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A Mid-Wisconsinan Pollen Diagram From Black Hawk County, Iowa

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A pollen sequence spanning the mid-Wisconsinan Farmdalian interstadial, from 34,460 to 20,850 RCYBP (radiocarbon years before present), was recovered from a peat along a cut bank on the Wapsipinicon River in Black Hawk County, Iowa. The pollen sequence is divided into three zones. Zone I at the base of the peat is dominated by *Pinus* and NAP (nonarboreal pollen) believed to represent an open pine parkland. Zone II, dominated by *Picea* and *Pinus* pollen, is interpreted as the record of a closed conifer forest, and Zone III, dominated by *Picea* and NAP, as open, taiga-like vegetation. Changes in the pollen sequence appear to reflect the abatement and subsequent return of glacial conditions. Comparable changes are recorded in pollen diagrams from elsewhere in Iowa, Missouri, Illinois, and Kansas.
INDEX DESCRIPTORS: Palynology, Quaternary, Farmdalian Interstadial.

Abundant, well-preserved pollen of mid-Wisconsinan age was recovered from a peat exposed along the Wapsipinicon River in Black Hawk County. This paper presents the second pollen diagram from a site of this age in Iowa, and helps to fill a large geographical gap in our understanding of regional vegetation patterns during the mid-Wisconsinan.

DESCRIPTION OF THE SITE

The site is located in the NW ¼, SE ¼, NW ¼ of section 36, T. 90 N., R. 11 W. (Littleton 7½′ Quadrangle), about 6 km northwest of Littleton, Iowa (Fig. 1, #1). The Wapsipinicon River here has cut its bank into a low stream terrace. The peat crops out for approximately 50 meters along the bank. The site is within the area of the Iowan erosional surface, which is developed on pre-Wisconsinan till deposits (Ruhe *et al.*, 1968). *Betula, Quercus, Acer,* and *Salix* grow in a gallery forest at the site. Cultivated fields lie less than 100 m to the north, and a small pine plantation grows about 1 km south of the site. The regional vegetation before settlement consisted of prairie.

STRATIGRAPHY

The peat lies within the terrace deposits. It is overlain by approximately 3.7 m of leached, stratified silt loam, sandy loam, and gravelly alluvium. The contact between the peat and the sandy loam is convoluted. The peat deposit is lenticular, nearly pinching out to the east and thickening to 1.52 m near the west end, where the section was measured. Beyond this, it is covered with colluvium.

River level stood 7.0 m below banktop when the section was measured in August, 1976. Starting .6 m below river level, the stratigraphy at the sample location was: 7.6 - 6.7 m, silt, gray with scattered gray-green sandstone pebbles grading downward into sand; 6.7 - 5.3 m, silt, brown with some angular blocky structure, clayskins, and numerous rootlet tubules; 5.3 - 3.8 m, peat, red-brown, fine-grained to granular in texture, with moss and wood fragments and fibers; 3.8 - 2.6 m, sand, buff, medium-grained with 0.3 to 0.65 cm-thick silt lenses and layers, convoluted near the base; 2.6 - 2.0 m, gravel, red-stained, leached, and very sandy; 2.0 - 1.5 m, silt, sand and gravel, buff, with an uneven basal contact; 1.5 - 0.91 m, sand, gray, fine to medium grained; 0.91 - 0 m, silt, black to gray with much organic material.

RADIOCARBON DATES

Pollen was present from the sandy silt at 3.68 m to the silt below the peat at 5.48 m. A sample from 3.66 to 3.69 m yielded a radiocarbon date of 20,850 ±450 RCYBP (I-9766), after treatment for removal of carbonates and humic acids. Material from 5.37 to 5.49 m was dated at 34,460 +2000, −2760 RCYBP (DIC-876), after removal of carbonates and humic acids. The structure, clayskins and root tubules suggest some B-horizon soil development at this level.

The radiocarbon dates place the time of peat formation in the later part of the mid-Wisconsinan interstadial complex (Plum Point interstade), defined from the Lake Erie region (Dreimanis and Goldthwait, 1973), or the early Woodfordian, Farmdalian and late Altonian stages as defined in Illinois (Willman and Frye, 1970).

METHODS

Blocks of material 15 × 3 × 10 cm were cut from the bank starting .35 m above the top of the peat, and continuing to .91 m below the peat. The blocks were sealed in plastic bags to be sampled for pollen and examined in detail in the laboratory.

Twenty samples were removed at .15 m intervals from the field samples for pollen analysis. Their volume was first measured in water. Tablets of *Eucalyptus* pollen grains were then added, to allow calculation of the concentration of pollen in the sediment. Treatment with KOH, HCL, HF, and acetolysis followed, as outlined in Faegri and Iverson (1975). The treated samples were stained with safranin and suspended in silicone oil for counting. Thirteen samples from the peat

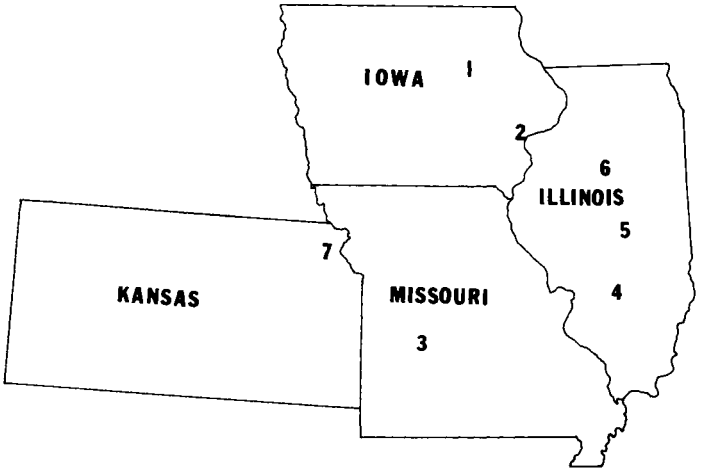

Figure 1. *Locations of Farmdale pollen sites: #1. Wapsipinicon Cut Bank; #2. Butler Farm; #3. Boney Spring; #4. Pittsburg Basin; #5. Macon County; #6. Richland Creek; #7. Arrington & Muscotah Marshes.*

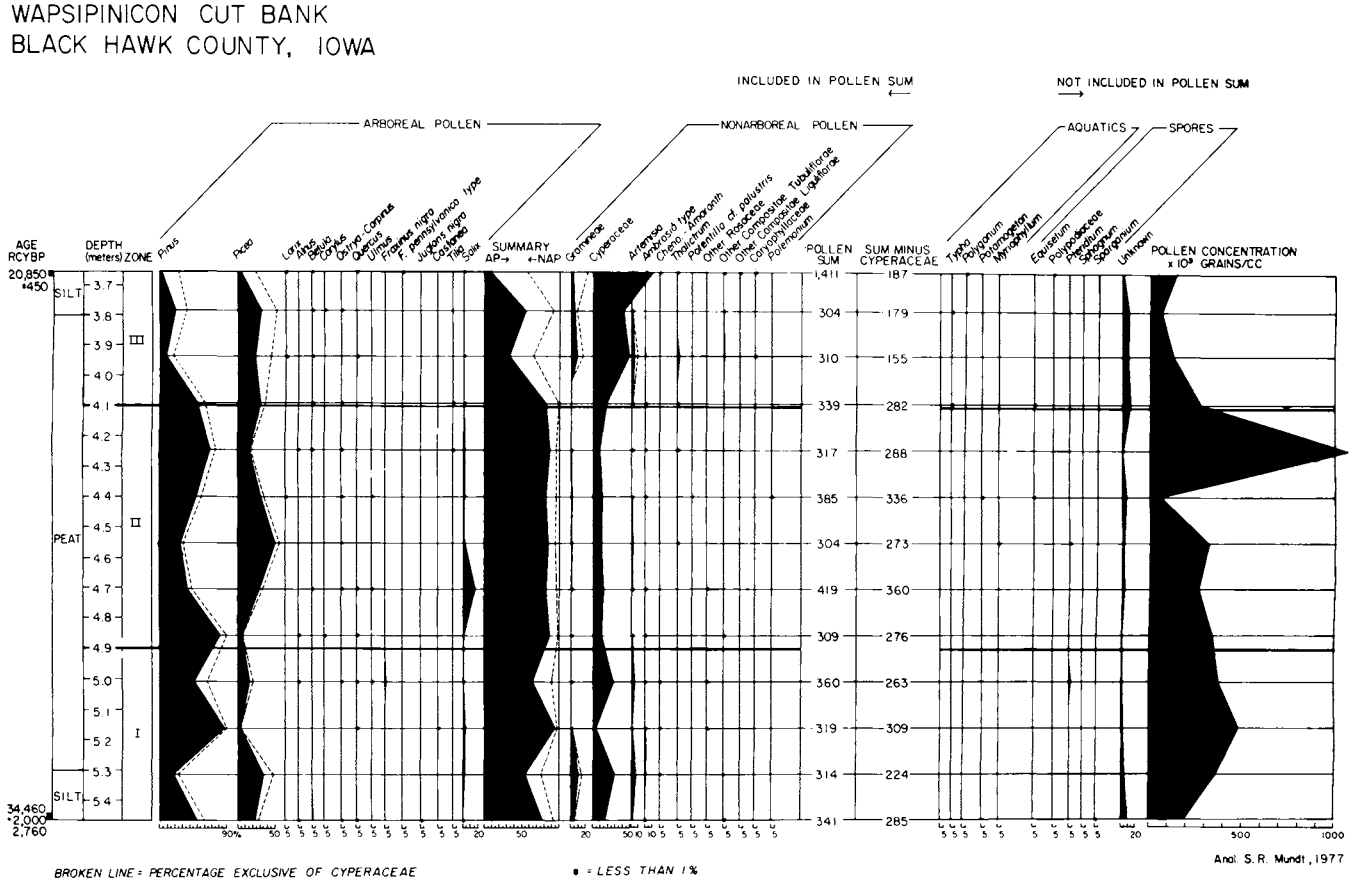

Figure 2. *Pollen percentages and concentrations.*

and adjacent silts contained sufficient pollen to be counted.

Pollen concentration was calculated according to the following formula, adapted from Maher (1972):

$$C = \frac{N \cdot R}{V}$$

where: C = number of grains of a taxon per unit volume

N = number of grains of *Eucalyptus* pollen in a tablet, 16,180 (pers. comm. to R.G. Baker from L.J. Maher, 1976)

R = number of grains of the taxon counted in a sample divided by number of grains of *Eucalyptus* pollen counted in the sample

V = volume of sediment in the sample, in cc.

RESULTS

POLLEN PERCENTAGES

Pollen of spruce, pine and Cyperaceae outnumber all other types (Fig.2). Pollen of sedge presumably growing at the site of peat deposition generally occur in numbers that exaggerate sedge's importance in the regional vegetation. Because of this, a second percentage curve is shown as a dashed line for selected taxa, based on the pollen sum excluding sedge pollen. This percentage is given in parentheses in the following discussion. The diagram has been divided into three zones:

Zone I: Pine - NAP, 4.9 - 5.5 m

Pine ranges from 19 to 87 (26 to 90) per cent, reaching its overall maximum, and averages 54 (66) per cent. NAP ranges from 6 to 45 (2 to 23) per cent and averages 24 (9) per cent. The highest value of spruce in this zone, 34 (48) per cent occurs at the base and coincides with peaks in Graminae of 10 (14) per cent, *Artemisia* of 4 (6) per cent, and *Ambrosia*-type pollen of 1 (2) per cent. *Betula, Fraxinus* and *Salix* are present in this zone as 1 to 2.6 per cent.

Zone II: Spruce - Pine, 4.1 - 4.9 m

NAP drops to an average of 16 (4) per cent and ranges from 13 to 19 (2 to 6) per cent. Grass does not exceed 3 (3) per cent. Spruce and pine successively dominate the AP (arboreal pollen). In the lower half of the zone, spruce reaches its overall maximum of 50 (56) per cent, accompanied by birch, *Ostrya-Carpinus* and *Artemisia* peaks of less than 5 per cent, and the overall maximum of willow, 15 (18) per cent. Pine dominates the upper half of the zone, reaching a high value of 68 (75) per cent. Together the conifers consistently make up about 85 per cent of the total pollen in Zone II.

Zone III: Spruce - NAP, 3.7 - 4.1 m

Spruce values range from 4 to 30 (24 to 52) per cent and average 19 (24) per cent, while pine ranges from 4 to 21 (25 to 36) per cent and averages 11 (26) per cent. AP consists almost entirely of pine and spruce. Total NAP increases dramatically because of a large influx of sedge pollen, ranging from 46 to 92 (7 to 35) per cent and averaging 41 (17) per cent. Grass and sedge reach their overall maxima in this zone

and significant amounts of *Artemisia,* up to 4 (8) per cent, *Ambrosia*-type, 1(2) per cent, other Compositae Tubuliflorae, up to 1 (2) per cent each, and *Thalictrum,* up to 3 (6) per cent are present.

POLLEN CONCENTRATIONS

Changes in pollen concentration (Fig. 2) further characterize the three pollen zones. Such changes are produced by changes in the rate of sedimentation, differential compaction of the sediment and variations in the rate of pollen deposition. Zone I concentrations undergo a smooth increase and then decrease, over a relatively narrow range, from 1.9×10^5 to 4.8×10^5 grains per cc, averaging 3.7×10^5 grains per cc. Relatively large fluctations in pollen concentration occur in Zone II. Values include the overall minimum of 0.58×10^5 and the overall maximum of 10.6×10^5 grains per cc. The average in Zone II is 4.5×10^5 grains per cc. In Zone III concentrations again vary over a narrow range, from 0.6×10^5 to 1.4×10^5 grains per cc, and average 1.1×10^5 grains per cc, lower than in Zone I or Zone II.

DISCUSSION

INTERPRETATIONS

The variety and relatively large amounts of NAP, large amounts of pine pollen, and moderate pollen concentrations suggest that Zone I, beginning about 34,460 RCYBP, represents an open pine parkland. The relatively low percentages of spruce pollen indicate that spruce was either rare or growing at some distance from the site. Low NAP values, large percentages of pine and spruce, and high average pollen concentration indicate the presence of a closed conifer forest during Zone II. High NAP values, relatively low pine and spruce percentages, and extremely low pollen concentrations suggest that the forest re-opened during Zone III. Pine appears to decline as conditions ceased to favor its growth, and the landscape may have assumed a taiga-like aspect. Peat formation ended at the close of this zone, about 20,850 RCYBP.

OTHER MIDWESTERN SITES

Pollen diagrams from sites in Iowa, Missouri, Illinois, and Kansas cover all or parts of the period from 20,850 to 34,460 RCYBP. With additional information from Iowa, the vegetational history of the Midwest during this period becomes clearer.

A pollen sequence from Butler Farm, Muscatine County, Iowa (Fig. 1, #2) indicates a closed conifer forest dominated by pine and later by spruce from 28,800 to 22,750 RCYBP (Van Zant *et al.,* in prep.).

Between 34,000 and 24,000 RCYBP, NAP and pine pollen dominate pollen sequences from springs in the Missouri Ozarks (King and Lindsay, 1976) (Fig. 1, 3). Pine and sedge each range up to 60 per cent of all pollen during this period, and no spruce macrofossils or pollen are reported. After about 24,000 RCYBP, spruce appears in the pollen record, and a trend toward abundant spruce and low NAP values begins.

Pollen-bearing sediments from the Pittsburg Basin in Fayette County, Illinois (Fig. 1, #4) span the period from approximately 38,100 to 21,370 RCYBP (Grüger, 1972). Values for pine and oak each range from less than 10 up to about 35 per cent. Spruce values do not exceed 10 per cent, and NAP is abundant and diverse. Pollen diagrams from nearby Seminary School and Hickory Ridge Basins apparently cover parts of the same time span as Pittsburg Basin and contain the same major taxa in similar proportions.

A pollen sequence from the Peoria Loess, Robein Silt, and Roxana Silt in Macon County, Illinois (Fig. 1, #5) bears a date of greater than 33,000 RCYBP (Grüger, 1972). The Robein Silt is generally accepted as Farmdalian in age. The pollen sequence is divided into two zones. The older, Zone 1, contains relatively large proportions of grass and other herb pollen. Pine and spruce increase in Zone 2, while NAP values decline.

Pollen was also recovered from the Robein Silt and overlying Morton Loess at Richland Creek in Woodford County, Illinois (Fig. 1, #6) (Grüger, 1972). AP ranges from about 50 to 90 per cent in the silt unit. The total percentage of conifers remains nearly constant, although the relative proportion of spruce and pine fluctuates. Pollen from the loess unit is characterized by 50 to 90 per cent NAP. Pine values are consistently about 10 per cent higher than spruce values, and AP in general is less diverse than in the silt unit.

The lower parts of pollen diagrams from marshes near Arrington and Muscotah along the Delaware River in northeastern Kansas (Fig. 1, #7) bear dates of 24,500 and 23,040 RCYBP, respectively (Grüger, 1973). Lower levels in both marshes contain spruce, pine, and NAP. At higher levels, spruce pollen becomes much more abundant, and NAP declines.

REGIONAL RELATIONSHIPS

Before about 33,000 RCYBP, pollen diagrams from northern Illinois, Missouri, and Iowa indicate that the vegetation was probably an open pine parkland with spruce rare in the north and completely absent in the south. At a later time, as yet not determined by radiocarbon analysis, a closed spruce-pine forest probably became established in Iowa and Illinois as glacial conditions developed. Open pine parkland persisted in Missouri during this period, and an open pine and spruce community was apparently present in northeastern Kansas. After about 24,000 RCYBP, spruce became the dominant tree in Kansas, and probably also in Iowa and Illinois, and it appeared in Missouri for the first time. The forest probably assumed an open, taiga-like aspect in Iowa and northern Illinois as advancing glaciers rendered the region's climate unfavorable to pine. Nothing comparable to the oak-NAP and pine assemblage from southern Illinois is found in Iowa.

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REFERENCES

DREIMANIS, A., and R.P. GOLDTHWAIT, 1973, Wisconsin glaciation in the Huron, Erie, and Ontario Lobes, *in* The Wisconsinan Stage, R.F. Black, R.P. Goldthwait, H.B. Willman, eds., Geolm Soc. Am. Mem. 136, p. 71-106.

FAEGRI, K., and J. IVERSON, 1975, *Textbook of Pollen Analysis,* p. 101-112.

GRÜGER, E., 1972, Pollen and seed studies of Wisconsinan vegetation in Illinois, U.S.A., Geol. Soc. Am. Bull 83, p. 2715-2734.

GRÜGER, J., 1973, Studies on the late Quaternary vegetation history of northeastern Kansas, Geol. Soc. Am. Bull. 84, p. 239-250.

KING, J.E., and E.H. LINDSAY, 1976, Late Quaternary biotic records from spring deposits in western Missouri, *in* Prehistoric Man and His Environments — a Case Study in the Ozark Highland, W.R. Wood and R.B. McMillan, eds., p. 63-78.

MAHER, L.J. Jr., 1972, Absolute pollen diagram of Redrock Lake, Boulder County, Colorado, Quaternary Research 2, number 4, December 1972.

RUHE, R.V., DIETZ, W.B., FENTON, T.E., and HALL, G.F., 1968, Iowan drift problem, northeastern Iowa, Iowa Geol. Survey Report of Investigations, 7, 40 p.

WILLMAN, H.B., and J.C. FRYE, 1970, Pleistocene stratigraphy of Illinois, Ill. State Geol. Survey Bull. 94, 204 p.