Pollen Study in the Gatineau Valley, Quebec

John E. Potzger
Albert Courtemanche

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The Butler University Botanical Studies journal was published by the Botany Department of Butler University, Indianapolis, Indiana, from 1929 to 1964. The scientific journal featured original papers primarily on plant ecology, taxonomy, and microbiology.

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Butler University
Botanical Studies
(1929-1964)

Edited by

J. E. Potzger
The *Butler University Botanical Studies* journal was published by the Botany Department of Butler University, Indianapolis, Indiana, from 1929 to 1964. The scientific journal featured original papers primarily on plant ecology, taxonomy, and microbiology. The papers contain valuable historical studies, especially floristic surveys that document Indiana’s vegetation in past decades. Authors were Butler faculty, current and former master’s degree students and undergraduates, and other Indiana botanists. The journal was started by Stanley Cain, noted conservation biologist, and edited through most of its years of production by Ray C. Friesner, Butler’s first botanist and founder of the department in 1919. The journal was distributed to learned societies and libraries through exchange.

During the years of the journal’s publication, the Butler University Botany Department had an active program of research and student training. 201 bachelor’s degrees and 75 master’s degrees in Botany were conferred during this period. Thirty-five of these graduates went on to earn doctorates at other institutions.

The Botany Department attracted many notable faculty members and students. Distinguished faculty, in addition to Cain and Friesner, included John E. Potzger, a forest ecologist and palynologist, Willard Nelson Clute, co-founder of the American Fern Society, Marion T. Hall, former director of the Morton Arboretum, C. Mervin Palmer, Rex Webster, and John Pelton. Some of the former undergraduate and master’s students who made active contributions to the fields of botany and ecology include Dwight. W. Billings, Fay Kenoyer Daily, William A. Daily, Rexford Daudenmire, Francis Hueber, Frank McCormick, Scott McCoy, Robert Petty, Potzger, Helene Starcs, and Theodore Sperry. Cain, Daubenmire, Potzger, and Billings served as Presidents of the Ecological Society of America.

Requests for use of materials, especially figures and tables for use in ecology text books, from the *Butler University Botanical Studies* continue to be granted. For more information, visit www.butler.edu/herbarium.
POLLEN STUDY IN THE GATINEAU VALLEY, QUEBEC

J. E. POTZGER
Butler University

ALBERT COURTEMANCHE
University of Montreal, Quebec

The authors have repeatedly made reference to the complexity of Quebec’s past glacial and forest history, determined in part by the wasting Laurentide ice center, sea invasion, large pre-glacial lakes, altitudinal differences between the Shield and the St. Lawrence valley, as well as by the developments in the history of the Great Lakes.

In this maze of controlling influences, the Ottawa valley is unique in its extension from the St. Lawrence valley a great distance northward into the Shield. As one flies over rivers in the James Bay area today, one is impressed with the influence which valleys have on forest migrations. It is quite evident that these valleys are today centers of distribution for forests which later fan out over the whole area. In early post-glacial times, the Ottawa valley may likely have been such an avenue for migration northward as well as into the rugged Shield. For that reason a pollen study was begun in the Gatineau valley, a tributary of the Ottawa river (Fig. 1), to see if the forest might give some information on differences in forest and climate as compared with areas on the Shield.

GLACIAL HISTORY

According to Antevs (1) the wasting Mankato ice left a prominent outwash plain and moraine in the neighborhood of Kazabazua, which he calls the Lake Timiskaming Retreat, halting at the Cochrane moraine, 150 miles south of James Bay. This he considers correlative with the close of Lake Algonquin. At that time trees could begin their northward march and invasion of the region called Quebec.

METHODS

Samples were taken at 1-foot or more frequent intervals with the Hiller borer. These samples were placed into properly labelled vials and stoppered. In the laboratory the Geisler (3) alcohol method was used when compacted sediments separated readily, and the Erdtman (2) KOH method was used with compacted sediments. Gentian violet served as stain. One hundred and fifty to 200 pollen grains were counted at each level. Only pollens of trees were used to construct the graphs (Figs. 3, 4) but pollens of shrubs and herbs were tabulated and are given as total numbers counted in Tables 1-5.

* Owing to the recent death of Dr. Potzger correspondence relating to this paper should be directed to Albert Courtemanche.
The complexity of Quebec's wasting Laurentide ice sheets has led to differences between the developments in the history of the valley. It is quite evident that rests which later fan out the Ottawa valley may likely be as into the rugged terrain northward into the Gatineau valley, a forest might give some comparison with areas on the left a prominent outwash, which he calls the Lake Aline, 150 miles south of Lake Algonquin. At intervals with the Hillier vials and stoppered. In sed when compacted sedi-H method was used with 100 and fifty to pollens of trees were used of shrubs and herbs were in Tables 1-5.

Provincial Quebec Province of Quebec Gatineau Valley

<table>
<thead>
<tr>
<th>Bog Name</th>
<th>Location</th>
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<tbody>
<tr>
<td>Kazabazua</td>
<td>Messines</td>
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<tr>
<td>Lacroix Bog (Messines)</td>
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<tr>
<td>Hobblety Creek</td>
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<td>Cleaver Lake</td>
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<td>Brock Lake</td>
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FIGURE 1
Outline map of the Gatineau Valley area and location of Bogs.
Kazabazua Bog (45° 57' N, 76° 04' W; alt. about 600 ft.). This is a beautiful deep twin kettle set in glacial moraines. The two basins are separated by a fill wall. While the lower basin still has a central open pool, the upper one (where the boring was made) is completely closed and a dense Sphagnum mat heavily invaded by Chamaedaphne has completely solidified (Fig. 2). The bog is set about twenty feet below the sandy plain. A spruce-tamarack forest covers the separating wall. It is located about one half mile from Kazabazua. The immediate vicinity is cleared land, but forest with pine and oak is not far from the bog.

Lacroix Bog (46° 16' N, 76° 00' W; alt. approx. 600 ft.). This bog is located about 9 miles south of Maniwaki along Route No. 3, on the farm (Lot 43) of Mr. Berchmans Lacroix, Messine, Canton Bouchette, Gatineau County. The bog constitutes the deepest central portion of a half mile wide, deep kettle. The northern third of the bog is covered with a sparse spruce-tamarack forest, while the balance of the mat is a dense cover of Ledum and Chamaedaphne. The slopes of the kettle are farmed, but a rocky upland, forming the eastern border, is covered with broad-leaved forest and pine. After several exploratory soundings, the boring was made in the central part of the bog.

Hobblety Creek Bog (46° 11' N, 76° 21' W; alt. approx. 700 ft.). This deep-set, small kettle, only about 200 feet across, is completely surrounded by moraines. A small rock basin lake is located only about 30 feet from the bog. Black spruce has invaded the border, and the completely closed surface is a deep mat of Sphagnum. Hobblety Creek bog is 6 miles south of the Eagle Creek Depot along the depot road. Exploratory soundings showed the deepest part of the kettle to be in the central portion.

Cleaver Lake Bog (46° 13' N, 76° 26' 35" W; alt. about 750 ft.) The origin of the bog was apparently a bay or a small lake drained along the eastern border by a creek. The lake was completely filled in, but a recently built dam, a mile upstream from Cleaver Lake, flooded the mat to a depth of two feet. The northeast flanking rocky upland is forested with pine, oak and birch. The low west shore was covered with spruce-tamarack forest. The boring was made in the central part, several hundred feet west of the creek.

Brock Lake Bog (46° 17' N, 76° 20' 30" W; alt. about 700 ft.). The elongate kettle is surrounded by a deep mire, and the mat is in the quaking stage. It is about one mile northwest of the Eagle Creek Depot, a short distance from Brock Lake.

RESULTS

In its gross features, the initial climatic and forest history is strikingly similar to that shown in the bogs of the St. Lawrence valley (5) and northward to Mont Tremblant Park (6). Climate must have been quite warm, for
...about 600 ft.). This is a beautiful... The two basins are separated by a central open pool, the upper one closed and a dense Sphagnum mat...solidified (Fig. 2). The bog is 6 miles south of the Eagle Creek Depot, a short distance west of the creek.

35° W; alt. about 750 ft.) The small lake drained along the eastern shore, but a recently built dam, a the mat to a depth of two feet. Rested with pine, oak and birch. A spruce-tamarack forest. The boring was...Kazabazua Bog. A typical consolidated kettlehole bog. Covered by a dense mat of Sphagnum, heavily invaded by Chamaedaphne. J. E. Purzer (right) and Albert Courtemanche.
Abies Larix Picea lauca Pic. mot Pinus banksiana Pinus strobus

Figure 3
Profiles of bogs 1, 2. See text for description.
Figure 3
Profiles of bogs 1, 2. See text for description.

Figure 4
Profiles of bogs 3, 4, 5. See text for descriptions.
TABLE 1

Kazabazua Bog. Numbers of pollen grains of shrubs and herbs tabulated while counting the stated number of three pollens.

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Lacroix Bog. Numbers of pollen grains of the stated number of tree pollens.

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The cooler, moist pine-oak belt has been followed by a later beech-yellow birch spruce-fir peak. While birch shrubs are more common in the cooler spruce-fir period, it appears that the main trend, indicated in the Mont Tremblant forest, is away from birch to spruce.

In general, all five types of forest are present in the Ottawa valley, but each is more or less differentiated from the others. This differentiation is probably due to the varying degree of isolation of each type from the others. The Ottawa valley was probably more isolated from the Shield than any of the others.

The St. Lawrence valley was probably less isolated from the Shield than any of the others.
The cooler, moist pine-hemlock period is clearly accentuated as well as the later beech-yellow birch interval. This yielded here also, to the second spruce-fir peak. While birch shows a bimodal pattern, correlated somewhat with the cooler spruce-fir period, it does not attain the importance in the forest complex indicated in the Mont Tremblant Park region.

In general, all five types of climate (Q.1-Q.5) expressed in the St. Lawrence valley, are present in the Gatineau valley forest history. The overall climate differed in that it favored white and red pine, and oak was a more prominent pioneer genus than in other parts of Quebec.

**DISCUSSION**

The Ottawa valley with its tributary, the Gatineau valley, are located mainly within Halliday's (4) forest areas L-4, which he describes as the area where white pine probably reached its maximum development in Canada. To quote him, "Extensive areas within the section originally supported fine stands of white and red pine with a scattering of other species." This description fits very well
The records of the pollen profiles from the five bogs of that region. The five pollen profiles also correlate favorably with those reported by Potzger and Courtmanche (7) from Newington, Alfred and St. L. bogs. According to pollen records, this pine belt once extended much farther into the Laurentian upland, with significant abundance to Lat. 48°. On the Shield, the pine dominance was depressed to insignificance at the close of the major xerothermic period, but not in the Gatineau valley region. There is a decrease of pine in the topmost half-foot of the peat, but this might well represent the disturbance by man, as described by Halliday (4). By observation, it is very plain that the region is still pine country, and splendid stands of pine are rebuilding by secondary succession.

Here, as in all of lower Quebec, Jack pine replaced the spruce-fir period. This Jack pine dominance swept across Quebec to its present outposts at Lat. 49°

### TABLE 3

Hobblety Creek Bog. Numbers of pollen grains of shrubs and herbs tabulated while counting the stated number of tree pollens.

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<th>Park levels</th>
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The five climatic c- (5) and Potzger and...
of trees and herbs tabulated while counting the stated number of tree pollens.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Table 4: Clever Lake Bog. Numbers of pollen grains of shrubs and herbs tabulated while counting the stated number of tree pollens.</th>
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<tbody>
<tr>
<td></td>
<td><strong>Shrubs</strong></td>
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<td><strong>Herbacceous plants</strong></td>
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<td></td>
<td><strong>Pteridophytes</strong></td>
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Flight over this belt, with the controlling part this lowly pine plays in the forests at these latitudes. Potzger and Courtemanche (7) found that following the major xerothermic period with subsequent cooling, jack pine pressed southward to replace the crowding white and red pine forests, which is shown in the profiles as a bimodal peak in bogs from Clova (Lat. 48° N) northward. This "revival" of dominance faded to an "echo" at Lat. 46° of the Gatineau valley. The recent cool period is recorded however, even at Lat. 46°, by the weak recovery of spruce and fir (Figs. 3, 4).

One can hardly overlook the early prominence of oak in these Gatineau valley profiles. Unfortunately pollen studies do not well permit ascertaining if one or all species of oak present in the Gatineau valley today were involved. If the pioneers migrated northward, they soon fanned out eastward to the Laurentian upland in the Mont Tremblant region, where they are at present, less abundant in number than in the Gatineau valley. Only one species of oak, Quercus rubra, is found in relic groups in the Mt. Tremblant Park area.

The five climatic changes and fluctuations (Q.1 to Q.5) listed by Potzger (1) and Potzger and Courtemanche (7) for southern Quebec and the St.
Brock Lake Bog. Numbers of pollen grains of shrubs and herbs tabulated while counting the stated number of tree pollens.

Shrubs | Herbaceous plants | Pteridophytes
--- | --- | ---

<table>
<thead>
<tr>
<th>Height</th>
<th>No. pollen</th>
<th>Alnus</th>
<th>Betula pumila</th>
<th>Cornus</th>
<th>Corylus</th>
<th>Fraxinua</th>
<th>Larix</th>
<th>Leucocarya</th>
<th>Crataegus</th>
<th>Compositae</th>
<th>Nyssa sylvatica</th>
<th>Trapa</th>
<th>Dryopteris</th>
<th>Osmunda</th>
<th>Lygodium</th>
<th>Unknown spaces</th>
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Lawrence Valley also left their imprint on the forest history of the Gatineau valley. When one compares the profiles with those reported by Potzger and Courtemanche (6) from lakes and bogs of the Mont Tremblant area, some differences stand out. Spruce and fir are less abundant, the hemlock peak has only half the prominence it indicates in the Mt. Tremblant area as far north as Lac Monroe, and progressive decline of white and red pine is not apparent. When the native vegetation comes under the influence of civilized man, it is difficult to separate climatic control from physiographic influences. However, in the Mont Tremblant region, undisturbed secondary succession after lumbering shows lack of reproduction by pine, suggesting continuence of climatic factors which began to militate against pine long before civilized man entered the picture. The excellent reproduction by pine observed in the Eagle Creek surveys suggests lack of reproduction by pine, suggesting continuence of climatic influence of civilized man entering.

Pollen frequency methods of pollen analysis are of the most importance.

An initial warm period by highest abundance of cover with very low deciduous increase in a Pine (low oak peak) to negligible representation of pine-spruce-fir-birch.

The Gatineau valley and the Mont Tremblant area.

The senior author wishes to express his appreciation to Mr. Francis J. Baldus for the field work and for guiding in the trifling details of the Canadian Intermontane profiles.

1. ANTEV, ERNST. Geol. 61:191-210. 1941.
5. POTZGER, J. E. E. N. 401. 1935.
6. POTZGER, J. E., AND ST. LAWRENCE VALLEY.
the profiles from the Mont Tremblant area (6). The decline of pine at the 6 inch level in the Gatineau valley profiles is interpreted as representing the influence of civilized man.

SUMMARY

Pollen frequencies in the deposits of five bogs covering a radius of about 50 miles in the Gatineau Valley of Quebec were determined by conventional methods of pollen analysis. It is concluded that the Gatineau Valley was one of the most important routes for plant migration during early post-glacial times. An initial warm period (similar to that of all southern Quebec) is suggested by highest abundance of oak in the first or second foot-level and pine forest cover with very low spruce fir. Cooling climate followed soon, marked by a decided increase in abundance of spruce. Succession is similar at all five bogs. Pine (low oak peak) to pine-spruce, to Jack pine, while spruce and fir decreased to negligible representation, to white-red pine with minor hemlock peak, to pine-spruce-fr-birch which suggests cooling climate during the recent past. The Gatineau valley apparently differs climatically from all of southern Quebec and the Mont Tremblant Park region, which can not be attributed to latitude alone.

ACKNOWLEDGMENT

The senior author acknowledges with gratitude the research grant from the Eli Lilly Research Foundation, Indianapolis, Indiana, which provided the assistance of Mr. Francis Hueber. We express thanks to Mr. Hueber for assistance in the field work and for preparation of the slides; to Mr. A. C. Dixon, forester of the Canadian International Paper Co. at the Eagle Creek Depot, Maniwaki, for guiding in the trip to Cleaver Lake; to Mr. Berchmans Lacroix for permission to sample the bog on his property; to Mr. Jules Milette for preparation of graphs; to the Mont Tremblant Biological Station of the Game and Fisheries Department, Province of Quebec, for laboratory facilities and helpfulness in field work, especially for providing transportation facilities.

LITERATURE CITED