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Pre-and Postsettlement Pollen from a Short Core, Blackhawk Lake, West-Central Iowa

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SYNOPSIS: Pre- and Postsettlement Pollen from a Short Core, Blackhawk Lake, West-Central Iowa. *Proc. Iowa Acad. Sci.*, 80(1):41-44, 1973. The pollen within a short core from Blackhawk Lake shows the impact of settlement in the area. The proportions of both ragweed and pigweed pollen increased while the proportions of total arboreal pollen decreased. Among the arboreal pollen types, oak and hickory decreased while elm increased. These changes in the pollen record need to be recognized when samples of modern pollen are used to aid the interpretation of fossil pollen.

Recent work (Davis, 1967; Kapp, 1965; McAndrews, 1966; Ritchie, 1967; Lichti-Federovitch and Ritchie, 1968; Webb and Bryson, 1972; and Wright, 1968) indicates the importance of records of modern pollen for the interpretation of assemblages of fossil pollen. Analysis of the surface sediments of lakes, peat bogs, or cattle tanks provides records of the contemporary pollen rain. These samples of the modern pollen can be correlated with modern vegetation and with spectra of fossil pollen, thus providing a link between the fossil data and the vegetation they reflect. A major problem in the use of modern samples is that, unlike the fossil spectra, the modern spectra indicate not only the effects of climate and soils on the vegetation but also the effects of man's activities, e.g., large-scale plowing and sowing of the land. In particular, herb pollen, especially ragweed (*Ambrosia*), appears in greater proportions in contemporary sediments than in sediments deposited prior to the massive disruption of the natural landscape. It is important, therefore, to investigate the changes in pollen records that are related to the land's settlement by white men and to identify the effect of their agricultural practices on these records.

Short cores of bottom sediments from lakes provide a convenient means for studying these changes. In general, a short column of sediments will contain pollen from both settlement and presettlement times. A comparison of the pre-settlement record with that after settlement will reveal the changes in the pollen record related to man's activities.

For this purpose, pollen samples were extracted and analyzed from a short core taken from Blackhawk Lake (42°20′ N, 95°40′ W) in Sac County, Iowa (Figure 1). Today the land around Blackhawk Lake is mostly cultivated. According to Küchler's map (1964) of the potential natural vegetation, this region of the state lies within an area of bluestem prairie. Within this type of vegetation, 4 grasses predominate: tall bluestem (*Andropogon gerandi*), little bluestem (*A. scoparius*), Indian grass (*Sorghastrum nutans*), and panic grass (*Panicum virgatum*). Several species in the composite and legume families are also found. Only a few remnants of the native prairie remain intact today.

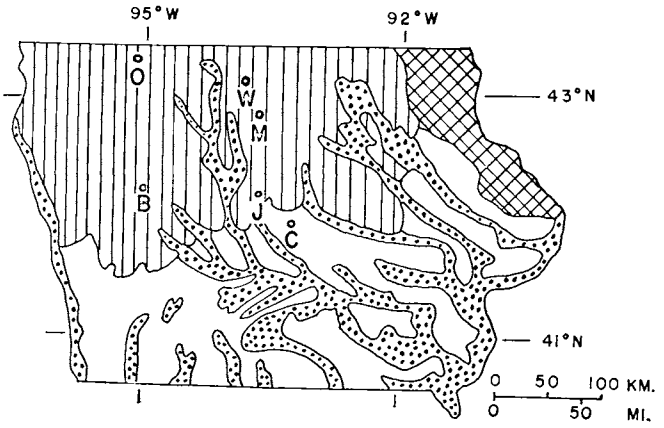

Figure 1. Map of Iowa showing the location of the sites of pollen work discussed in the text. B = Blackhawk Lake, O = Lake Okoboji, W = Woden Bog, M = McCulloch Bog, J = Jewell Bog, and C = Colo Bog. A simplified picture of the potential natural vegetation (after Küchler, 1964) is also given. The area of vertical lines represents bluestem prairie; area of cross-hatching, maple-basswood forest; stippled area, oak-hickory forest; and clear area, mosaic of bluestem prairie and oak-hickory forest.

MATERIALS AND METHODS

In 1966, a field crew led by G. Fred Lee of the Water Chemistry Department at the University of Wisconsin used a 4-in. piston corer to obtain a 57-cm core from Blackhawk Lake. The core was divided into 5-cm segments and portions of each segment were isolated for pollen analysis. Some of the sediments from the 50- to 55-cm segment were submitted for radiocarbon dating, and a date of 780 ± 60 BP was obtained (Bender et al., 1968).

Subsamples taken from 9 of the 11 5-cm segments were processed by standard palynological procedures (Faegri and Iversen, 1964), which remove most of the unwanted sediments and leave a concentrate quite rich in pollen. This residue was placed in glycerine jelly and mounted on microscope slides. The pollen grains were identified at between 250 and 1000X magnification on a Zeiss® photomicroscope, and counts of at least 280 grains were made for all samples but one. In the 20- to 25-cm segment only 87 grains were counted.

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TABLE 1. POLLEN COUNTS FOR BLACKHAWK LAKE, IOWA

Pollen type	0-5 cm	5-10 cm	10-15 cm	15-20 cm	20-25 cm	25-30 cm	30-35 cm	40-45 cm	50-55 cm
Picea			2	1	2		1	6	8
Pinus	10	12	19	32	52	6	40	32	46
Quercus	36	23	25	33	44	22	72	57	55
Carya			1	1		2	5	8	10
Juglans	4	3	3	3	4		2	5	1
Ulmus	6	18	7	6	3		2	4	4
Salix	3	6	6	8	10		6	6	2
Tilia	1						1	1	
Fraxinus	1	1	1				1		3
Betula								1	
Ostrya-Carpinus	5	2	5	1					1
Acer				1	1				
Populus				1			2	3	
Alnus						1			
Corylus									1
Cornus									1
Total trees	66	65	69	87	116	31	132	123	132
Ambrosia	161	175	190	124	86	23	74	92	75
Chenopodiaceae	40	49	63	59	40	11	20	27	23
Gramineae	22	40	21	29	37	7	20	15	33
Artemisia	2	5	4	7	16	2	18	8	10
Other Compositae	8	8	9	2	7	3	11	14	13
Cyperaceae	1	6		13	19	6	13	21	28
Other herbs	2	2	1	3	6	3	7	12	11
Total herbs	236	285	288	237	211	5	163	189	193
Typha latifolia							1	6	11
Total Pollen	302	350	357	323	327	85	295	317	336

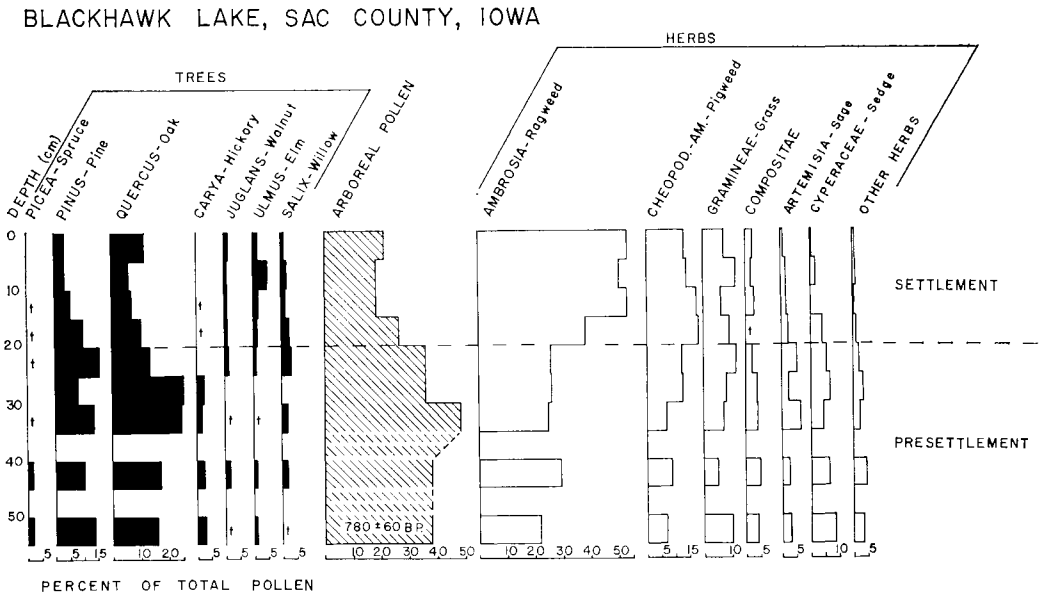

Figure 2. Diagram of percentages of pollen counted at each level in the core.

RESULTS AND DISCUSSION

Table 1 contains the numbers of grains counted in each sample and Figure 2 presents a diagram of the percentage values. A pollen sum including all pollen types was used to calculate the percentages plotted on the diagram.

The record from ca. 1170 AD to the present contains two major subdivisions. The sediments from 20-55 cm record conditions prior to settlement of the area by white men, and the sediments from 0-20 cm record the period after settlement. The line between these two zones is placed at 20 cm because of the abrupt rise in ragweed percentages. This increase in ragweed is the event which has signaled settlement in other short cores collected in the Midwest (McAndrews, 1966, 1968; and Davis et al., 1972).

Prior to settlement, the pollen record indicates prairie conditions in the area. Nonarboreal pollen dominates the spectra and occurs in proportions greater than 50%. From a study of pollen samples located in prairies, Lichti-Federovitch and Ritchie (1965) infer prairie conditions when the herbs appear in proportions of this size. The spectra of the lower two samples in this zone resemble the spectra found at Kirchner Marsh (Wright et al., 1963) in zone C-b. These workers interpreted that prairie invaded the landscape around Kirchner Marsh during this zone that dates from 5300 to 7100 BP.

The principal types of pollen found in this presettlement zone are the same as those found in the upper zones at Jewell, Colo, McCulloch, and Woden Bogs (Brush, 1967; Walker, 1966; Durkee, 1971). The values, however, for the principal herbs (ragweed and pigweed [Chenopodiaceae]) are lower than the values found in zone 3 at Woden Bog. Because the two records are not contemporaneous (the record at Woden Bog ends about 3000 BP, which is long before the beginning of the record reported in this paper), this difference may be partly due to a climatic change that occurred after 3000 BP but before 800 BP. Preliminary results from a pollen study in Lake West Okoboji (Dodd et al., 1968) indicate such an event. Herb pollen percentages there decreased after 3000 BP.

Another possible cause for the difference in herb pollen percentages between the two sites may be the different collecting efficiencies for bog and lake surfaces. The values of herbaceous pollen types can be enhanced in bogs because herbs may be able to grow on the bog surface, especially in times of drought. The description given of Woden Bog (Durkee, 1971, p. 838) indicates that the bog may have dried out seasonally in its natural state.

After settlement, when the rise in ragweed occurred, there was a synchronous increase in the proportion of pigweed pollen and a fall in arboreal pollen. These changes indicate the major effect of cultivation, which created bare and disturbed soil that could be invaded by weeds at the expense of other pollen types. Some cutting of local trees also occurred and contributed to the fall in the proportion of arboreal pollen. The percentages of hickory (*Carya*) and oak (*Quercus*) pollen decreased, and the percentage of elm (*Ulmus*) increased. These changes also indicate that the trees on drier locations may have been cut in preference to the trees found immediately around the lake. Communities dominated by oak and hickory tended to grow on drier ground than those dominated by elms (Conard, 1954). Certainly, the woods of oak and hickory are preferred to that of elm for building purposes.

CONCLUSIONS

The results of this work indicate that man has not only increased the proportions of herbs in the pollen record but has also differentially selected among the tree types. Adjustments should be made for these effects of man on the pollen record when modern samples from western Iowa are used to help interpret assemblages of fossil pollen.

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