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Stratigraphy and Preliminary Pollen Analysis of a Lake County, Illinois, bog

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STRATIGRAPHY AND PRELIMINARY POLLEN ANALYSIS OF A LAKE COUNTY, ILLINOIS, BOG[1]

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The last decade has marked a growing interest in paleoecology stimulated by stratigraphic studies and pollen analyses of peat deposits. A number of bogs of considerable interest occur in the northeastern part of the state of Illinois, in Lake and McHenry counties (Waterman 10).

In the fall of 1932 a detailed study of one of these bogs, the deposit about two miles north of the town of Volo, Illinois, was begun. This occurs in the Gray's Lake Quadrangle, whose exact boundaries are 42° 15′-42° 30′. The investigations followed two main lines: (1) Analysis of the fossil pollen grains in the peat to determine the possible changes in the vegetation of the region which have taken place during the formation of the bog, and (2) Microscopic analysis of the peat to determine the botanical composition of the various peat-types occurring as well-marked strata in the deposit. Much information concerning the history of the development of the bog can be obtained from a knowledge of the peat profile.

METHODS

The methods employed here are essentially those used by Erdtman (3). Samples of peat were collected at intervals of twenty centimeters from the surface to the bottom of the bog. Complete series of samples could only be taken in sections of the bog where the peat was firm enough to be cut and retained by the sampler. A portion of the center of the core was carefully removed with a scalpel and placed in numbered glass vials. They were brought into the laboratory and prepared for study while still moist.

Approximately one cubic centimeter of material was boiled in 10 per cent potassium hydroxide to which a few drops of safranin had been added, centrifuged, decanted, washed with distilled water, centrifuged and decanted again. A small amount of the material near the surface of the filtrate was removed by means of a pipette and placed on

[1]A portion of the work done on a thesis submitted in partial fulfillment of the requirements for the Master of Science degree in Northwestern University. The pages of Butler University Botanical Studies are open to all Butler University alumni.

a slide. After most of the water had evaporated, glycerine and cover slip were added. Permanent slides were ringed with balsam and at least two slides from each level were prepared.

Erdtman (3) and Sears (8) claim that trustworthy results are obtainable by counting 100 or 150 pollen grains per level. The latter number was used in all the counts in this study. Identification was made on the basis of measurements of extant pollen grains of identical genera and comparison with Sears' (8) drawings and descriptive key. As specimens of pollen of present-day plants were not available in sufficient amounts to make accurate identification of all fossil pollen possible, a comparison was made of the proportions of pollen of winged conifers and of deciduous trees and herbaceous plants at the different levels in the peat. Winged coniferous pollen was further differentiated as to the genera: Abies, Picea and Pinus. Results of the tabulation are shown in Figure 2.

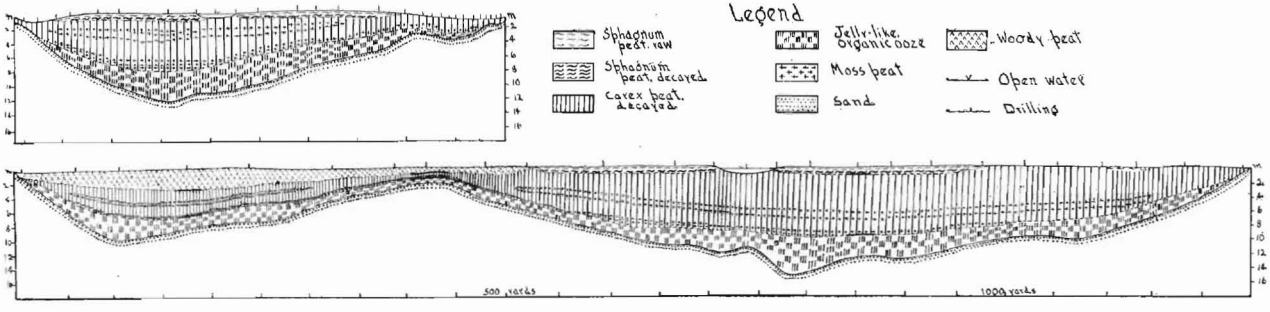
OBSERVATIONS

The following peat-types were found from the top downward: *Raw Sphagnum peat:* less than 5 cm. thick, consisting of the dead lower parts of living plants and only fairly well preserved. *Decayed Sphagnum peat:* about 15 cm. in thickness, in all stages of decomposition. This depth of Sphagnum peat is not in accord with the previous report of about seven feet given by Kurz (6). *Carex peat:* from 2.0-2.5 m. thick, finely fibrous, dark brown, consisting mainly of rootlets, grass stems, some woody fragments and parts of free vascular strands; much decayed. *Moss peat:* 1.0 m. in average thickness, reddish brown, coarsely fibrous, composed of a single species of an aquatic moss, *Drepanocladus Wilsoni Schimp.*, a common bog and lake moss both in Europe and North America.[1] It is intermixed with fine rootlets. *Carex peat:* 1.0 m. thick, finely fibrous, dark brown, containing seeds, stems of grasses and parts of leaves. Moss stems in the lower portion. *Moss peat:* 2.0 m. in thickness, coarsely fibrous, dark brown to black, consisting of *Drepanocladus Wilsoni Schimp.;* larger and blacker than the same species in the moss layer above. Williams[2] states that the species of this genus are all quite variable and that the larger and blacker specimens of this layer grew more submerged in water than the others. *Organic ooze:* 1.2 m. thick, gray brown, jelly-like and rubbery, amorphous, with only

[1]Specimens of mosses sent to Dr. R. S. Williams for identification.
[2]Personal communication.

FIGURE 1

BOG PROFILE, CONSTRUCTED FROM BOTH LENGTHWISE AND CROSSWISE LINES OF DRILLING, VOLO BOG



a few fibrous strands in the upper portion. Incineration shows it to be largely organic matter with little mineral residue. In a few cases it contains shells of molluscs. This layer rests upon a sand bottom.

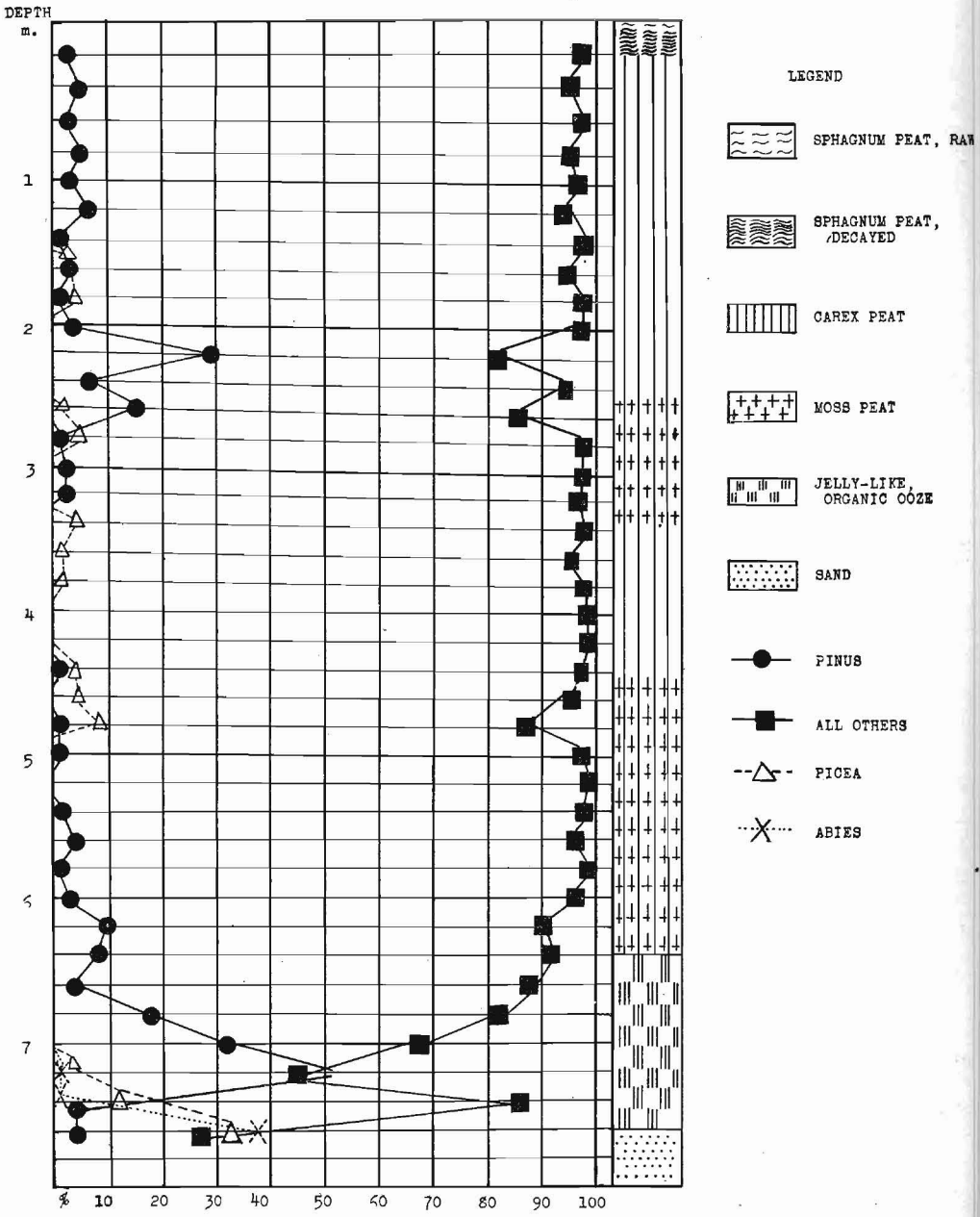
The peat-types described above are in the same sequence throughout the bog, though in varying amounts. In the extreme northern and southern parts of the bog the Sphagnum peat is absent and the Carex peat is overlain by dry woody peat 1.0-2.0 m. in thickness, very coarsely fibrous, red brown, consisting of branches and roots of trees and small stems of shrubs. Figure 1 illustrates profiles of the bog constructed from both lengthwise and crosswise lines of drillings.

In one or two instances, deposits of marl were encountered, 1.0-1.2 m. in average thickness. Where marl is found, it occurs as a layer above the sand bottom or is incorporated with the organic ooze. This was particularly true at the point where the bottom rises to within two meters of the surface. The following molluscs taken from the marl were identified by Dr. F. C. Baker: *Valvata tricarinata* (Say), *Amnicola Leightoni* F. C. Baker, *Amnicola gelida* F. C. Baker, *Fossaria obrussa decampi* (Streng), *Gyraulus* sp. undet., *Physsa sayii* Tappan, immature. According to Dr. Baker, both species of Amnicola are not found living at present, and Fossaria is approaching extinction. However, all are molluscs that lived in fresh water.

A summation of total number of spores counted and the relative per cent of each kind shows that where percentage of conifer pollen is high, there is a correspondingly low percentage of deciduous pollen. The analysis graph and bog profile (Figure 2) show that Abies and Picea are dominant at the lowest level, deposited in vast quantity at an early stage of the bog-lake when its surface was not covered by vegetation. Above this the peat consists of organic ooze or material deposited under water, of moss peat, Carex peat, moss peat again, Carex peat again and Sphagnum peat in the order named. From the 6.4 m. to the 0.2 m. level the peat represents material deposited in shallow water or from the underside of floating vegetation mats. In this portion of the profile, Pinus pollen appears only in minimum quantity, whereas deciduous pollen is dominant. Abies pollen disappears entirely above the 7.0 m. level, while Picea pollen appears at four disconnected levels, *viz.*, at 4.4-4.8 m., 3.4-3.8 m., 2.6-2.8 m., and 1.4-1.8 m.

FIGURE 2

POLLEN DIAGRAM AND BOG PROFILE, VOLO BOG



DISCUSSION

As the diagram indicates, a conifer forest of Abies and Picea, no longer present in this region, controlled the area during the early development of the bog, but was later replaced by a deciduous forest which has remained dominant up to the present time. The sudden change from coniferous pollen dominance to deciduous pollen dominance suggests that the factors unfavorable to the then dominant forest aided the invaders in rapid ecesis. Distribution of vegetation is dependent upon climatic conditions, and, according to Auer (1), "the pollen content of the successive layers of the individual bogs is a direct indication of the comparative abundance of the different trees growing at the time the peat layers were forming." This succession of trees is typical for the majority of bogs in southeastern Canada (Auer (1)), in Wisconsin, Michigan and Ohio (Sears (8)), Illinois (Voss (9)), and Indiana (Lindsey (7) and Houdek (5)). Bogs of Indiana and Illinois (Lindsey (7), Houdek (5), Voss (9), and Fuller (4)) show Abies disappearing in the lower strata, as is shown in the present study of the Volo bog. Picea usually persists only for a short time after the disappearance of Abies. Farther north in Wisconsin (Fuller (4)), Picea persists throughout the entire postglacial period. The behavior of Picea in the present study is thus intermediate between that shown farther south in Illinois and Indiana (Voss (9) and Lindsey (7)) and that farther north in Wisconsin.

As to climatic changes, predominance of pollen of Abies and Picea is generally thought to indicate a cool, dry climate, and predominance of pollen of deciduous trees and herbaceous plants a warmer, more humid climate. The presence of decayed peat layers is thought by Dachnowski (2) to indicate a change in climate, but he suggests that this correlation needs further investigation. The primary conclusions drawn from most of the investigations in this field have been concerning climatic changes as reflected in the relative pollen abundance. However, except for the apparent change to warmer and dryer conditions immediately following the melting of the ice, generally regarded as a definite change in climate, the limited scope of this paper prevents any broader interpretation of climatic change.

Whether or not the data presented indicate climatic changes since the Late Middle Wisconsin ice invasion, they at least show the succession of vegetation since that time. The order of postglacial succession has been: Abies-Picea, Picea-Pinus and Pinus-all others.

SUMMARY

1. The Volo bog is a water-laid peat deposit which has formed in a depression containing two basins. The shallow basin is completely filled with solid peat, while over the deeper basin a small body of open water still remains. The depression is found in highly calcareous till of Late Middle Wisconsin age.

2. Two main layers of peat occur in the deposit: (1) Organic ooze, the lower one-fourth, and (2) Carex peat, composing the upper three-fourths of the total depth of peat. In this deep stratum there occur at two levels distinct layers of moss peat of a single species of an aquatic moss, *Drepanocladus Wilsoni Schimp.*

3. There is no Sphagnum peat recognizable as such below a depth of twenty centimeters in the Volo bog. There is a gradual transition downward from living Sphagnum at the surface to Sphagnum which is greatly decomposed and finally entirely absent. The disintegration and decomposition of the Sphagnum as well as much of the Carex peat is apparently associated with extensive bacterial action in the alkaline water and with periods during which the bog was not submerged.

4. Pollen of Abies and Picea reach a maximum in the lower levels, followed by an increase in pollen of deciduous trees and herbaceous plants. Pinus pollen continues throughout postglacial time. This indicates that the depression at Volo began filling up at a time when a conifer forest dominated the area, but which was soon replaced by a deciduous forest which has remained dominant up to the present time.

5. The stratigraphy may or may not indicate climatic changes during the postglacial period, but the pollen analysis shows that the order of succession since the last ice invasion has been: Abies-Picea, Picea-Pinus and Pinus-all others.

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