period, and their temporal agreement

with wet conditions at the site is not, in my opinion, a matter of

circumstance. But stronger support for the case is needed. Specifically,

pedological tests should be made to examine the hypothesis that these
two (and no other) stratigraphic units were deposited under wet conditions
of climate. Geological evidence should be correlated with geological
evidence for a secure argument.

The pattern of palynological evidence recovered from the site shows
little agreement with the records synthesized by Martin and Mehringer
(1965) for the arid Southwest. Those records indicate no major climatic
changes, while the Joe's Valley record indicates a major change between
the deposition of Bed I and the Fremont-Modern deposits. Fluctuations
of paleoclimatic conditions, and the directions and magnitudes of the
fluctuations, were summarized for the Southwest by Mehringer (1967b).

His data indicate wet conditions at the approximate date of level 0;
drying conditions at about the time of basal level 1; conditions trending
towards further dryness during the interval from lower through upper
level 1; and probably maximally dry conditions at the time of levels 2 and
3.

There is, however, amazingly good correlation between the paleoclimatic
reconstructions based on pollen records from Joe's Valley Alcove and those
(yet unpublished) from central New Mexico and the Llano Estacado region
of Texas. A relative paleoclimatic chronology presently exists for the
area directly south of the Colorado Plateau in New Mexico. The pollen
records upon which the chronology is based were analyzed between 1965 and
1968 by Mehringer and by Schoenwetter, from samples collected from
archaeological sites in this district by Irwin-Williams. Radiocarbon
assays from the sites leave no doubt that the chronology covers the
time range from 1600-9500 B.P., but the exact dating of the units of
chronology still awaits. Correlation of the pollen records with the radio­
carbon dates is not easily accomplished, for the natural stratigraphic and
cultural stratigraphic units must be identified first, then the
stratigraphic positions of the pollen samples (mostly taken at arbitrary
intervals at profile locations in a site) must be related to these in
order to establish indirect correlation of the pollen and C-14 samples.

It is presently thought that the two oldest periods of dune building
in the district are dated approximately at 4000 and 6500 B.C. These are
acceptable dates for the deposition of Bed I, so the relative chronology
of paleoclimatic events between these dates in New Mexico might expectably
correlate with that from Joe's Valley. The correlation is shown in Table
11.
Table II. Correlation of paleoclimatic records.

<table>
<thead>
<tr>
<th>Joe's Valley Alcove</th>
<th>Central New Mexico</th>
<th>Llano Estacado</th>
</tr>
</thead>
<tbody>
<tr>
<td>level / date B.C.</td>
<td>Relative Unit / Date</td>
<td>Pollen Zone / Date</td>
</tr>
<tr>
<td>3/4250 Dry</td>
<td>N/4000 ± Dry</td>
<td>1/3600 Drier</td>
</tr>
<tr>
<td>2 Very wet</td>
<td>O wet</td>
<td>1 Wetter</td>
</tr>
<tr>
<td>1 Dry</td>
<td>P Quite Dry</td>
<td>1 Drier</td>
</tr>
<tr>
<td>1 Quite Dry</td>
<td>Q Dry</td>
<td>1 Wetter</td>
</tr>
<tr>
<td>1 Very wet</td>
<td>R wet</td>
<td>1 Wetter</td>
</tr>
<tr>
<td>0/6260 Quite Dry</td>
<td>S/6500 ± Dry</td>
<td>1/6500 Drier</td>
</tr>
</tbody>
</table>

In an unpublished manuscript (referred to in Wendorf, 1970), Oldfield and Schoenwetter have more thoroughly evaluated the records upon which they based an earlier study (Oldfield and Schoenwetter, 1964). They establish a biostratigraphic unit, Pollen Zone I, which recurs at three localities and which is bounded by radiocarbon dates of 6520± 350 and 3630 ± 160 B.C.

The frequency of Arboreal Pollen - essentially pine pollen of the pinyon category - is greater in Zone I than in either the preceding or succeeding pollen zones. This and other palynological characteristics function effectively to set Zone I apart as indicative of a major climatic interval of post-glacial time. This agrees with the interpretation of Bed I at Joe's Valley. There are two significant maxima in the pine pollen values during the Zone I period. These are interpreted as indicative of wetter conditions than occur today. The pattern is most marked at the Lubbock Reservoir and San Jon Reservoir localities, where conditions of alluvial deposition occurred. In the playa deposits of White Lake the two maxima also occur, but the intervening minimum is not statistically significant. The whole pattern seems very much in keeping with that from Joe's Valley, which is also a locale of alluvial deposition.

Correlation with the Laguna Salada pollen sequence from the central portion of the Colorado Plateau (Hevly, 1964) is not directly possible because of a lack of critical dating in that record. The uppermost AP
maximum of the post-glacial period must date prior to 1600 B.C.; the lower is earlier in the post-glacial period, following 8,000 B.C. There is no reason to doubt a correlation of these with the Joe's Valley record, but they cannot be taken as a confirmation.

In sum, there are both agreements and disagreements of correlation of the Joe's Valley pollen records. The disagreements seem principally to be with paleoclimatic models derived from palynological data collected to the northeast and the southwest of the location. Paleoclimatic reconstructions based on palynological data gathered southeast of the locale, or on geological data gathered west and northwest, is in agreement. It would appear that there is no particular reason to mistrust the paleoclimatic reconstruction of Table I because of poor correlation. Since the record is internally consistent, it is reasonable to take it at face value as a true, if not representative, indication of local paleoclimatic events.

Inferences

Accepting the record at face value, certain of the palynological data provide information of cultural ecological significance. Foremost, the record of moisture fluctuation indicates that through the Archaic period environmental changes occurred which would have dramatically affected the quality, quantity and distributions of wild food resources. If we presume that the economic character of the cultural expressions represented in the Bed I deposits was critically controlled by wild foods, and if we assume that economic change through the time of occupation will be reflected in the archaeological record by significant changes in distribution or frequency of function-specific artifacts, we would expect that the assemblages recovered from basal level 1 and level 2 would be very different from those of the other levels of Bed I. This issue should be carefully considered when plans are made for further excavation at the locality.

Second, it should be noted that though maize cobs were found in the Fremont deposits maize pollen was not observed in the 200 grain count. Observation of an estimated 300 additional pollen grains of this sample also failed to yield a single grain of maize pollen. Alternatively, both pollen of Cleome (beeweed) and pollen of an economically important member of the Umbelliferae (Umbel family) were observed in this sample. While maize was consumed at the cave, the pollen data would appear to indicate that it was probably not grown in the immediate area during Fremont times. Wild plant resources, however, seem to have been gathered and processed at the site.

The relationship of the paleoclimatic chronology from Joe's Valley to those obtained elsewhere provides much food for thought. It would appear to indicate that at least 3 related, but distinctive, paleoclimatic chronologies are needed to deal with the question of the nature of post-
glacial climatic events in North America. Each of these would have a broad regional applicability, and would apparently apply in other ways than we have been led to suspect by virtue of modern relationships between climatic and physiographic conditions. The desert lands of California and Arizona apparently fall into one paleoclimatic region (perhaps along with the Great Basin and the western portion of the Colorado Plateau), but the steppe lands of the eastern portion of the Colorado Plateau fall into a second region which also includes the desert and grassland portions of New Mexico and central Texas. The plains of northern Texas, as well as those north along the front range in Colorado, however, would fall into the region which also includes the temperate portions of the United States. The Amstad Reservoir record (Bryant, 1966) appears to represent yet another sort of pattern, which may be linked to the pollen record of Coahuila (Myers, 1973). The primary scientific significance of the Joe's Valley Alcove probably lies in this area of its relevance to issues of continent-wide paleoclimatic reconstruction. The paleoclimatic implications of the sedimentation sequences, the geomorphology, and the floral and the faunal remains in the deposits should be thoroughly and substantively studied as aspects of any further investigation of the locality. Micro-stratigraphic analysis and three-dimensional recording of all material remains and samples seems highly indicated in future exploration of this site.

The weakest inferences to be derived from these records relate to something the archaeologist is most interested in: reconstruction of vegetation during the horizons of occupancy. This is primarily a matter of control; a surface sampling program involving 50-100 specimens collected from known vegetation patterns in the district would resolve the issue to our satisfaction. Presently, it would appear that the dry horizons of Bed I time were periods when plains-like or prairie-like conditions prevailed while the wet horizons saw the establishment of woodland stands at favorable locations and savanna stands (principally of pinyon with juniper) more generally in the immediate area. Sagebrush may have been a prominent member of transition floras occurring as trees died off prior to the development of the Prairies. Available data indicate no vegetation pattern difference during Fremont times and that observed today.
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Schoenwetter, James

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