

THE AMERICAN BOTTOMS POLLEN CHRONOLOGY  
PREPARED FOR THE CAHOKIA CERAMIC CONFERENCE

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## INTRODUCTION

I hope I may be excused for the formality of this presentation at this ostensibly informal conference. I do so because I am trying to convince you that the palynological record from Cahokia is archaeologically important, and I am trying to overcome the fact that this record has been rejected as important for over a decade.

The information I shall present here, with a small but critical exception, is not new. Pollen work on samples from Cahokia began in 1961 as part of the Highway Salvage Program then in force, and pollen studies continued into the 1963-64 academic year. At that time I circulated a manuscript on a pollen chronology resulting from the analysis of 119 samples from the American Bottoms and a few from Struever's Apple Creek Site for comparative purposes (Schoenwetter 1963). Briefly stated, the implication of the pollen study was that neither the house form chronology that had been proposed by Warren Wittry (*in* Wittry and Vogel, 1962) nor the ceramic chronology that had been proposed by Joseph Vogel (1964) had sufficient chronological value to support their use as a general rule by project archaeologists.

When copies of this manuscript were sent to the archaeologists of the American Bottoms Project it was met by either shocked silence or by a clamorous negative. I was not prepared for this reception, but I recognized that a critical form of evidence in support of the pollen chronology was lacking. The then-missing link in my argument was the fact that the ceramic lots directly associated with the pollen samples had not yet been analyzed. Rough field evaluations had been accomplished in a few cases, but I had no listing of the supposedly datable sherds directly associated with the sediment samples that yielded sufficient pollen for analysis. In light of the reception my manuscript received, I

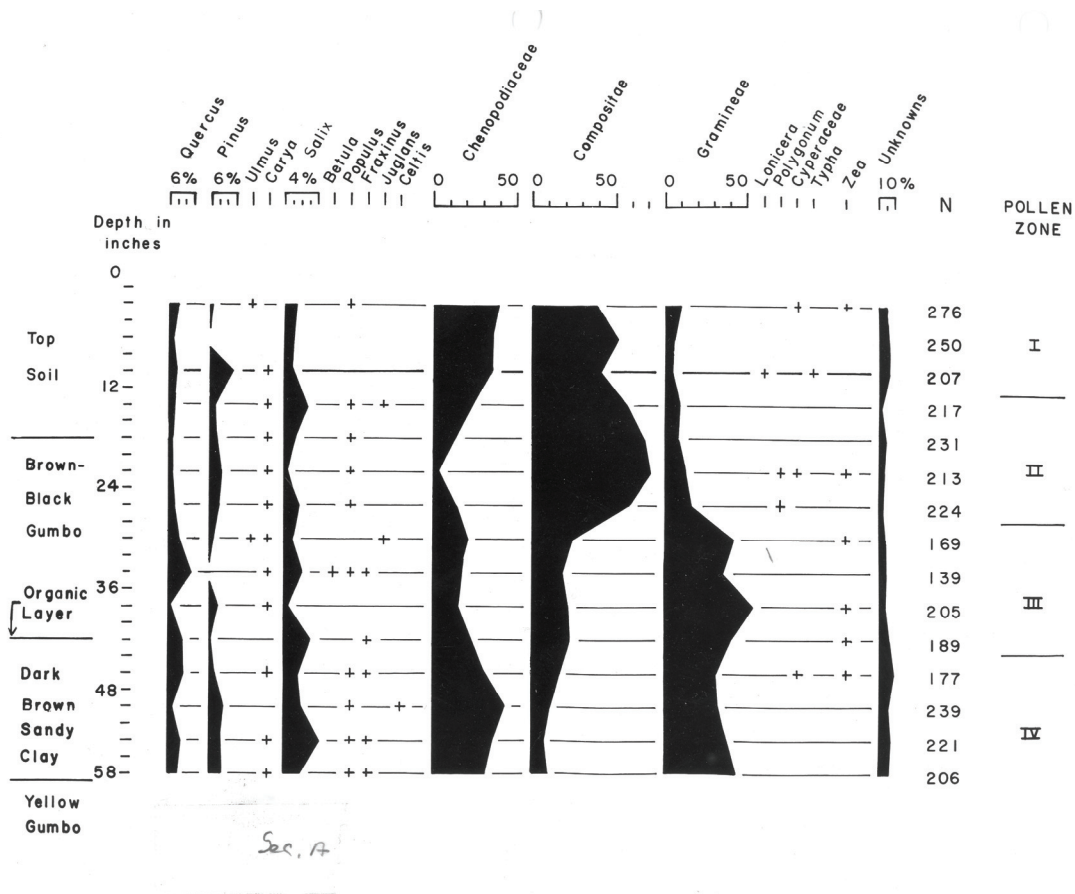
decided to sit quietly on the manuscript until that deficiency could be resolved.

Otherwise, publication of my conclusions might serve more to confuse issues of chronology at Cahokia than to illuminate them, and it has been my intention to illustrate how *helpful* pollen studies may be in archaeological research.

I have come to the conference to present the data I have of both palynological and archaeological character. In themselves, the palynological records show the existence of a sequential series of pollen zones. These appear to express environmental conditions across the geographic expanse of the American Bottoms, so seem to be valid markers of discrete temporal units covering the period of Mississippian occupation of this area. The archaeologist should be able to use the pollen zones in much the same way that paleontologists use index fossils: that is, as a way to determine whether associated cultural materials are earlier or later in relative time.

As I shall attempt to document for you, the pollen sequence information is generally consistent with the chronological information established through stratigraphic superposition and radiocarbon dating, but not fully consistent with Vogel's or O'Brian's (1972) ceramic chronologies nor the chronological interpretations Wittry proposed on the basis of variations in house forms..

## EVIDENCE AND ARGUMENT FOR THE POLLEN CHRONOLOGY

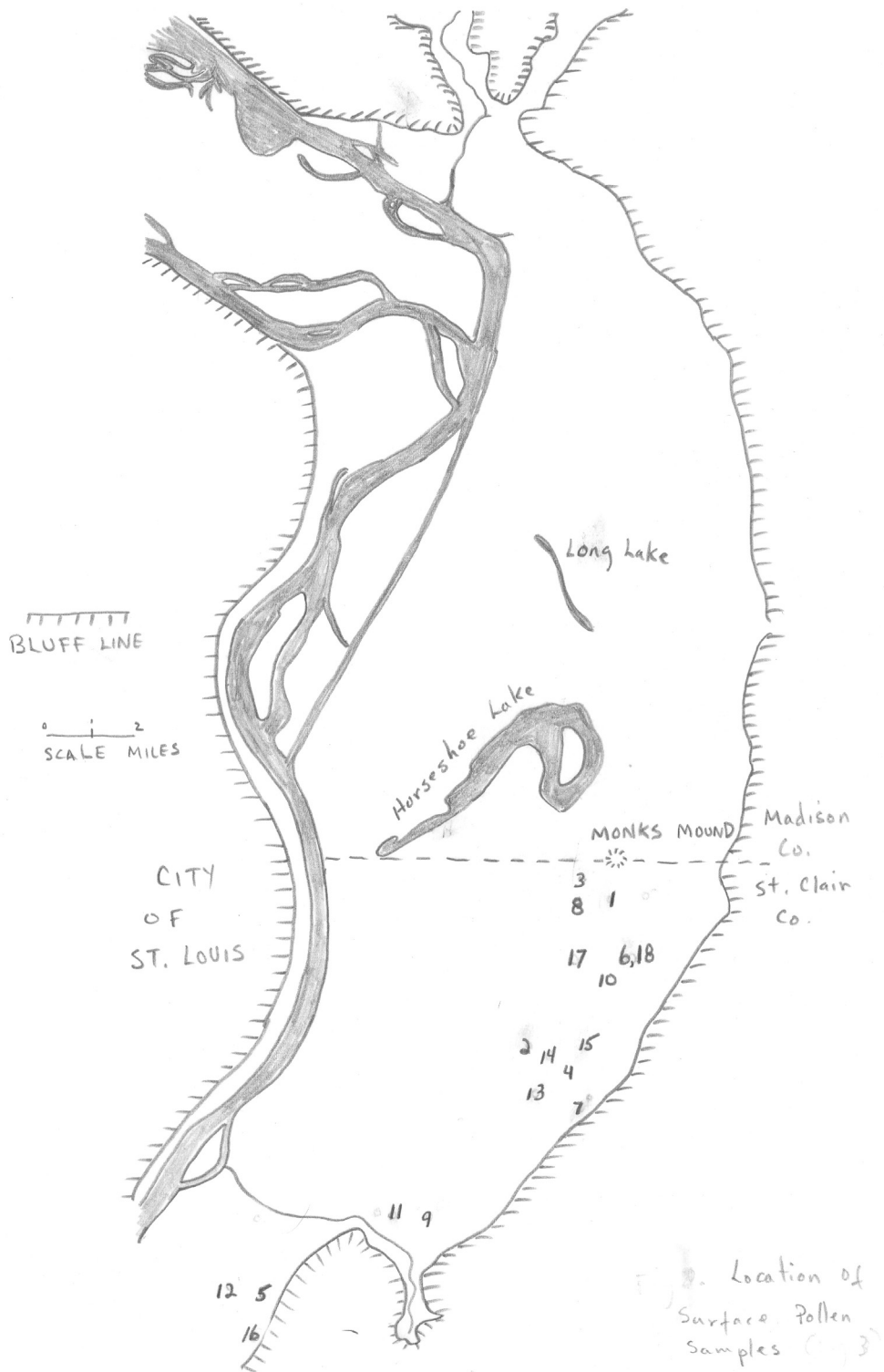


The first thing I will show you is the pollen diagram recovered from Tract 15A at the field point designated 840 R260. This is a stratigraphic column recovered from a profile along the slough fed by Cahokia Creek. The characterization of the deposits is that recorded by the archaeologists who collected the sediment samples at 4-inch intervals. Note that no plow zone was observed at this profile.

It is clear that the pollen frequencies change dramatically through the stratigraphic column. At the top of the diagram, both Chenopodinnae (previously recorded as Chenopodiaceae) and Compositae pollen values are high. Beginning about 14 inches below the surface, Compositae pollen values are significantly greater than those of any other taxon. Compositae pollen frequency declines at the 26 inch level, and from this

point to the 44 inch level the Gramineae pollen frequency is significantly greater than the frequency of any other pollen type. From the 44 inch level to the base of the profile, both Gramineae and Chenopodinae pollen achieve statistically impressive values. I have used these fluctuations to establish a series of pollen zones in stratigraphic order on the diagram.

The simple existence of such fluctuations in pollen frequencies through time does not document the chronological value of the units (i.e. the pollen zones) of the diagram. In order for the units of a "pollen sequence" to be of chronological value, they must be arguably identified as exemplifying some ecological condition extending over a reasonably extensive geographic space. To assess the likelihood that the zones represent ecological conditions, I collected and analyzed samples of pollen rains produced by vegetation patterns existing under various ecological conditions in the American Bottoms area. The degree of similarity of such pollen records to those of the sediment samples would indicate the sorts of ecological conditions existing in the area at the present time that also existed when the deposits were formed and trapped the pollen rains expressed as zones in the pollen sequence.





are at least two general similarities between these modern pollen rain records and the fossil pollen rain records of the pollen sequence. First, both sorts of pollen records show far greater frequencies of Compositae, Chenopodinae, and Gramineae pollen than they do of any other taxa. Second, the statistically significant variations that occur in both sorts of pollen records occur principally in those three taxa.

These similarities create a consistency that overrides expectations generated through knowledge of the types of vegetation that produced the pollen rains of the modern samples. A priori, one would expect that there would be more pollen derived from trees in modern pollen rain samples from wooded loci than in samples from farmland loci, or more pollen of the crops produced on farmland than pollen of the weedy taxa that are removed from such loci through cultivation. Empirically, though, it is clear that pollen rains don't work that way on the American Bottoms at present. Given the methodological priority of the principle of uniformity (i.e. the assumption that the present is the key to the past), we are obliged to conclude that pollen rains did not work that way on the American Bottoms when the fossil pollen rains were deposited, either.

To use an archaeological analogy, the two sorts of pollen records are as alike as the sorts of archaeological records one might recover from two large test trenches at a single site. Consistency between test trenches as regards types and frequencies of archaeological data would demonstrate that the same complex of cultural events was sampled in each case. Similarly, consistency of types and frequencies of pollen data demonstrates for the pollen analyst that the same complex of botanical/ecological conditions was sampled in each case. The nature of those botanical/ecological conditions



may be identifiable through consideration of the relationship of patterns of palynological data to the habitat characteristics of the sampled loci.

In samples 2-8, and in 4 of the six samples from the Long Lake area, both Chenopodinae and Compositae pollen values are significantly higher than those of any other taxon. Thus 11 of the 24 modern pollen rain samples from the American Bottoms yield the same sort of data as the fossil pollen rains sampled by the uppermost pollen zone in the slough samples. These 11 samples come from all portions of the district and reflect all of the various micro-environments sampled.

In modern pollen rain sample 1, the Compositae pollen frequency is greater than that of any other taxon. This is the only sample collected in an area of clay soil. There are four other samples in which Compositae pollen occurs with greater than 30% frequency. Two of them are from the shore and sediments of Long Lake; the other two (samples 15 and 16) are from swamp margin and drained lake locales, respectively. All of the samples with Compositae pollen frequency above 30%, but no other pollen frequency equivalent or greater than this value, were collected at locations of unusually wet micro-environmental conditions. Some of the modern pollen rain samples from wet micro-environment locales have Compositae pollen frequencies equal to or greater than 30%, but also have similar frequency values for Chenopodinae pollen, however.

There are six surface samples in which only Chenopodinae pollen values equal or exceed 30% frequency. These are all from sandy and sandy loam sediments, which drain faster than clay sediments and thus identify a relatively drier micro-environment.

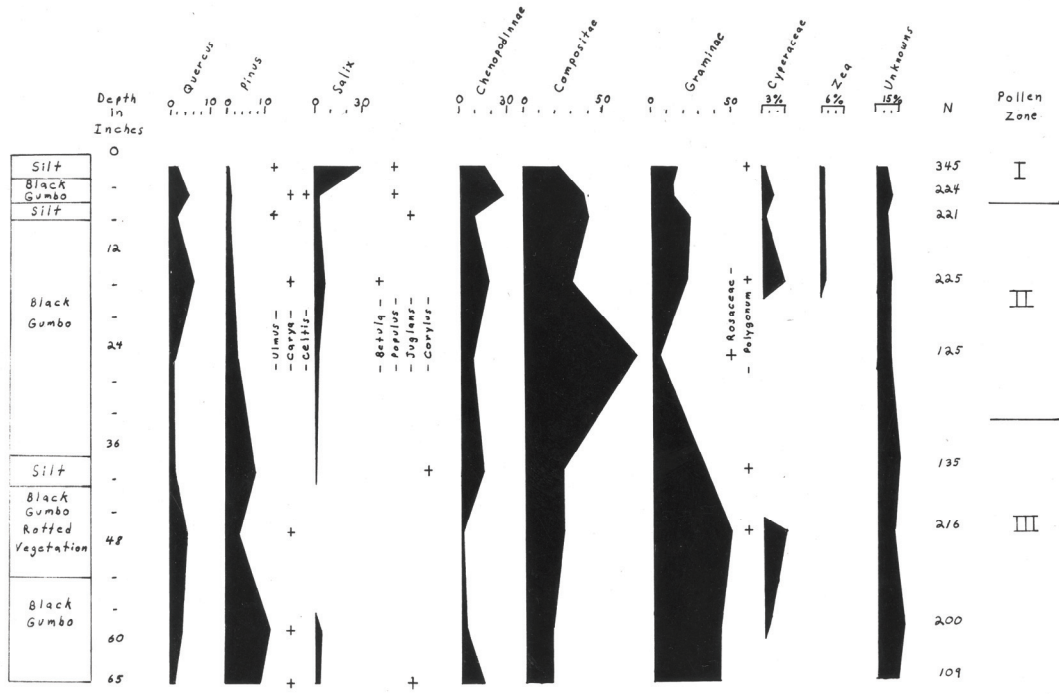
Two of the ecological conditions represented as pollen zones in the slough deposit samples, then, are identifiable by their similar representation in the modern pollen rain

samples. In modern pollen rain samples from the American Bottoms, Compositae pollen frequency values equal to or greater than 30% appear to reflect wet micro-environmental conditions. Lacking evidence to the contrary, we may assume this is exactly what fossil pollen rain samples of this sort reflect occurred in the past, as well.

The botanical/ecological condition expressed in the modern pollen rain by samples that incorporate 30% Compositae pollen **and** 30% Chenopodiaceae pollen appears to be the widespread “norm” for the American Bottoms area today. Recovery of fossil pollen rain records with these same characteristics from the most recently deposited samples at the top of the stratigraphic column would appear to indicate that this environmental condition has some antiquity.

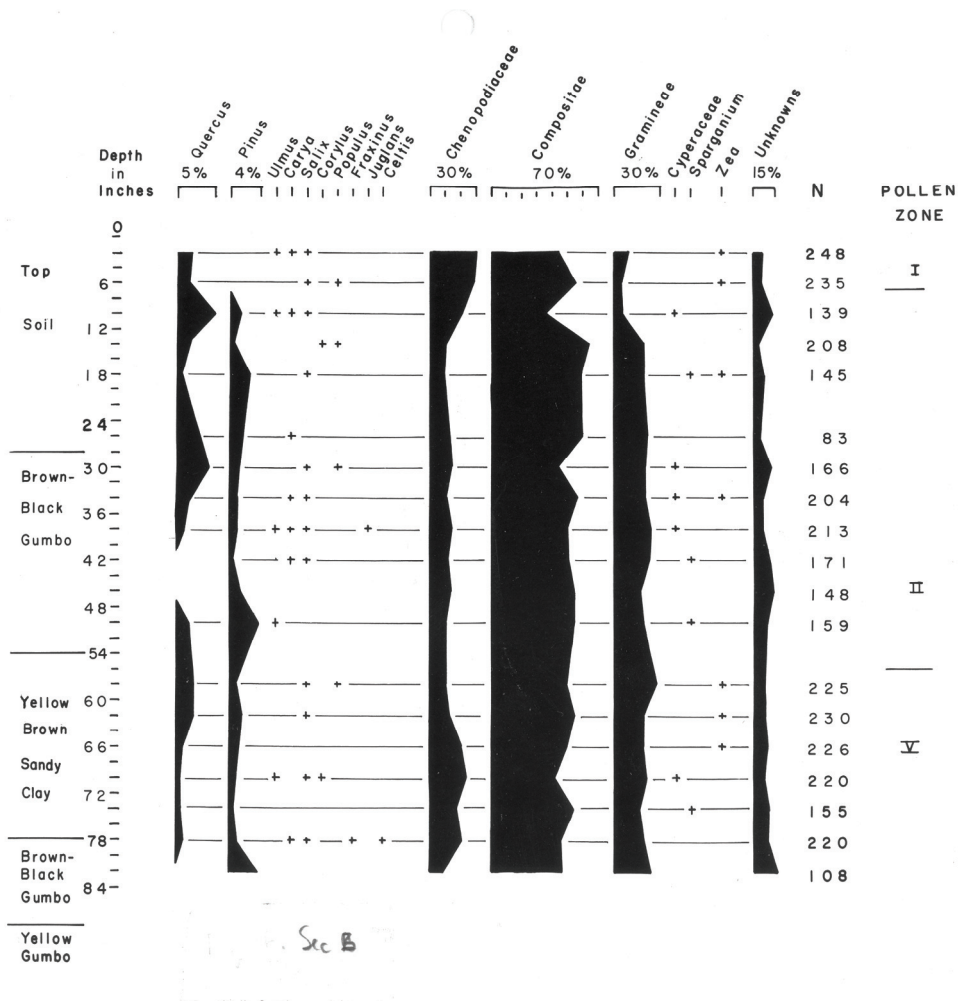
I can propose other arguments, but the above constitutes sufficient evidence to indicate that the pollen zones of the Cahokia slough sequence have identifiable ecological homologues, and thus satisfy one of the two criteria that would allow them to qualify as chronological markers. At least, a pollen zone with only Compositae pollen in greater than 30% frequency seems to reflect a wetter period than one with other pollen types equal to or greater than 30% frequency.

The other criterion that must be satisfied is demonstration that the same pollen zones, in the same temporal order, must have a reasonable areal distribution. This is demonstrated by the occurrence of pollen sequences from other locations on the American Bottoms that contain the same series of pollen zones.



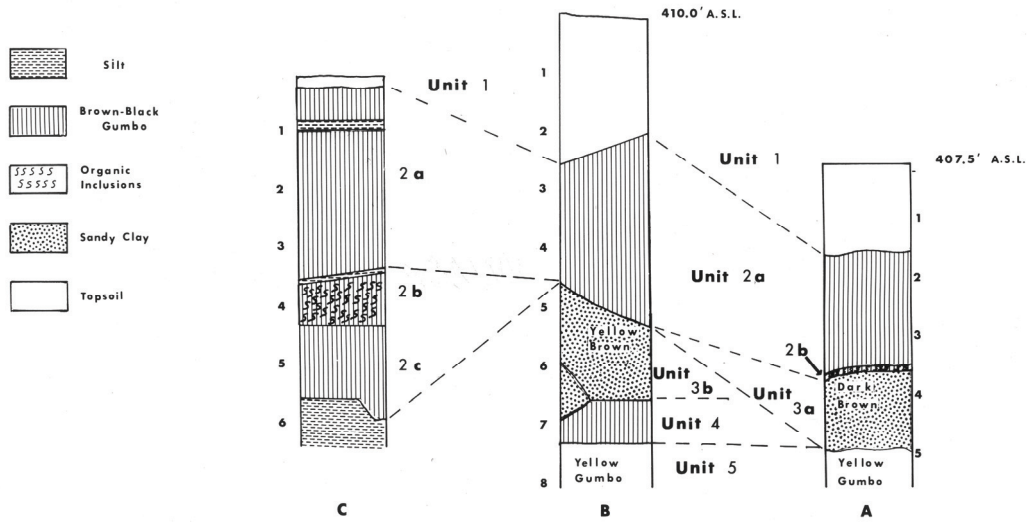
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Figure 4 illustrates the results of the pollen analysis of the samples of a second sediment profile. It was collected along the same slough, but at the Powell-Zurkhlen site approximately 2.5 km from 840 R260 at Cahokia. Here the pollen sequence is complete only into Pollen Zone III, but the pattern of similarity is clear.



The pollen sequence recovered from sediment samples of a third profile (Figure 5), collected 200 meters from the first profile, contains a similar sequence of deposits as the first profile, but yields none of the pollen spectra characteristic of Pollen Zones III or IV.

The discrepancy in pollen sequences between the first and third profiles has been the subject of much discussion between myself, Dr. Wittry and James Porter. I believe that the discrepancy can be accounted for by the reconstruction of a complex series of depositional events in the geomorphological history of the slough (Fig. 6).

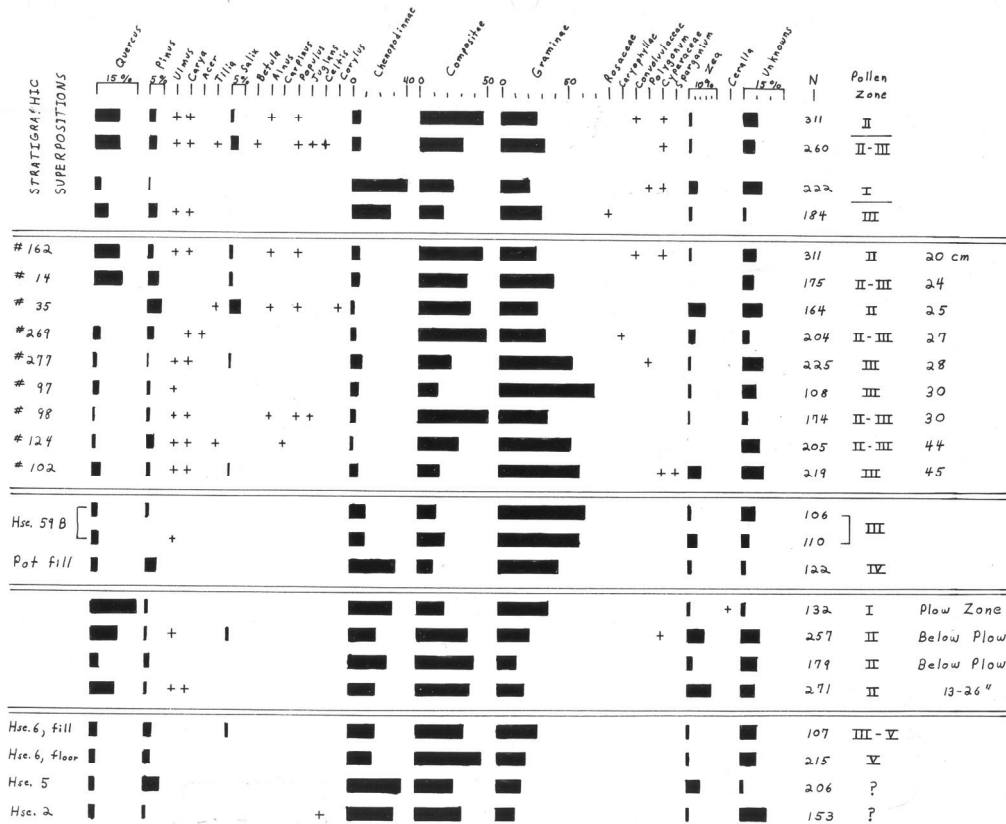


Porter considers this reconstruction geologically plausible but not really documentable. Dr. Wittry is frankly skeptical of some of the assumptions demanded by my reconstruction.

I shall not here explore the rationale of this reconstruction. Suffice it to say that I do not feel that the pollen chronology is seriously threatened by the discrepancy and I have utilized my reconstruction of slough events to isolate a fifth pollen zone at the base of the third sedimentary profile. This Pollen Zone V has the same palynological characteristics as Pollen Zone II, so reflects the occurrence of the same sort of environment, but is older than Pollen Zones III and IV. Though the evidence for the existence of five stratigraphically ordered pollen zones in the sequence I have illustrated

-- and with the palynological characteristics I have noted-- may yet be disputable, I think we can agree that the issue is still open to empirical testing. Thus we can pursue the analysis of other stratigraphically ordered pollen samples from the American Bottoms as potential tests of the hypothesis that the pollen chronology developed from analysis of the slough profile deposits is archaeologically valid and useful.

As we are all aware, stratigraphic superpositioning of datable cultural materials is fairly rare in the American Bottoms area. For the palynologist, the matter is further complicated by the necessity of excluding study of samples above the base of the plow zone stratum, and the fact that only one third of the pollen samples collected by the field archaeologist are likely to contain sufficient pollen for analysis. Further, though layers of mound fill represent stratigraphic superpositions of cultural materials, the pollen of mound fill samples may not have accumulated at the time the mound was constructed, so may have no temporal relationship to the artifacts with which they are associated. Here, though, is a chart of the results that were obtained (Figure 7).



At the Mitchell Site, a pair of samples was collected on and below the floor of Feature 9. The upper sample contains a pollen spectrum typical of Zone II in the slough sequence. The sample collected below it contains a pollen spectrum that yields more than 30% of both Compositae and Gramineae pollen. I interpret this as a spectrum transitional in character between the typical spectra of Pollen Zones II and III, and thus indicative of transitional ecosystem conditions that existed during the transitional interval between those zones.

In the second case of pollen sample superposition from Mitchell, one sample was collected just above the base of the plowzone and another was collected immediately below it at the same locus. The uppermost sample, like six of our 24 surface samples,

contains only Chenopodiineae pollen in great frequency. The lower one contains a typical Pollen Zone III pollen spectrum. The superposition of samples reflecting Zone I over those reflecting Zone III conditions observed in the slough pollen sequence seems replicated in this case.

There were only nine other sediment samples collected at the Mitchell Site that contained sufficient pollen to provide reliably robust pollen spectra. They were taken at various places on the site, so their stratigraphic relationship to each other is far from precisely reckoned by their relative absolute depths below the modern surface. As Figure 5 shows, however, results of their analysis are not fully random. The sample collected closest to the surface has a pollen spectrum typical of those of Pollen Zone II, the one collected at greatest depth has a spectrum typical of those of Pollen Zone III, and those collected at intervening depths are typical of those of Pollen Zones II, III or have the transitional characteristics of a temporal interval between them. Taken at face value, these results are generally consistent with expectations given the hypothesis that the pollen sequence from the slough identifies a valid pollen chronology.

Turning to Tract 15B at Cahokia, there is a single instance of superimposed pollen records. A ceramic vessel was discovered lying upon the floor of house 89B. The pollen spectrum of a sample of pot fill was typical of those of Pollen Zone IV. Superimposed upon house 89B was house 59B. Two samples from separate proveniences in house 59B, one of wall trench sediment and one of floor sediment, were analyzable. Both yielded pollen spectra typical of those of Pollen Zone III.

At the Powell-Zurklen Site, four samples that had been collected in stratigraphic order were analyzable. One from the plow zone incorporates a pollen spectrum in which



only Chenopodinae pollen exceeds 30% frequency, as is the case in one-quarter of the modern surface samples and the samples of Pollen Zone I. Two samples collected just below the base of the plow zone, and one collected from a depth of 13-26 inches, yield spectra typical of samples in Pollen Zone II of the slough sequence.

At the Collinsville Airport Site, we have palynological records from four samples whose relative antiquity is known. Two samples, one from the fill and one from the floor of house 6, were directly superimposed. A third sample derived from a separate, but more ancient house, house 5.

The youngest of these samples has a pollen spectrum incorporating 30% of both Compositae and Graminae pollen. The next oldest sample contains only Compositae pollen in great frequency. It would appear that the pollen chronology has finally run afoul of superimposed data, because this seems to illustrate recovery of a pollen spectrum typical of Pollen Zone II situated beneath one with the character of records of the Zone II-III transition suggested to be older than those of Zone II at the Mitchell Site. I do not think this is the actual case.

While I have studiously slid over the issue earlier, perhaps you will remember that I interpreted the discrepancy in the first and third slough profiles as indicative of an ancient pollen zone, Pollen Zone V, which had the same palynological characteristics as Pollen Zone II. Though I realize that it may seem like pulling an ace out of my sleeve, I interpret the floor sample from Collinsville Airport as representative of this ancient horizon of time and the sample collected above it as representing the transitional horizon between this Pollen Zone V and Pollen Zone III.

Part of the justification for this interpretation is that the slough profile that led to recognition of Pollen Zone V also derived from the Powell-Zurklen Site. But part is the fact that a sample from Powell-Zurklen which came from the floor deposit of an older house, house 5, is also unlike those of the pollen sequence yet palynologically comparable to the spectrum of the sample from Feature 215 at Powell-Zurklen and also comparable a pollen record from the Unit H deposit at Sub-Mound 51 (at Cahokia) that is associated with a very old radiocarbon date and was collected stratigraphically below typical Pollen Zone V records. At this juncture, there is not sufficient information to formally identify this putatively most ancient sort of pollen spectrum as Pollen Zone VI of the American Bottoms pollen sequence. But I believe such a zone is likely to exist.

To summarize, there are seven separate American Bottoms locations where superimposition of pollen records offered potentially replicate expressions of a five-zone pollen sequence. Pollen records of the Zone IV type only occur at the site of Cahokia, however, and some of the pollen records from the Mitchell Site and the Powell-Zurklen Site suggest they were deposited during the time ecosystem conditions were changing from those expressed by an earlier pollen zone to those expressed by a later pollen zone (the Zone V-III and the Zone III-II transition episodes). I interpret the restricted occurrence of the Zone IV pollen records as a reflection of local ecosystem modification occurring during the construction of Monks Mound at Cahokia. Whether that interpretation is accepted or not, the fact remains that five of the seven spatially separated American Bottoms locations produced superimposed pollen sample records consistent with a five-zone pollen chronology. The fact that the sorts of pollen spectra that occur in the fossil record also occur in the surface pollen record, which suggests that the types of

pollen spectra that characterize the pollen zones reflect ecosystem/vegetation conditions that yet occur in the American Bottoms district, reinforces the conclusion that the five-zone pollen sequence is a valid pollen chronology that expresses changing ecological patterns through the time of Mississippian occupation of the district.

**PALYNOLOGICAL “DATES” FOR TRACT 15A AND 15B HOUSES**

Working from data at Tracts 15A and 15B, Wittry (1962) proposed a chronological sequence of house forms which was supported by a ceramic chronology established for these tracts by Joseph Vogel (1964). Bluff houses, the earliest in this sequence, are small semi-subterranean houses of single pole construction; Early Mississippian houses are smaller rectangular wall-trench structures; and Late Mississippian houses are larger wall-trench structures. A temporal overlap between Bluff and Early Mississippian house construction styles was posited on ceramic grounds, but Vogel interpreted the distinctions between the ceramic assemblages associated with Early and with Late Mississippian houses as evidence that the two styles of houses were occupied sequentially.

Most of the houses exposed through archaeological excavations at Tracts 15A and 15B at Cahokia were sampled for pollen, but analysis was productive for only 13 samples. Those collected from house floors or wall trenches that yielded pollen records were:

<b>House/Tract</b>	<b>Pollen Zone Diagnosis</b>	<b>House Type</b>
157A	II	Late Mississippian
156A	II-III	Late Mississippian
35A	II-III	Late Mississippian

59B	III	Late Mississippian
43B	III	Late Mississippian
43A	III	Late Mississippian
32A	III	Early Mississippian
85A	III	Early Mississippian
77A	III	Late Bluff
146A	III	Not Identifiable
89B	IV	Not Identifiable
74A	?pre-V	Bluff
69A	not diagnosable	Early Mississippian

The pollen sequence information suggests that some of the Late Mississippian-style houses encountered at Tract 15A may be younger than others, but some were occupied at the same time that some Early Mississippian-style houses and Late Bluff-style houses were occupied. This, in turn, argues that the ceramic assemblage that Vogel interprets as reflecting a late temporal horizon actually reflects a distinctive cultural tradition or sociological pattern.

And when Wittry's criteria of house form are used to relate architectural and palynological data from the Mitchell and Collinsville Airport sites, Bluff-style houses are associated with all of the zones of the pollen chronology. The pollen data suggests, then, that Wittry's chronology is not defensible.

#### **COMPARISON OF RADIOCARBON AND PALYNOLOGICAL "DATES"**

During the 1961-1963 field seasons, a systematic attempt was made to collect a sediment sample for pollen analysis in direct association with each specimen of charcoal collected for radiocarbon analysis. A number of such samples did not yield palynological

data, and some of the resulting radiocarbon assays were not accepted on archaeological grounds (e.g. TBN 336-17, 2560 $\pm$ 75; TBN 336-33, 1600 $\pm$ 211; TBN 336-34, 2439 $\pm$ 223).

The following table identifies the pollen zone diagnosis for pollen samples directly associated with accepted radiocarbon dates.

<b>LAB#</b>	<b>ASSAY YEARS B.P.(1950)</b>	<b>POLLEN ZONE</b>
<b>M-1339</b>	685 $\pm$ 100	II-III
<b>M-1338</b>	725 $\pm$ 100	III
<b>M-1302</b>	750 $\pm$ 150	III
<b>M-1335</b>	765 $\pm$ 200	III
<b>M-1298</b>	785 $\pm$ 150	III
<b>M-1337</b>	805 $\pm$ 100	III
<b>M-1333</b>	825 $\pm$ 100	III-IV
<b>M-1336</b>	885 $\pm$ 200	III-IV
<b>M-1303</b>	950 $\pm$ 150	IV
<b>WIS-391</b>	850 $\pm$ 65	V
<b>WIS-390</b>	890 $\pm$ 55	V
<b>WIS-389</b>	900 $\pm$ 50	?
<b>M-1340</b>	1025 $\pm$ 110	?
<b>M-1292</b>	1055 $\pm$ 150	V
<b>M-1294</b>	1125 $\pm$ 150	V

The number of radiocarbon dates from the American Bottoms area has increased dramatically since 1962, but palynological research in this area has not. Though the tabulation shown above strongly suggests that the pollen zone sequence (possibly excepting the palynologically distinctive “?” samples) constitutes a true chronology, the issue becomes more ambiguous when the confidence interval spans are considered as part of the antiquity of the radiocarbon assays.

The best information available to me on *stratified* radiocarbon samples with associated pollen records is from C-14 dated stratigraphically superimposed houses at Tracts 15A and 15B:

HOUSE/TRACT	C-14 ASSAY	POLLEN ZONE DIAGNOSIS
<b>59B</b>	M-1334 385± 90	III
<b>43B</b>	M-1332 515±100	III
<b>35A</b>	M-1339 685±100	II-III
<b>32A</b>	M-1338 725±100	III
<b>77A</b>	M-1335 765±200	III
<b>74A</b>	M-1340 1025±200	?

Using a 1-sigma C-14 range, the pollen chronology would appear to be inconsistent with radiocarbon dating, since House 35A is radiocarbon dated as older than Houses 59B and 43B, but the pollen chronology suggests it is younger. Use of a 2-sigma C-14 range would eliminate this discrepancy but would raise the prospect that Houses 77A and 74A were contemporaneous – which is denied by the pollen chronology and their stratigraphic relationship.

Overall, the best that can be said about the relationship of available radiocarbon dates to the relative dates for associated pollen samples is that there is no *necessary* disagreement between the two. But the two chronologies cannot be said to reinforce each other, either, nor does the radiocarbon data supply absolute estimates of the antiquity of the pollen zones.

## COMPARISON OF THE POLLEN CHRONOLOGY AND THE O'BRIEN CERAMIC CHRONOLOGY

During the past two years, Mr. William Chmurney has analyzed the ceramic lots associated with the American Bottoms pollen records and has interpreted their seriation

status according to the criteria established by Patricia O'Brien (1972). Some samples diagnosed as Pollen Zones IV and III were associated with ceramic assemblages that O'Brien's chronology would place in Phase 3 (AD 1000-1175) and in Phase 4 (AD 1175-1275). However, samples of all of the zones of the pollen chronology were associated with ceramic assemblages O'Brien's chronology would place in Phase 5 (AD 1275-1450). Clearly, there is no correspondence between the two sorts of chronologies, and the general correspondence of the pollen zone sequence with archaeologically acceptable radiocarbon dates from the American Bottoms leads to the conclusion that O'Brien's ceramic phase chronology is without merit.

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