Palynology of the Koster Site:

First Report

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In December 1970 a stratigraphic series of 113 sediment samples from the Koster Site, Illinois River Valley, were processed by the standard extraction procedure for terrestrial samples in this laboratory. A top-priority listing of 51 samples had been drawn up for this series by Dr. Streuver. Nineteen of those samples were selected for this preliminary analysis, representing all of the cultural horizons evidenced through the archaeological record yet obtained from the site.

The purpose of this first stage of the research effort was not highly sophisticated. Basically, we investigated the samples to resolve the following questions:

(A) Is pollen preserved in sufficient quantity and with sufficient quality in these samples to justify further expenditure of research effort?

(B) Do the results of analysis of these samples offer grounds for mapping of further research strategy?

(C) Do the results offer prospect of fruitful comparison with existing paleoecological records from nearby regions?

(D) Do the results offer prospect of aid to the primary archaeological goal of analysis of the subsistence-settlement represented by this site?

All of these basic questions are now recognizably answerable in the affirmative.

(A) Pollen preservation in these samples involves problems of both quantity and quality. It seems likely that the problem of obtaining enough pollen for analysis from the samples can be overcome in most cases through

modification of our standard laboratory procedures. Except in the case of the sediments of Zones X and XI, the main problem seems to be a small quantity of pollen per unit volume of deposit. This can be resolved through the processing of larger volumes of sample for extraction of contained pollen. Zones X and XI appear to be pollen sterile, though XI contains a quantity of other organic matter and the presence of pollen was anticipated.

Using the standard extraction technique, only 9 of the samples yielded sufficient pollen for analysis. An additional 8 samples of the series would yield sufficient pollen with minor changes in laboratory technique. The standard of sufficiency set for this phase of the investigation was 50 pollen grains per drop of extract from a sediment sample of 100-200 cc.'s volume. Depending upon future research strategy this standard may have to be revised upwards. As only one or two of the samples now contain more than 150 pollen grains per drop of extract, upward revision of the standard of sufficiency would demand significantly greater investment of laboratory time in the preparation of samples for microscopy. The statistical strength of the results, however, would be vastly improved by higher standards.

The quality of pollen preservation in these samples is poor relative to that expected in aquatic or sub-aquatic deposits. This makes identification of the pollen difficult, and consequently reduces faith in the validity of the statement of results. As I became more familiar with the pollen of these samples, my ability to resolve identification problems increased, but I should say that something between 5 and 10 percent of the pollen identifications made from these samples are inaccurate or at least questionable. I do not think this is an intolerable range of error. It could be reduced by granting the expenditure of greater amounts of laboratory time to the resolution of

identification problems. However, the reduction of such errors by one-half (to the 1-5 percent level) would increase the time expenditure per sample by at least one-third.

(B) Preservation problems are certainly real enough to influence research strategy. Presently, the total study of a specimen takes approximately three-fourths of a full working day. This includes the time necessary to extract the pollen by standard procedures, to observe and identify 50-100 grains, to implement analytic procedures, and to write up the results. A full work month of 22 days, then, results in the completion of 27-28 samples. Most time is spent in observation and identification of the pollen; the 50-100 grain pollen counts of the samples thus far analyzed averaged three and one-half hours to complete. Should we desire 200 grain pollen counts, as we probably will prefer in order to justify statistically sophisticated analyses, we must postulate at least an average expenditure of another three hours. The effective result would be to allow completion of about 20-22 fossil samples in a full work month, granting the present range of error in identification. An additional 15 or 20 surface pollen samples could probably be analyzed at the same time, assuming that the surface samples submitted from the Apple Creek district are typical for the Illinois River Valley.

Should Streuver's 1971 NSF proposal be granted, the equivalent of seven full months are to be expended in the laboratory on pollen studies.* Roughly, this allows time for completion of perhaps 100 surface pollen samples and 150 fossil samples. Clearly, the assignment of priorities to specific samples is

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*I submitted alternative budgets to implement the pollen work. Both provide for seven months lab time, but the less expensive uses Graduate Research Assistant labor. The resulting lack of expertise on the part of the analyst would probably reduce the number of complete analyses by one-fourth.

a critical matter. Should the present priority system hold, 30 of the priority openings have been assigned to fossil samples now in hand. Is this too large a proportion? Obviously, the answer depends upon project goals and the sorts of problems the palynological record is supposed to attempt to resolve. It would certainly be to the advantage of the project to define those goals and problems within the framework of the palynological logistics to some degree.

(C) The accompanying pollen diagram illustrates the results of the analyses. It will be noted that there are statistically significant distinctions between the pollen records of distinctive cultural horizons in most cases. The lowermost sample of the Whitehall-Jersy Bluff horizon is palynologically unlike that of the uppermost level of this horizon, but essentially like that of the samples of the Black Sand horizon. If an error has not been made in the assignment of the 12" level to the Whitehall-Jersy Bluff horizon, this would indicate that ecological conditions of the Early Woodland period reoccurred in Late Middle Woodland/Early Late Woodland times.

Without statistically more valid analyses or the control of modern surface samples, it is impossible to derive meaningful interpretations of the paleoecological conditions represented by these data. It is important, however, to realize that except in the case of the sample from 12" depth pollen records of apparently disparate temporal horizons are quite distinct while those of essentially the same temporal horizon are alike. For example, the pollen spectra of Zones II, IV and VIII could not be confused. This is exactly what we should expect if the pollen records were true reflections of ancient ecological patterns. The paleoecological chronologies of North America clearly show distinctions at the dates of 600 BC, 2000 BC and >2000 BC. The Koster chronology shows paleoecological distinctions at those dates also.

There seems much reason for optimism that the Koster pollen sequence will prove correlative with other North American pollen chronologies. This should allow a chronological control on the site independent of the C-14 determinations.

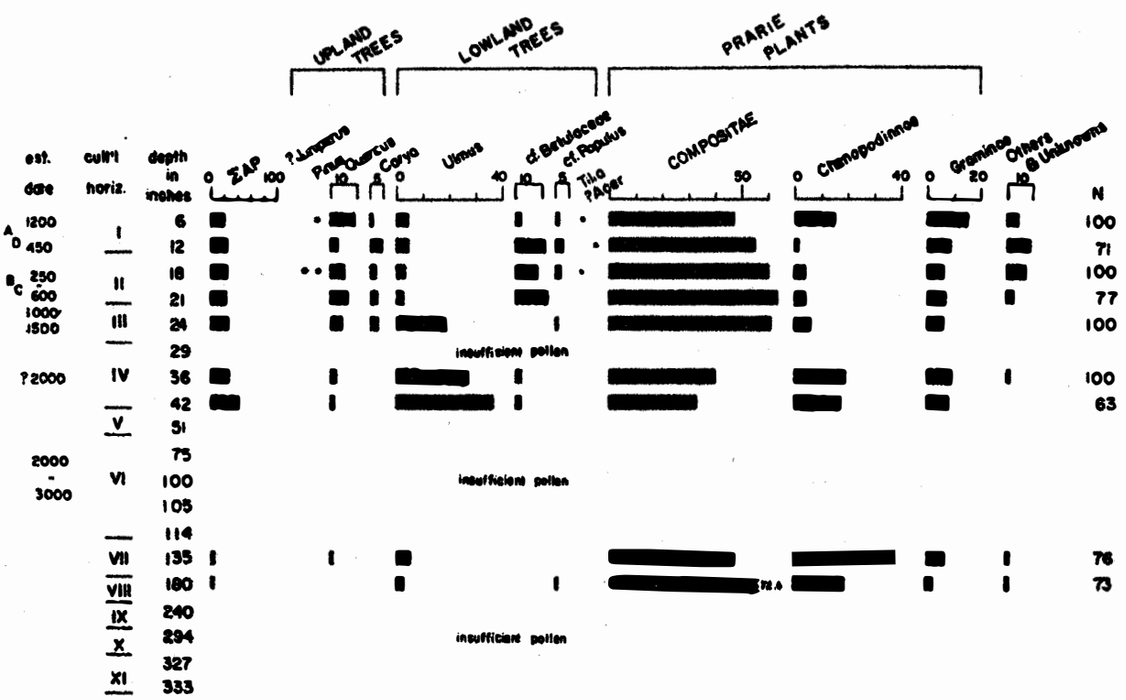
(D) The phenomenon of distinctive paleoecological records on the different cultural horizons lends credence to the hypothesis of changing subsistence-settlement patterns through time. I am guessing here, but I believe the record indicates differential tree coverage of the Koster site at different times. The site appears at first glance to have been more densely forested during the times of horizon II, III and especially horizon IV than at other times. Considering the arboreal taxa involved, I would guess that there was either floodplain forest or slough margin forest at the site at those times, and floodplain prairie during the periods of horizons I, VII and VIII.

The lack of pollen from horizon VI is not as critical as first appears since this particular deficiency can be overcome through modification of laboratory procedures. These samples have a high proportion of organic residue which obscures the pollen and reduces the number of pollen grains per drop of extract. The occurrence of such volumes of organic matter may itself have paleoecological significance. The estimated age of these sediments places their deposition during the Hypsithermal or "climatic optimum" paleoclimatic interval. Supposedly, an "optimal" climate would result in heavy vegetative growth and, ultimately, in an unusually heavy deposition or organic detritus in sediments of that time.

The lack of pollen from horizon XI, on the other hand, more likely represents deposition at an extremely slow rate with consequent pollen destruction at the soil surface. Perhaps negative palynolggical evidence of this sort may aid geomorphological investigations of paleoclimatic value.

Pollen preservation quality of the different taxa may prove a critical issue for paleoecological interpretation. In the sample from 6" depth, an unusual amount of Quercus pollen was observed, but it was all broken and corroded. This would appear to reflect long-distance transport and indicate that local vegetative growth was somewhat sparser during this period than others. This may be an effect of the human settlement of the locus or it may be a reflection of paleoecological pattern. Similarly, the quality of preservation of the Ulmus pollen of horizons III and IV is sufficiently poor that the identification is open to some question. Assuming that misidentification is not the real problem, it would seem that the paleoecological meaning of Ulmus pollen in these samples may be quite different from the meaning of the same pollen type in, for example, horizon II.

Though paleoecological interpretation of these records is yet hazy, the clear impression received is that significant distinctions in vegetation pattern occurred at this locus at different times. I believe that it can be fairly assumed for the moment that these differences were differentially exploited by the settlements of different periods, and I feel confident that testable hypotheses of culture dynamics may be generated on the basis of that assumption. I would suggest, for example, that the minimal record of Carya pollen in the samples dated prior to 1500 BC may support the idea of a deficiency in this food resource through most of the Archaic relative to later times. This would suggest a differential gathering strategy, which should be reflected in the demographic pattern, the faunal and floral remains, and the type and frequency of storage pits at the site.


UPLAND TREES
LOWLAND TREES
PRARIE PLANTS
est. date
cult'l horiz.
depth in inches
ΣAP
?Juniperus
Pinus
Quercus
Carya
Ulmus
cf. Betulaceae
cf. Populus
Tilia
?Acer
COMPOSITAE
Chenopodineae
Gramineae
Others & Unknowns
N
A D 1200
450
B C 250
600
1000
1500
?2000
2000 - 3000
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
6
12
18
21
24
29
36
42
51
75
100
105
114
135
180
240
294
327
333
insufficient pollen
insufficient pollen
insufficient pollen
100
71
100
77
100
100
63
76
73