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Microfossil Studies of Four Southwestern Ontario Bogs

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MICROFOSSIL STUDIES OF FOUR SOUTHWESTERN ONTARIO BOGS*

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The region traversed by Highway 17, between Fort William and Kenora in southwestern Ontario, Canada (Figure 1), lies within the area described by Nichols (1935) as the northern coniferous forest. This region has been severely glaciated by ice of the Fifth Wisconsin substage (Thwaites, 1934). Following the retreat of the ice, much of the area was inundated by Early Lake Agassiz and other lakes that are now smaller than in early post-Pleistocene time. During the course of postglacial time many of the ponds and shallow portions of the lakes have filled with peat, and extensive bog land is now present. The mineral soils are shallow, as one would expect in a region of extensive glacial scour. They are deepest where moraines, outwash, and glacial lake deposits are present. The underlying rocks are granites, gneisses, and basalts. Outcrops are abundant and frequently extensive. The terrain is flat to rolling, and the relief is approximately three hundred feet in parts of the region.

In the summer of 1942 the senior author collected samples of peat from borings in four deposits spaced at intervals along Highway 17 between Fort William and Kenora. A microscopic study of these has

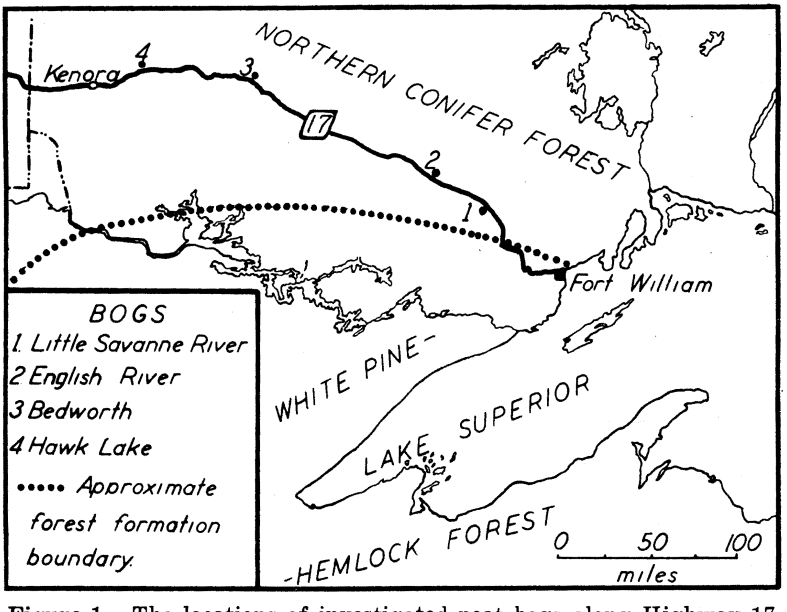

Figure 1. The locations of investigated peat bogs along Highway 17 in the Province of Ontario, Canada.

*Contribution from the Science Laboratories of Coe College No. 10 N. S.

been undertaken to determine their plant microfossil content, and to extend the geographic range of paleoecological studies in North America. The locations of the four deposits are shown in Figure 1.

The method of peat preparation employed in the present study is the KOH schedule commonly in practice among paleoecologists and has been fully stated in an earlier paper (Wilson and Webster, 1942). The number of fossils counted at each level was two hundred.

LITTLE SAVANNE BOG

The Little Savanne bog is approximately 2.8 miles east of the Little Savanne River on Highway 17. Its area is several square miles, and it is irregular in outline. The physiographic setting appears to be a depression in an outwash plain. The average depth of the deposit is about three feet and it is underlain by a sandy clay.

The tree cover of the bog is black spruce (*Picea mariana*), but it is sporadic and not dense, for the area has been partially burned. Heaths are abundant and *Ledum groenlandicum*, *Chamaedaphne calyculata*, and *Kalmia polifolia* are the common species. *Sphagnum* and *Polytrichum* mosses make up the surface mat.

The forest on the surrounding sandy soils is principally jack pine (*Pinus banksiana*), quaking aspen (*Populus tremuloides*), white birch (*Betula papyrifera*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), larch (*Larix laricina*), and pin cherry (*Prunus pennsylvanica*). One white pine (*Pinus strobus*) was seen twenty miles northwest of the bog, and, according to information given by Dr. R. V. Drexler (personal oral communication), others occur along the lake shores a few miles south of the deposit. No oak was observed, though it is probably nearby on the outwash plain. It is reported from the Quetico to the southward.

Table 1 and Figure 2 give the microfossil record and show the succession found in the deposit. All species of trees or shrubs recorded as fossils except *Tsuga canadensis* are found in or near the region today.

ENGLISH RIVER BOG

This deposit is located half-way between the English River and Upsala, Ontario. It is 4.7 miles east of the railroad crossing between the above mentioned points. The area of the bog covers at least several square miles. It is irregular in outline. One boring was made, and seventy inches of peat was found. The underlying soil is sandy clay.

The surrounding area is outwash plain with protruding rock drumlins. The bog appears to have developed in a kettle hole in the outwash plain.

The bog cover is black spruce (*Picea mariana*), jack pine (*Pinus banksiana*), whose trunks are seldom more than one and one-half inches in diameter, larch (*Larix laricina*), white birch (*Betula papyrifera*), swamp birch (*Betula pumila*), quaking aspen (*Populus tremuloides*), and alder (*Alnus crispa*). The surface of the bog is a thick

TABLE 1. LITTLE SAVANNE BOG

SPECIES	DEPTH IN INCHES					
	36	24	18	12	6	0
Pinus strobus and *P. resinosa*	7.5	5.5	5.5	4.5	7.0	6.0
Pinus banksiana	27.5	17.0	7.0	13.0	8.0	16.0
Picea glauca	20.0	32.5	42.0	49.0	56.0	48.0
Picea mariana	43.0	38.0	39.0	29.0	19.5	21.0
Abies balsamea	1.5	4.5	2.5	2.0	2.5	6.0
Tsuga canadensis	.....	0.5	0.5	.....	.....	.....
Betula sp.	.....	1.5	0.5	1.0	5.5	1.0
Alnus sp.	0.5	0.5	1.0	1.0	1.0	1.0
Acer sp.	.....	.....	1.0	.....	.....	0.5
Quercus sp.	.....	.....	.....	0.5	0.5	0.5

TABLE 2. ENGLISH RIVER BOG

SPECIES	DEPTH IN INCHES						
	70	60	48	36	24	12	0
Pinus strobus and *P. resinosa*	4.0	.5	5.0	7.5	5.5	73.0	6.5
Pinus banksiana	27.0	19.5	42.5	40.0	31.0	7.0	26.0
Picea glauca	62.0	68.0	22.5	17.0	4.0	2.5	23.5
Picea mariana	5.5	10.0	27.5	30.5	57.5	15.5	42.5
Abies balsamea	.....	.....	0.5	0.5	.....	.....	.....
Betula sp.	.....	0.5	1.0	3.5	1.5	1.0	1.0
Salix sp.	.....	.....	.....	.....	.....	.....	0.5
Quercus sp.	1.5	1.5	1.0	1.0	0.5	1.0	.....

TABLE 3. BEDWORTH BOG

SPECIES	DEPTH IN INCHES							
	41	36	30	28	20	12	6	0
Pinus strobus and *P. resinosa*	2.0	7.5	11.0	11.5	10.5	8.0	14.0	6.5
Pinus banksiana	17.5	7.0	16.5	15.5	6.0	8.5	33.5	27.0
Picea glauca	49.5	29.0	18.5	18.0	21.5	23.0	23.5	31.0
Picea mariana	27.0	49.0	41.0	51.5	51.5	53.0	26.0	33.0
Abies balsamea	4.0	6.0	4.5	2.0	8.0	5.5	2.0	2.0
Betula sp.	.....	1.0	8.0	1.5	2.5	2.0	1.0	0.5
Acer sp.	.....	0.5	0.5	.....	.....	.....	.....	.....

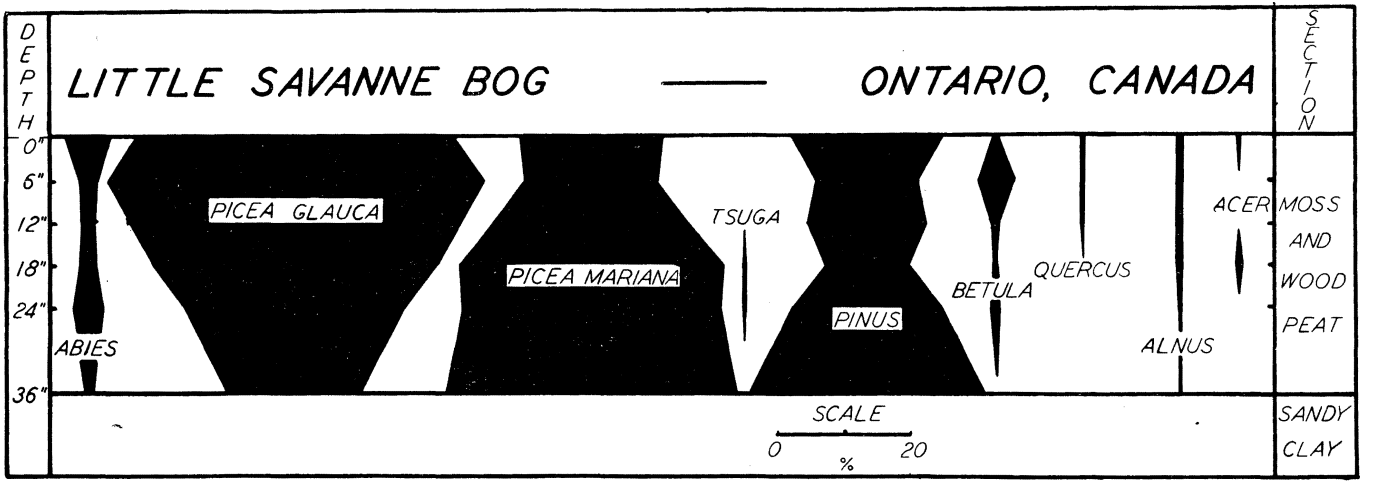

Figure 2. Diagram showing the microfossil succession in the Little Savanne peat bog.

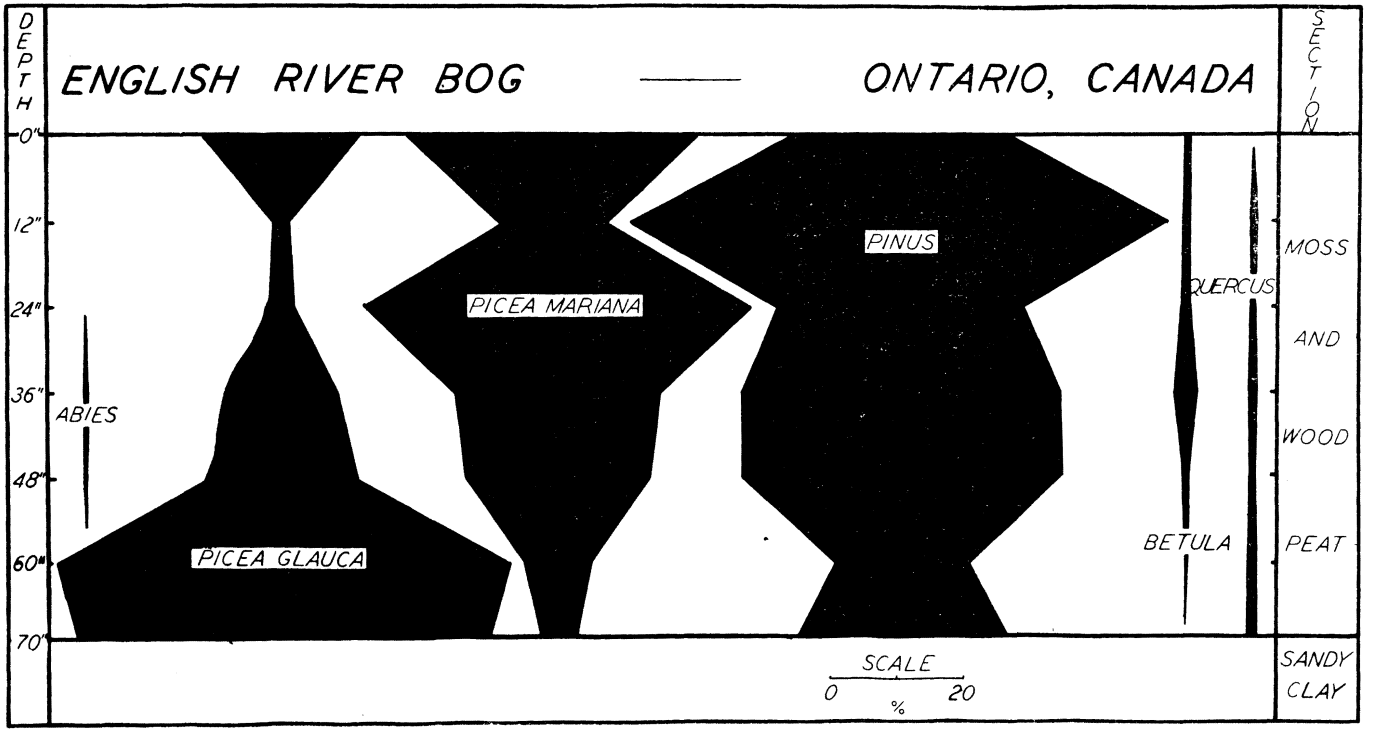

Figure 3. Diagram showing the microfossil succession in the English River peat bog.

mat of *Sphagnum* and *Polytrichum* mosses. The same heaths as are recorded on the Little Savanne bog also occur here.

The regional cover is predominately jack pine, especially upon the outwash. Black and white spruce, white birch, quaking aspen, and pin cherry are also present.

The microfossil record is given in Table 2 and the succession is shown in Figure 3.

BEDWORTH BOG

The Bedworth bog is an area of approximately twenty acres which is located two miles northwest of Bedworth, Ontario. The greatest depth of peat was found to be thirty-nine inches, and it is underlain by sandy blue clay.

The bog is covered by black spruce and a deep *Sphagnum* mat. On the upland the forest appears to be an equal mixture of jack pine, black spruce, white spruce, quaking aspen, a few balsam fir, and pin cherry trees. Information gained from local sources indicate that there are a few clumps of red and white pines around the lake shores. The largest trees in the region are white spruce.

The glacial geology of the region near Bedworth is interesting because the abundant deposits of varved clay indicate the existence of a widespread glacial lake. Varved clay deposits of twenty feet thick were frequently seen along lake shores and in road cuts.

The microfossil record is given in Table 3 and the succession is shown in Figure 4.

TABLE 4. HAWK LAKE BOG

SPECIES	DEPTH IN INCHES							
	44	39	34	28	21	15	6	0
Pinus strobus and *P. resinosa*	.....	2.5	4.0	9.5	2.5	12.0	22.0	34.0
Pinus banksiana	15.0	57.5	51.0	36.5	50.0	44.5	12.0	25.0
Picea glauca	67.5	4.5	8.5	13.0	16.0	12.0	21.5	23.0
Picea mariana	16.0	22.0	23.0	26.5	29.5	29.1	39.5	14.5
Abies balsamea	1.5	0.5	1.0	2.0	1.0	0.5	2.0	2.0
Salix sp.	.....	.....	0.5	.....	.....	.....	.....	.....
Betula sp.	.....	9.5	7.5	10.0	1.0	1.0	3.0	1.0
Alnus sp.	.....	1.5	3.5	2.0	.....	0.5	.....	0.5
Acer sp.	.....	.....	0.5	0.5	.....	.....	.....	.....
Quercus sp.	.....	2.0	0.5	.....	.....	0.5	.....	.....

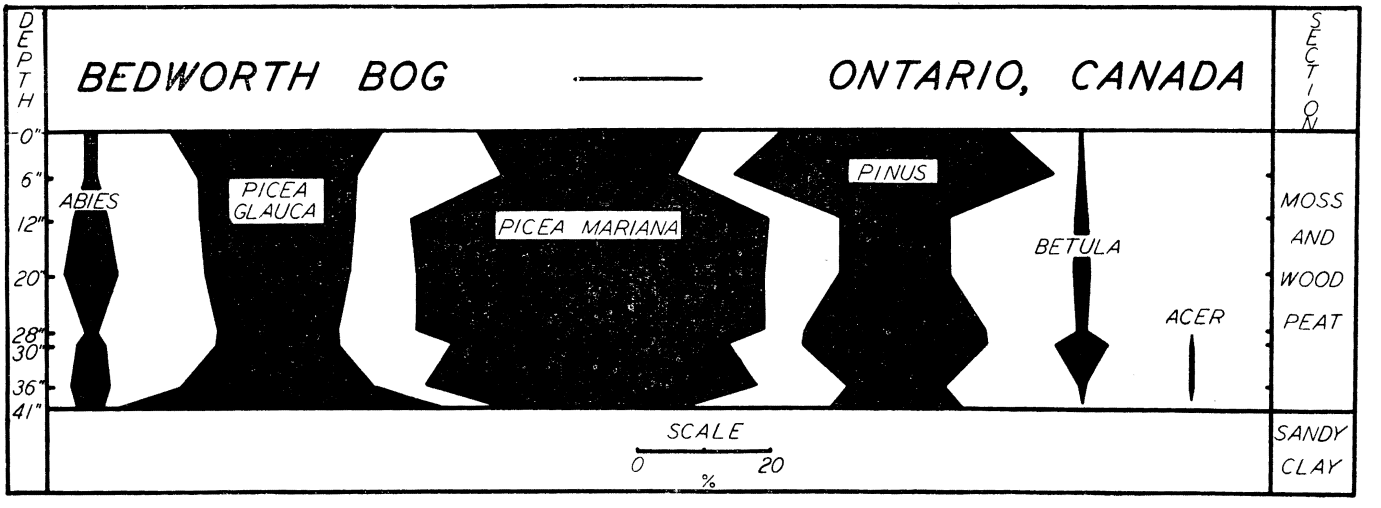

Figure 4. Diagram showing the microfossil succession in the Bed worth peat bog.

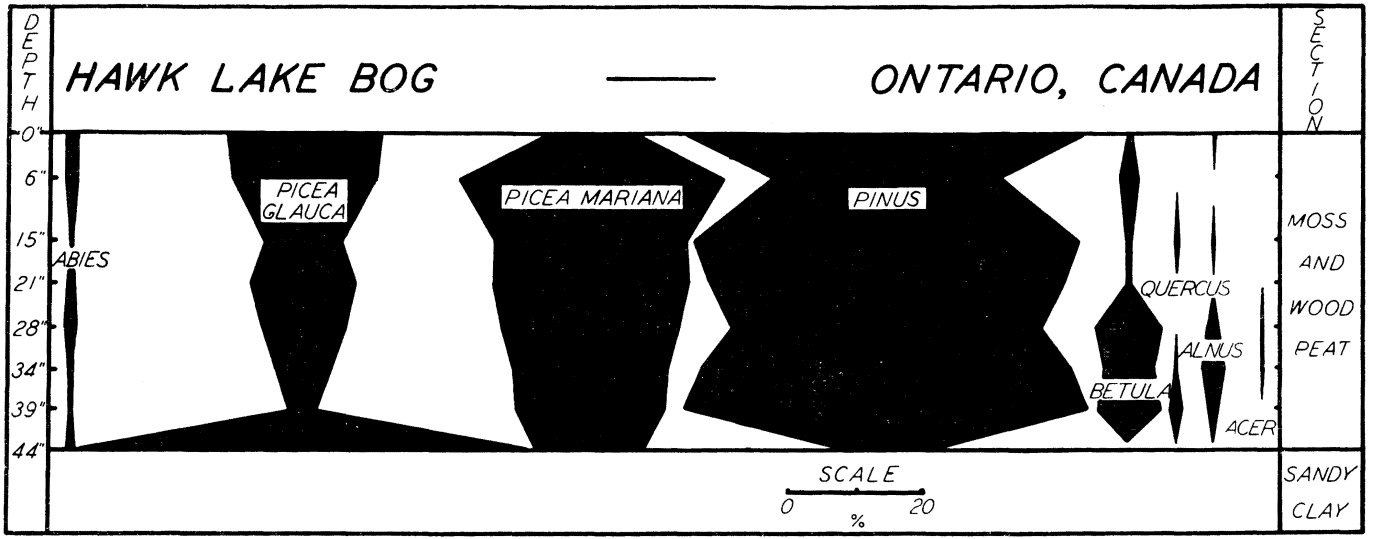

Figure 5. Diagram showing the microfossil succession in the Hawk Lake peat bog.

HAWK LAKE BOG

This deposit is located on the north side of Highway 17 about six miles east of Hawk Lake, Ontario. It is in the vicinity of Island Lake and covers an area of approximately thirty acres. Forty-two inches of peat was the greatest depth found, but a sample of sandy clay from forty-four inches below the bog surface also contained microfossils. Of all four bogs, this is the only sample of sandy clay that contained microfossils.

The bog cover consists of a deep mat of *Sphagnum* moss and a sporadic cover of black spruce, a few jack pine, and quaking aspen.

The upland cover consists of jack pine, black and white spruce, and alders (*Alnus incana* and *A. crispa*). One red pine was seen nearby, but in the immediate vicinity, this species and white pine are not frequent. They are, however, fairly abundant a few miles southwest of Hawk Lake.

The glacial geology of the vicinity consists of varved clays, moraines and tarn lakes.

The microfossil record is given in Table 4 and the succession is shown in Figure 5.

DISCUSSION

The historical development of the forests of southwestern Ontario is indicated by the four peat deposits described. The postglacial forest history of the region appears to be somewhat similar to that in northwestern Wisconsin previously described by the senior author (1938). The early forests were mainly spruce (*Picea glauca* and *P. mariana*) with considerable jack pine (*Pinus banksiana*) present. The spruce forests appear to have been invaded by pine, and more recently there seems to have been a slight shift back again to spruce. The deciduous element of the forests appears to be more pronounced during the period when pine was most important. This sequence is in general agreement with other like studies in the Lake Superior region. However, in a paleoecological study by Voss (1934), he describes the earliest forests of northern Minnesota as containing an important element of fir. This is a detail which does not agree with the findings in northwestern Wisconsin and Ontario. Pollen statistics indicate that fir was present but in no great abundance. The reported difference in the amount of fir in the two regions is considerable and appears to be too great for the areal distances involved. The discrepancy may perhaps be explained by the early confusion among investigators in general concerning the identity of *Abies* and *Picea glauca*.

The fossil pollen spectra of three bog profiles are in general agreement, and the fourth, the Little Savanne bog, agrees generally with the upper levels of the other three. Three borings were made in the Little Savanne bog, and thirty-six inches was the greatest depth found. It is possible that a deeper place exists in the bog, or the sandy clay deposit that was taken to represent the bottom of the bog may be in reali-

ty a lens overlying older peat; or that the bog remained a drainage channel during an extended period after the region was free of ice, thus the moving water prevented the accumulation of peat. That an entirely different forest history occurred near the Little Savanne bog seems improbable since the English River bog is probably near enough to be used as a check on the forest history of the Little Savanne region. The English River bog is in general agreement with the two others discussed here, and with bogs of northern Minnesota and Wisconsin. For the present, the Little Savanne bog is considered as showing only the upper portion of the regional pollen spectra. Regardless of this possible incompleteness, the deposit is of value in depicting the later forest history of the Little Savanne region.

Though all four deposits are located within the northern conifer forest formation (Figure 1), they are not near enough to be compared in great detail. The extreme east and west bogs are nearly two hundred miles apart and the western bog is approximately seventy miles further north than the eastern one. The distances between the four are not equal; beginning on the east they are spaced at intervals of approximately 40 miles, 100 miles, and 50 miles.

The forest in the region of the peat bogs is generally uniform in species except near each end of the traverse. On the east there is a small amount of oak, white, and red pine. Drexler (1941) describes the forest fifty miles south, in the Quetico region, as containing locally, American elm (*Ulmus americana*), black ash (*Fraxinus nigra*), bur oak (*Quercus macrocarpa*), and soft maple (*Acer saccharinum*). White pine is fairly abundant in that region, but is sporadic in the region of the Little Savanne bog and northwestward. None of the deciduous species listed above were seen in the immediate vicinity of any of the bogs. In the middle portion of the traverse, very little pine, and probably no oak is to be found in the present forest. On the west near Kenora, considerable ash and white pine was observed.

In the succeeding few paragraphs, descriptions of various pollen curves are given.

White spruce (*Picea glauca*) pollen is very abundant in the basal layers of all bogs except the Little Savanne. In the other three, it becomes markedly reduced in importance a short distance above the bottom. thus indicating a change in the composition of the forests. Near the top of the peat deposits, white spruce pollen again attains importance, though not as great as in the basal levels of the bogs. For white spruce, this type of curve is not peculiar to the Ontario region under discussion, but has been noted in peats of Minnesota and Wisconsin. Probably it would be more widely noted if investigators separated white and black spruce pollen. Such a separation is desirable since white spruce is likely to be more abundant upon the upland than in the bogs. Black spruce may be localized to a small area as the peat in the bog becomes a subaerial deposit, and therefore will give a modified picture of the forests. Also by recognizing white spruce, a greater knowledge of forest composition and vegetational shifts becomes possible.

The separation of black and white spruce is not extremely difficult since there exists a textural difference on the bladders and a fairly constant size difference. Photomicrographs of the common conifers of Wisconsin have been published in another paper by the authors (1942) and show the difference between these two species of spruce.

Black spruce (*Picea mariana*) pollen is most abundant near the middle or somewhat higher in the profile, except in the Little Savanne bog.

Pine (*Pinus*) pollen in the diagrams has not been separated into species since there are possibly three involved. It has been the experience of the authors that much jack pine (*Pinus banksiana*) pollen is readily distinguished by its small size, but small grains of the red and white pines and large grains of jack pine are easily confused. These border line forms make it necessary to lump all species together in the diagrams, but an attempt to separate them is made in the tables. Much of the pine pollen in bogs described is unquestionably jack pine, since that is the only important species in the region. The curves of pine pollen abundance in the three westermost bogs is fairly uniform and indicates that jack pine was an early and important entrant into the region with white spruce. Near the middle levels or above, pine usually reaches its maximum.

The role of fir (*Abies balsamea*) in the pollen spectra is minor and does not appear to be consistently associated with any particular part.

Hemlock (*Tsuga*) pollen is one of the most interesting finds. In the Little Savanne bog it occurs in the middle and slightly lower level. The nearest known living hemlock is in Minnesota, approximately two hundred miles southwest of the Little Savanne bog.

Oak (*Quercus*) pollen is present in all except the Bedworth bog, though it never exceeds two per cent. It is not found in the surface peat except in the Little Savanne bog. The occurrence here might be expected, since living oak is recorded from the region a short distance to the south. Its earliest occurrence is in the bottom level of the English River bog. The curves of oak pollen abundance are in agreement with those of the Coleraine and Highland bogs in northern Minnesota described by Voss (1934), and those in northwestern Wisconsin described by Wilson (1938).

The pollen of maple (*Acer*) appears most frequently in the middle layers of the bogs. It is absent from all basal levels and from all surface levels except in the surface level of the Little Savanne bog.

Birch (*Betula*) is less important at the surface than in the lower levels of the bogs. It is not found in the basal level of any of the four bogs. The species involved in the region are the paper and bog birches. The latter is the more abundant and probably contributed most of the fossils of that genus.

Alder (*Alnus*) and willow (*Salix*) pollen contribute little to the spectra and are somewhat sporadic in occurrence. In the Hawk Lake bog, alder was found most abundant in the lower levels. In the others no marked relation is apparent.

Based on the fossil pollen studies of four peat deposits, the following tentative historical summary of the northern conifer forest in the region of southwestern Ontario is given: (1) conifers (spruce dominant); (2) conifers (pine dominant), oak, birch, maple, alder somewhat frequent; (3) conifers (spruce increasing), oak, birch, maple, and alder less frequent.

The forests are relatively recent, for the region was traversed by the ice of the Fifth Wisconsin substage, and later was widely covered by Early Lake Agassiz and other lakes whose areas are now constricted. Other bogs must be investigated before detailed statements can be made concerning the forest development of the region.

SUMMARY

1. Four bogs located along Highway 17 between Fort William and Kenora in southwestern Ontario, Canada, have been investigated to determine the fossil pollen succession and history of the northern conifer forest in which the area lies.
2. The area was severely glaciated by the Fifth Wisconsin substage, and later covered in part by Early Lake Agassiz and other recently constricted lakes. The bogs were formed in kettle holes or in impounded drainage areas.
3. The early forest consisted largely of white and black spruce with a large element of jack pine. These forests were invaded by pine and a small element of deciduous trees, of which oak, maple, and birch were members. Finally, near the surface of the deposits there appears a slight shift back to a greater abundance of spruce. Such a sequence in forest history is also apparent in other parts of Lake Superior region.

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LITERATURE CITED

Drexler, R. V. 1941. Forest communities of the Quetico Provincial Park of Ontario. Iowa Acad. Sci. 48 123-127.

Nichols, G. E. 1935. The hemlock-white pine-northern hardwood region of eastern North America. Ecol. 16: 403-422.

Thwaites, F. T. 1934. Outline of glacial geology. Edwards Bros. Ann Arbor, Mich.

Voss, John. 1934. Postglacial migration of forests in Illinois, Wisconsin, Minnesota. Bot. Gaz. 96: 3-43.

Wilson, L. R. 1938. The postglacial history of vegetation in northwestern Wisconsin. Rhodora 40: 137-175.

———— and R. M. Webster, 1942. Microfossil studies of three northcentral Wisconsin bogs. Trans. Wis. Acad. Sci. Arts, and Letts. 34: 177-193.

