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ONTARIO-98-TOUR BOOK

1998-"Moorexkursion" to Southern Ontario, Canada
(University of Bern International Vegetation-historical Bog & Mire Excursion)

August, 20-30, 1998

by J.H. McAndrews and J.N. Haas

Royal Ontario Museum and Department of Botany, Univ. Toronto
August 1998

Dear participants of the 1998-Moorexkursion

It's a great pleasure to hand you the tour-book for this 'Moorexkursion'. We wish you a scientifically interesting stay and hope to introduce you into the main subjects and problems of the vegetation and landscape history of the last 11'000 years of Southern Ontario.

Main general differences to the european vegetation development after the ice retreat is the late appearance of human impact due to farming activities. Our excursion area was settled by the first 'Woodland' farming indians about 600 years ago and heavily altered by european settlers at a later stage beginning approximately 150 years ago (only!). This will be the main theme for the excursion at **Crawford Lake** on **August 21,** as well as on **Wilcox Lake** on the Oak Ridges Moraine north of Toronto on **August 27**. As indian farming relied on maize/corn, squash, beans, sunflowers and tobacco and did not know breeding of livestock – except for turckey (but not in Ontario), which we hope to see in wildlife on August 26 (!) – the human effect on the forest vegetation may have been very different than in prehistoric Europe.

Our research area was already used by prehistoric, non-farming communities of hunter-gatherer throughout the Holocene. Their archaeologically known remains are rare, one of them being the Petroglyphs, which we will visit on **August 26**, 1998. Besides wild animals and a remarkable diverersity of plant food, they heavily relied on wild rice gathering (Zizania palustris), a valuable staple crop, which was collected from canoes in running shallow water localities. Wild rice gathering and drying of ears for storage was done by indians until recently in southern Ontario (and is still done in Northern Wisconsin and Minnesota today), and will be a focus on **August 25 and 26**, 1998.

Small scale changes in soil moisture conditions and gradients have heavily influenced peatland development. So, understanding (palaeo-)hydrological conditions is important for the interpretation of late-Quaternary vegetation change. Besides evidence for water level changes at Crawford Lake, we will discuss hydrologically related sediment changes at the ombrogenous boreal-type bog **Wylde Bog** on **August 22.** A sediment coring is therefore planned there. In order to understand vegetation succession stages dependent on water availibility we will try to follow a kind of transect by visiting a conifer bog forest at **Webb's Lake** on **August 26**, deciduous wet forests on the Canadian Precambrian Shield on **August 26**, mesic forests at **Peters Woods** near Centreton on **August 25**, black oak savanna/prairie grassland at the **Red Cloud Cemetery** on **August 25**, and dry shrub/forest communities at the **Marmoraton Iron Mine** on **August 26**.

Another subject will be the forest development during the warmest phase of the early- and mid-Holocene, with special emphasis to the development of beech (*Fagus grandifolia*) and Eastern hemlock (*Tsuga canadensis*). The latter tree shows a remarkable decline around 5700 years ago (4800 BP) related to hemlock looper activities in all of Northeastern North America (Bihry & Filion 1996). However direct evidence of this pathogen attack is poor, so other factors such as climatic change may have been involved, which we will discuss at **Shepherd Lake** on **August 23**, 1998.

The deglaciation processes and their impact on vegetation recovery 11'000 years ago, and we will review and evaluate if the Younger Dryas cooling period is detectable for this continental part of Northeastern North America. The longest late-glacial section in the area at Webb's lake will be one of the main subjects on **August 26**, 1998.

Sangamonian (Eemian) Interglacial deposits are very rare in Northern America, we will therefore visit the best studied section near Toronto on **August 27**, 1998, which has been subject of sedimentological, pollen, plant macrofossil, Coleoptera, Molluscs and Trichoptera studies (among others).

By disentangling the Mastodon's last meals within a late-glacial upland area on **August 28** we will close this vegetation-historical overview over Southern Ontario.

Welcome to Southern Ontario for this first 'Moorexkursion' outside Europe! (which hopefully will not remain the last one on another continent!)

Welcome! Jock and Jean Nicolas

Detailed Program for August, 20-30 1998
(subject to change, depending on weather, special interests etc.)

<u>August 20</u>
Departure from Zürich in the morning, arrival at Toronto in the afternoon (4.35 p.m. for the group flight).
Welcome drink and snacks at McAndrews' house (optional).
Overnight in Toronto (Hart House University of Toronto Tel. -416-978-7274 and Victoria College Tel. -416-585-4524).

<u>August 21</u>
Breakfast at your own at the Hart House.

8 a.m.:	Departure for **Crawford Lake** Conservation Area: Introduction to the Late Quaternary vegetation history of S-Ontario. Laminated sediments and Indian farming. Visit to old growth Esquising Forest (with up to 1000-years-old white cedar / *Thuja occidentalis*).
Lunch	near the Crawford Lake Visitors Centre.
2 p.m.:	Visit to the reconstructed Iroquoian Indian Village (14th and 15th century AD; pre-contact period) / Indian crops. Optional walk to Crawford Bog

Overnight in Elora (Village Inn, Tel. -519-846-5333), Dinner on your own in Elora.

<u>August 22</u>
Breakfast at the Village Inn.

8.30 a.m.:	Departure for Luther Lake Conservation Area
9 a.m.	**Wylde Bog** to visit a large ombrogenous boreal-type, +/- undisturbed bog. Sphagnum-heath peatland, invading Larix and Pinus sylvestris. Vegetation History of Wylde Bog and **Wylde Lake**. Coring of Wylde Bog.
Lunch	in bag
2 p.m.:	Departure for **Pike Lake**: Vegetation History and lake level fluctuations.
4 p.m.:	Departure for Lion's Head on Bruce Peninsula

Overnight in Lion's Head (Lion's Head Beach Motel Tel. -519-793-3155 and Mom's Motel Tel. -519-793-3555), Dinner on your own at Mom's Restaurant in Lion's Head.

<u>August 23</u>
Breakfast at Lion's Head Beach Motel and Mom's Motel.

9 a.m.:	Departure for **Shepherd Lake**: Holocene lake-level fluctuations and climate change at Shepherd Lake: Reconstruction by means of aquatic plants and animals. The Mid-Holocene hemlock-decline (*Tsuga canadensis*) in northeastern North America. Its possible reasons and consequences.
Lunch	at Shepherd Lake.
2 p.m.:	Departure for Mary Lake, Open Discussion: Reasons for Early Holocene low sedimentation rates?
thereafter:	Some hours without program! Swimming, shoping, etc. at Lion's Head. Or for those interested: Discovery of possible remnants of prairie vegetation (Alvar vegetation?) in Cape Crocker Indian Reserve

Overnight in Lion's Head (Lion's Head Beach Motel and Mom's Motel), Dinner on your own at Mom's Restaurant in Lion's Head.

August 24

Breakfast at Lion's Head Beach Motel and Mom's Motel.

9 a.m.: Departure for **Shouldice Lake**: Holocene Vegetation History. Lake level rise and fall of Lake Huron / Georgian Bay and the Great Lakes. Alvar vegetation.

12 a.m.: Walk through **Bruce Peninsula National Park**, Flora of the Niagara Escarpment;

Lunch at Georgian Bay.

4 p.m. Departure for **Dorcas Bay**: Examples of Bog Flora of the Bruce Peninsula.

Thereafter: Dinner on your own in Tobermory

9 p.m.: Departure from Tobermory for Lion's Head

Overnight in Lion's Head (Lion's Head Beach Motel and Mom's Motel).

August 25

Breakfast at Lion's Head Beach Motel and Mom's Motel.

8 a.m.: Departure for a relatively long travel day with common short-stops of interest.

Lunch at Port Perry on your own.

ca. 2 p.m. Short photo-stop of the Wild Rice stands at **Lake Scugog**.

ca. 3 p.m. Visit and one-hour walk through the fantastic **Peter's Woods Provincial Nature Reserve**: old growth mesic forest (possibly up to 400 yrs. old).

ca. 5 p.m. Visit to black oak savanna/prairie grassland remnants in **Red Cloud Cemetery**

Overnight in Codrington at Dunpollen (sorry, no Telephone) and at the Swiss managed (Familie Emmenegger!) Campbellford River Inn in Campbellford (Tel. -705-6531771). Dinner-Barbecue at Dunpollen.

August 26

5.30 a.m.! Wild-turckey-watching for those interested early risers on this beautiful summer morning!

7.30 a.m. Breakfast at Dunpollen and at the Campbellford River Inn.

8.30 a.m. Departure for **Marmoranton Iron Mine**: Shrub community on dry limestone. Short visit of a deciduous tree swamp with *Acer saccharinum, Fraxinus nigra* and fern communities. Short stop at famous contact zone between Precambrian Canadian Shield (1'000'000 yrs old) and Palaeozoic sediments (500'000 yrs old).

Lunch at **McGinnis Lake** (a wonderful Chara-Lake!). Discussion of the McGinnis pollen profile for the last 3000 years.

1.30 p.m. Visit of **Petroglyphs in Petroglyph Provincial Park**: Petroglyphs and their age?

3 p.m. **Rice Lake**: Serpent Mounds: Holocene lake levels of Rice Lake. Prehistoric Wild Rice (*Zizania*)-gathering.

5 p.m. **Webb's Lake**: Late Glacial vegetation history and wetland forest succession.

Overnight at Dunpollen and at the Campbellford River Inn in Campbellford. Dinner-Barbecue at Dunpollen.

August 27

Breakfast at the McAndrews Country House and at the Campbellford River Inn.

8.30 a.m. Departure for **Wilcox Lake**: Detailed Holocene vegetation history and prehistoric Human impact at Wilcox Lake.

Lunch at Wilcox Lake.

2 p.m. Departure for the famous Don Brickyard section

3 p.m. **Don Brickyard** section: Vegetation history of the Eemian (Sangamonian) Interglacial.

Overnight in Toronto (Hart House University of Toronto Tel. -416-978-7274 and Victoria College, Tel. -416-585-4524). Dinner on your own in Toronto. Optional program with J.N.Haas: Night boat tour to the Toronto Islands with beautiful sky-scraper skyline, etc.

August 28

Breakfast at your own at the Hart House.

7.30 a.m.	Departure for the Toronto-Humber Valley & Niagara Falls:
8.30 a.m.	**Humber Valley**: Lake Ontario water levels since 12'500 BP
9.30 a.m.	Departure for Niagara Falls. Geology of Niagara Falls.
Lunch	and Visit of **Niagara Falls** on your own. Optional program: sensational (and wet...) boat-trip into the mist of Niagara Falls!
2.30 p.m.	Departure for Niagara Peninsula: View of Whirlpool Rapids, visit of **Niagara Glen Forest** and presentation of the last mastodons and mammoths in North-eastern America: The mastodons last meal at the **Hiscock** site (New Yoork, U.S.A.)! A pollen and macrofossil study.
4 p.m.	Official end of the 1998-excursion through S-Ontario.
4.15 p.m.:	Winery tour at **Hillebrand Estates Winery**.
5 p.m.	Departure for Toronto.
8.30 p.m.	Optional **CN-tower-closing-dinner**.

Overnight in Toronto (Hart House University of Toronto Tel. -416-978-7274 and Victoria College, Tel. -416-585-4524).

August 29

Breakfast on your own at the Hart House.

The whole day for those interested: **Visit the McAndrews-labs**, discuss specific pollen and macrofossil material, view some pollen diagrams etc..

At Lunch time take a drink and a snack there, in order to prepare for the flight over the Atlantic!

Visit Toronto on your own: sight-seeing and shopping in Toronto. Some suggestions: Visit the **Royal Ontario Museum** and its exhibitions. Visit the Farmers market at **St.Lawrence Market:** There you can get all canadian products you might think of (Maple syrup, honey, salmon, BSE-free Beef, lobsters and much more). Or visit the **BCE-building** with its extraordinary architecture (nearby the farmers market). Enjoy a walking tour through down-town between the sky-scrapers. Enjoy a bus tour in Toronto. Visit the Toronto-Islands (if you have not done so before).

For the group flight:

4.30 p.m. at latest!	Individual Departure for Toronto-Airport by taxi or bus.
5.30 p.m. at latest!	Check-in at Toronto-Airport.
7.45 p.m.	Departure for Zürich (via Rome)

August 30

2.10 p.m.	Arrival at Zürich-Airport. Return to your destination.

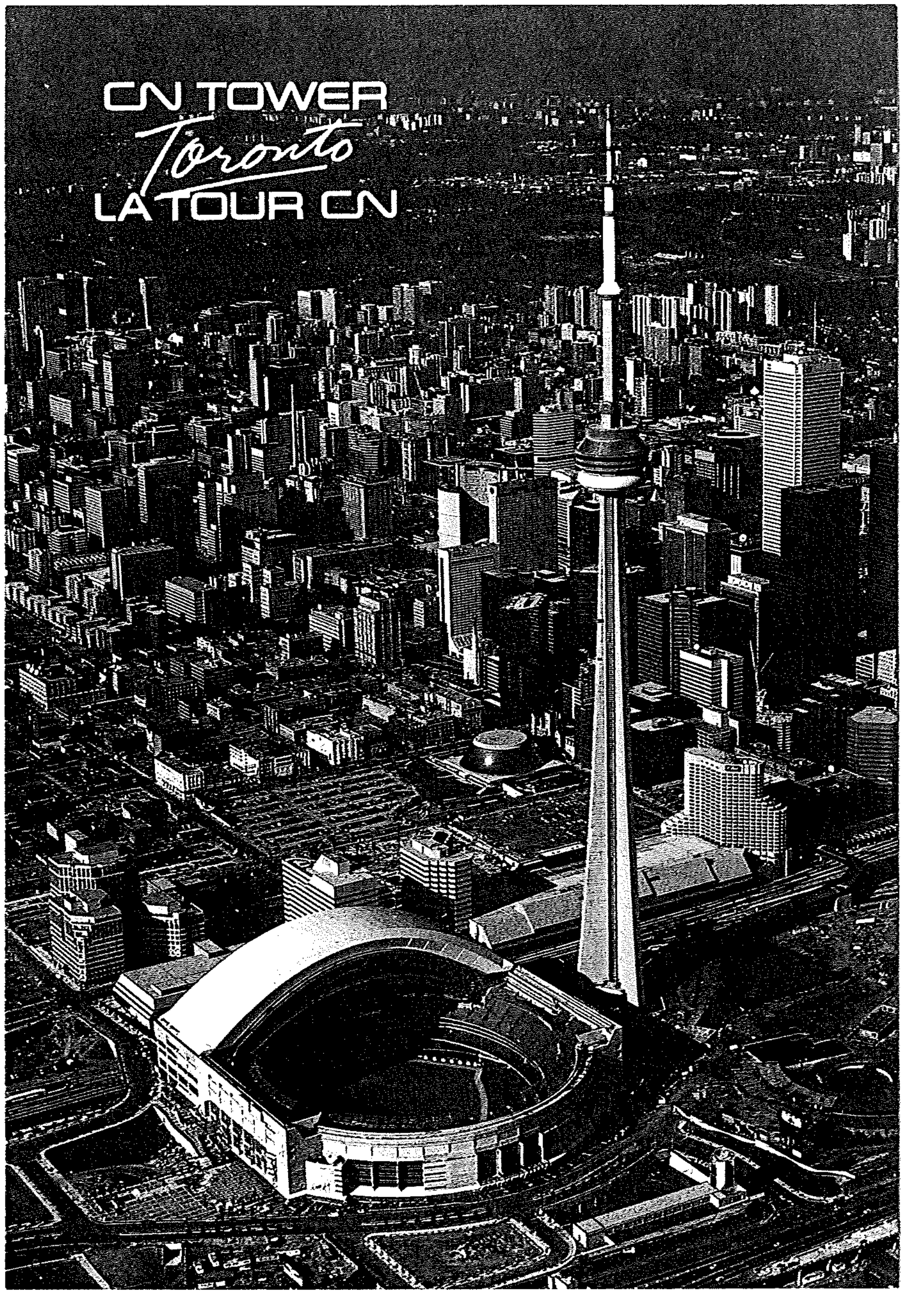
List of participants

Abbreviantions GF: Group Flight August 20 and August 29/30, 1998
SOF: Self-organized Arrival and Departure LO: Local Organizers and guides

1. Prof. Dr. Brigitta Ammann — SOF
   Geobotanisches Institut der Universitaet Bern, Altenbergrain 21, CH-3013 Bern
2. Dr. Christopher Carcaillet — SOF
   Departement de Geographie, Universite de Montreal, CP 6128 succ. "Centre Ville", Montreal (Quebec), Canada H3C 3J7
3. Thomas Giesecke — SOF
   Geographisches Institut der Humboldt Universität Berlin, Chaussee Strasse 86, D-10115 Berlin
4. Erika Gobet — SOF
   Auf der Mauer 3, CH-3176 Neuenegg
5. Inge M. Grosch — SOF
   Beethovenlaan 15, NL-2264 VE Leidschendam
6. Dr. Jean Nicolas Haas — LO
   Centre for Biodiversity and Conservation Biology, Royal Ontario Museum, 100 Queens Park, Toronto M5S 2C6, & Depart. Bot., Univ. Toronto, 25 Willcocks St., Toronto M5S 3B2, Ontario, Canada
7. Dr. Philippe Hadorn — GF
   25 rue des Coteaux, CH-2016 Cortaillod
8. Dr. Adam Hölzer — GF
   Staatliches Museum fuer Naturkunde, Erbprinzenstr. 13, D-76042 Karlsruhe
9. Prof. Dr. Stefanie Jacomet — SOF
   Botanisches Institut der Universitaet Basel, Schoenbeinstrasse 6, CH-4056 Basel
10. Ingrid Jansen — SOF
    Freiburgstr. 68, CH-3008 Bern
11. Prof. Dr. C.R. Janssen — SOF
    Laboratory of Palaeobotany and Palynology, Budapestlaan 4, NL-3584 CD Utrecht
12. Beate Kubitz — SOF
    Sternenburgstr. 92a, D-53115 Bonn
13. Prof. Dr. Thomas Litt — SOF
    Institut for Palaeontologie, Universitaet Bonn, Nussallee 8, D-53115 Bonn
14. Assoc. Prof. Francine McCarthy, Department of Earth Sciences, Brock University, St. Catherines, Ontario, L2S 3A1, Canada — LO
15. Prof. J.H. McAndrews — LO
    Centre for Biodiversity and Conservation Biology, Royal Ontario Museum, 100 Queens Park, Toronto M5S 2C6, & Depart. Bot., Univ. Toronto, 25 Willcocks St., Toronto M5S 3B2, Ontario, Canada
16. PD Dr. Klaus Oeggl — GF
    Botanisches Institut der Universitaet Innsbruck, Sternwartestr. 15, A-6020 Innsbruck
17. Dr. Siegfried Schloss — GF
    Gartenstrasse 18, D-76751 Jockgrim
18. Martina Stebich — SOF
    Institut for Palaeontologie, Universitaet Bonn, Nussallee 8, D-53115 Bonn
19. Dr. Willy Tinner — SOF
    Geobotanisches Institut der Universitaet Bern, Altenbergrain 21, CH-3013 Bern
20. Prof. Dr. Bas van Geel — SOF
    Hugo de Vries Laboratorium, University of Amsterdam, Kruislaan 318, NL-1098 SM Amsterdam
21. Dr. Pim van der Knaap — GF
    Geobotanisches Institut der Universitaet Bern, Altenbergrain 21, CH-3013 Bern
22. Jacqueline van Leuwen — GF
    Geobotanisches Institut der Universitaet Bern, Altenbergrain 21, CH-3013 Bern
23. Dr. Notburga Wahlmueller — GF
    Botanisches Institut der Universitaet Innsbruck, Sternwartestr. 15, A-6020 Innsbruck
24. Dr. Lucia Wick — GF
    Geobotanisches Institut der Universitaet Bern, Altenbergrain 21, CH-3013 Bern
25. Assoc. Prof. Dr. Nancy Williams — LO
    Division of Physical Sciences and Division of Life Sciences, Scarborough Campus, University of Toronto, 1265 Military Trail, Scarborough, Ontario M1C 1A4, Canada
26. Prof. Dr. Herb Wright — SOF
    Limnol. Res. Ctr., University of Minneapolis, Pillsbury Hall, 310 Pillsbury Dr. SE, USA-Minneapolis MN 55455

August 20

Arrival



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Remember

ALL BEARS ARE DANGEROUS

DO NOT APPROACH OR FEED A BEAR

YOU ARE RESPONSIBLE FOR YOUR SAFETY AND THE SAFETY OF OTHERS

KEEP CHILDREN NEARBY AND IN SIGHT

BEARS MAY BE FOUND ANYWHERE, EVEN IN DEVELOPED AREAS. ALWAYS BE ALERT

LEARN ABOUT BEARS. ANTICIPATE AND AVOID ENCOUNTERS. KNOW WHAT TO DO IF YOU ENCOUNTER A BEAR.

ODORS ATTRACT BEARS. REDUCE SOURCES OF ODOR FROM YOURSELF, YOUR TENT AND YOUR CAMPSITE. THIS INCLUDES FOOD, DISHES, UTENSILS, ETC. AS WELL AS SOAPS, TOILETRIES AND COSMETICS.

THE SMELL OF FISH STRONGLY ATTRACTS BEARS. WHEN PREPARING YOUR CATCH, USE A FISH CLEANING STATION OR DISPOSE OF REMAINS AS RECOMMENDED BY PARK STAFF.

COOLERS ARE NOT BEAR-PROOF! STORE FOOD SO THAT BEARS CANNOT SMELL OR REACH IT - IN THE TRUNK OF YOUR VEHICLE OR IN A BEAR-PROOF FACILITY

PLACE ALL GARBAGE IN BEAR-PROOF CONTAINERS PROVIDED, OR IF YOU ARE IN THE BACKCOUNTRY, SEAL IT IN PLASTIC BAGS AND PACK IT OUT

DON'T GET TOO CLOSE WHEN PHOTOGRAPHING BEARS. USE A TELEPHOTO LENS.

IT IS BEST NOT TO TRAVEL WITH DOGS. DOGS CAN ANTAGONIZE BEARS AND CREATE AN INCIDENT WHERE NONE EXISTED. NEVER LEAVE PETS UNATTENDED AND TREAT PET FOOD AS PEOPLE FOOD.

STAY AWAY FROM DEAD ANIMALS. BEARS MAY ATTACK TO DEFEND SUCH FOOD. REPORT ALL CARCASSES TO PARK AUTHORITIES.

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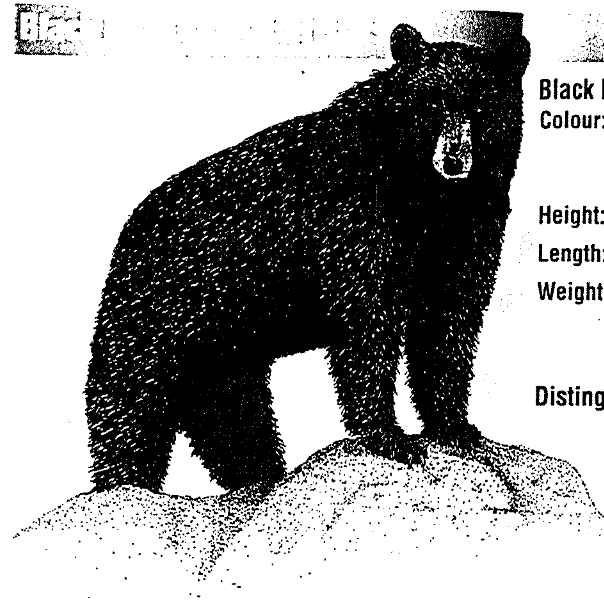


Threats to Black Bears

- **Destruction of habitat**
  Increased development pressures from logging, mining, and agriculture has destroyed habitat depleting local bear populations. Co–ordinated land use planning must ensure that bear populations have adequate habitat to remain a viable landscape species.
- **Overhunting**
  Increased co–operation between agencies and regulated hunting is required to ensure viable black bear populations.
- **International Trade**
  The growing demand for bear parts on the international market has resulted in the destruction of numerous black bears. Clear legislation at federal, provincial and territorial levels and support through law enforcement agencies is required to control illegal trade.
- **Human Ignorance**
  Habituation of bears to human foods and garbage has resulted in the destruction of numerous black bears. Proper food storage, garbage containment, collection and land–filling operations will reduce the likelihood of habituation.

Black Bear (Ursus americanus Pallas)

Colour: varies from pure black to cinnamon or blond. Most are black with a brownish muzzle; often with a white patch below throat or across chest.

Height: about 90 cm (30 in) at the shoulder

Length: about 1.5 m (3.5 ft)

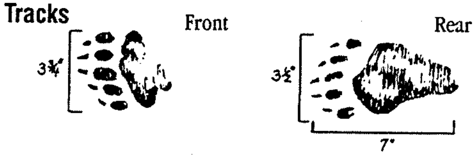
Weight: adults range from 50 kg to more than 270 kg (110 lbs to 590 lbs). Females are generally smaller than males.

Distinguishing characteristics:

Smallest member of the North American bear family. Usually has a straight facial profile and tapered nose with long nostrils. Feet are flat soled with short curved claws.

Black bears prefer forested areas though they adapt readily to areas occupied by humans.

Tracks



Park Information

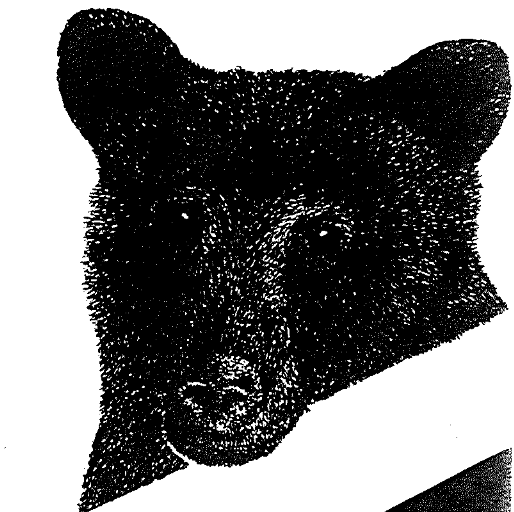
Black bears are the only type of bears that are found in Bruce Peninsula National Park and Fathom Five National Marine Park. There is a resident population of Black Bears on the mainland and on Cove Island. Black Bears are good swimmers: it is possible, but unlikely to encounter one on Flowerpot Island.

Your observations are an important component of the ongoing Black Bear research in the Upper Bruce Peninsula Ecosystem. Please report all sightings to Park Staff.

For up to date information on Bear activity, tune in to the Weatheradio, station 90.7 FM.

Publication également offerte en français.

Canadian Heritage Parks Canada — Patrimoine canadien Parcs Canada



You are in Black Bear Country

Canada

Bears and People

You are in Black Bear Country

Bears are wild animals that demand your respect. Prevent bear problems and "problem bears" by acting responsibly. Never approach or feed bears, handle your food and garbage properly and stay alert. Behaving responsibly in bear country will help to protect you and the bears.

PROBLEM BEARS ARE NOT BORN, THEY ARE CREATED

Bears and People

Bears are an important part of the ecosystem and are worthy of continued protection. For many people, seeing a bear is a highlight of their trip. Our national parks are dedicated to the protection of all wildlife with full regard given to public safety. With your co-operation, bears and people can co-exist. Please read this brochure carefully and follow the recommendations. It could protect both you and the bears. Please report any bear sightings to park staff.

For up-to-date information on bear activity please talk to park staff at visitor centres and warden offices.

Warnings / Closures

Bear Warnings

Bear warnings are posted for trails and areas of the park where bear activity is greater than that normally expected. Visitors should travel with additional caution and should contact park staff for more details on the circumstances leading to the warning.

Area Closures

Bears may be attracted to certain areas at different times of the year due to an abundance of natural food such as berries, nuts or spawning fish. These areas may contain high concentrations of bears and are important for the continued survival of the bears. To protect bears and visitors, these areas may be seasonally closed to visitor use.

Area Closures are instituted when a bear or bear activity poses a danger to park visitors. It is illegal to enter a closed area. Obeying an area closure will protect both you and the bears.

NEVER RUN FROM A BEAR

Tips for Hiking Safely

Hike in a group

Hike in a group and make loud noises, whistle, talk, sing or carry a noise-maker such as bells or a can containing stones. Most bears will leave if they are aware of your presence.

Use extra caution when traveling near rushing water or into the wind. The rushing water may mask your noisemaker and traveling into the wind will prevent the bear from getting your scent and being aware of your presence. Stay in the open as much as possible. Keep children close at hand on trails.

Use caution when near natural bear foods.

Berries, nut crops and fish, etc. are important sources of food to bears. Bears are attracted to areas where berries, nuts or fish are in season. Try to avoid these areas during this time.

Stay away from dead animals.

A dead animal is a concentrated food source and bears will aggressively defend it. You may be able to detect an animal carcass by smell or the sight of ravens or crows circling overhead (just like vultures!). Please report the presence of dead animals to park staff.

Watch for bear signs

Tracks, fresh diggings and droppings can be an indication that a bear is in the area.

Leave your dog at home

A dog often infuriates a bear and may bring on an attack. Your pet may come running back to you with the bear in pursuit!

Bear Resistant Containers

Research and documented studies have shown that these specially designed containers have reduced the numbers of human/bear incidents. Proper food storage though is still necessary when in bear country.

Chemical Bar Repellents

Chemical Bear Repellents or Bear Spray contains capsicum, a derivative of cayenne pepper, which when delivered to an animal's face causes immediate irritation of the eyes and upper respiratory tract. However, because of wind and other circumstances of an attack, the spray cannot be considered an absolute guarantee of safety. Despite the limitation, reports have credited the spray with saving lives.

If You Encounter a Bear

Despite taking all the precautions outlined in this brochure, you may still encounter a bear.

Keep calm

The best way to keep calm is to be prepared, know how you will respond if you encounter a bear.

Make a wide detour or retreat from the area

Leaving the area is the safest thing to do, if you cannot make a detour or retreat, wait until the bear moves from your path, always leave the animal an escape route.

Do not run

Bears can run as fast as a racehorse. You cannot outrun a bear and running may trigger an attack. Back slowly away from the bear facing it and talking in a soft voice.

The bear may approach

Bears may approach to get a better look at you or rear up on its hind legs and wave its nose in the air trying to obtain your scent. Continue backing away slowly and talking in a soft voice. Dropping a pack or object may help to distract the bear.

Watch for aggressive behavior

This includes snapping its jaws together, making a "whoofing" sound or keeping its head down with ears laid back. This may lead to an attack.

The majority of attacks come when a bear is surprised, particularly if it is a female with cubs. A bear may also be aggressive if it is protecting a food source.

The bear may bluff its way out of what it perceives as a threatening situation by charging and then veering away at the last second. Back away speaking softly, never run.

If an Attack Occurs

Playing dead is not appropriate with black bears.

Try to escape to a secure place such as a car or building. Climbing a tree may be effective, but remember the bear may climb up the tree after you.

If the bear does not break off the charge you should act aggressively by yelling and waving your arms to distract and intimidate the bear. If this fails, try to fight back using any object available. Bear spray may be effective.

Camping

COOLERS AND TENTS ARE NOT BEAR-PROOF; STORE FOOD IN YOUR VEHICLE

Put away food and garbage

Bears are strongly attracted to food and garbage and their odors. Put food into your vehicle anytime you leave your campsite, not just at night. Put all garbage into the containers provided.

When backcountry camping cache food away from your tent. Use bear-resistant food storage facilities where provided or suspend food between two trees a minimum of four meters off the ground and one metre from tree trunks. Bear-proof food containers are an option for areas where you cannot cache your food in trees.

Pack out all garbage. Don't bury it. Bears can easily locate it and dig it up becoming a danger to the next group of hikers. If you burn food scraps or garbage be sure to pack out any unburned portions.

Dispose of waste water in designated areas or pit toilets where available; where not, dispose in a well drained area down slope from your campsite and not near lake or stream edges.

Avoid smelly foods

DO NOT COOK OR EAT IN OR NEAR YOUR TENT / TRAILER

Do not cook or eat in or near your tent or tent trailer. The lingering odors of food are an invitation to bears. Don't get food odors on your clothing or sleeping bag. It is best to sleep in different clothing than that worn while cooking. Freeze-dried foods are best. Keep tent pads clean and free of food and garbage.

Use a flashlight at night. Bears may be active at night and the use of a flashlight may warn them away.

Avoid smelly cosmetics. Bears may be attracted to perfumes, hair sprays, soaps, toothpastes, shaving cream and cosmetics.

Select an appropriate campsite

CACHE FOOD AWAY FROM YOUR TENT

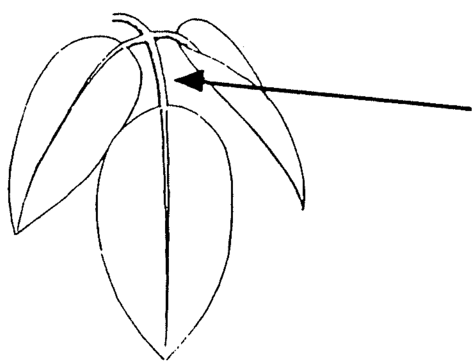
Use designated sites when they are available. In random camping areas pick a spot away from animal and walking trails and the sounds of rushing water. Camp near large sparsely branched trees that you can climb, should it become necessary.

Watch for bear sign. If you spot fresh bear sign then chose another area to camp in.

Symptoms of poisoning, and treatment

Most people develop symptoms 24 to 48 hours after contact. Sensitivity to the plant varies considerably according to the individual, and to how much sap came into contact with the skin.

The first symptom is severe itching. Later red inflammation and blistering of the skin occurs; in severe cases, oozing sores develop. The rash is spread by the sap, not as a result of contamination from the sores. Most cases disappear in 7 to 10 days.



Medical treatment is most effective if applied before the oozing sores appear.

Wash infected skin as soon as possible with cold water to minimize the severity of the rash, and to prevent the spread of the sap to uninfected parts of the body.

Unfortunately, your skin absorbs the active compounds in the sap within the first 3 minutes, and you cannot prevent the dermatitis without medical treatment.

About Poison Ivy

This plant, which grows in every province but Newfoundland, reaches it's greatest abundance in Southern Ontario, and Southern Quebec. It occurs on sandy, stony, or rocky shores, and sprouts in thickets, along the borders of woods, and in clearings.

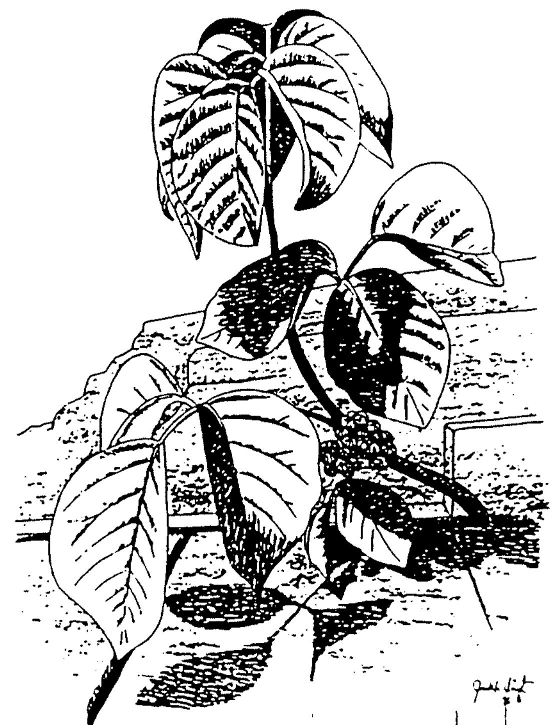
It's a perennial that spreads by seeds, or woody rhizomes. It may grow as a trailing vine, a shrub 5 to 120 cm high, or as an aerial vine that can climb to 15 m high.

Poison Ivy has <u>3 pointed leaflets</u>. The middle one has a <u>much longer stalk</u> than the 2 outside leaflets. The leaflet edges are smooth or toothed, or (rarely) lobed.

The leaves are reddish when they first emerge in the spring. They turn green during the summer, and become various shades of yellow, orange, red, or bronze in the autumn. In the summer the leaves may turn a dark red if the plant is exposed to the sun.

The small male and female flowers, normally found on separate plants, are cream to yellow-green and grow in clusters. The green to yellow berries are also clustered. They're globular, waxy, and 3 to 7 mm in diameter.

Poison Ivy!



General Introduction

Geology of Ontario

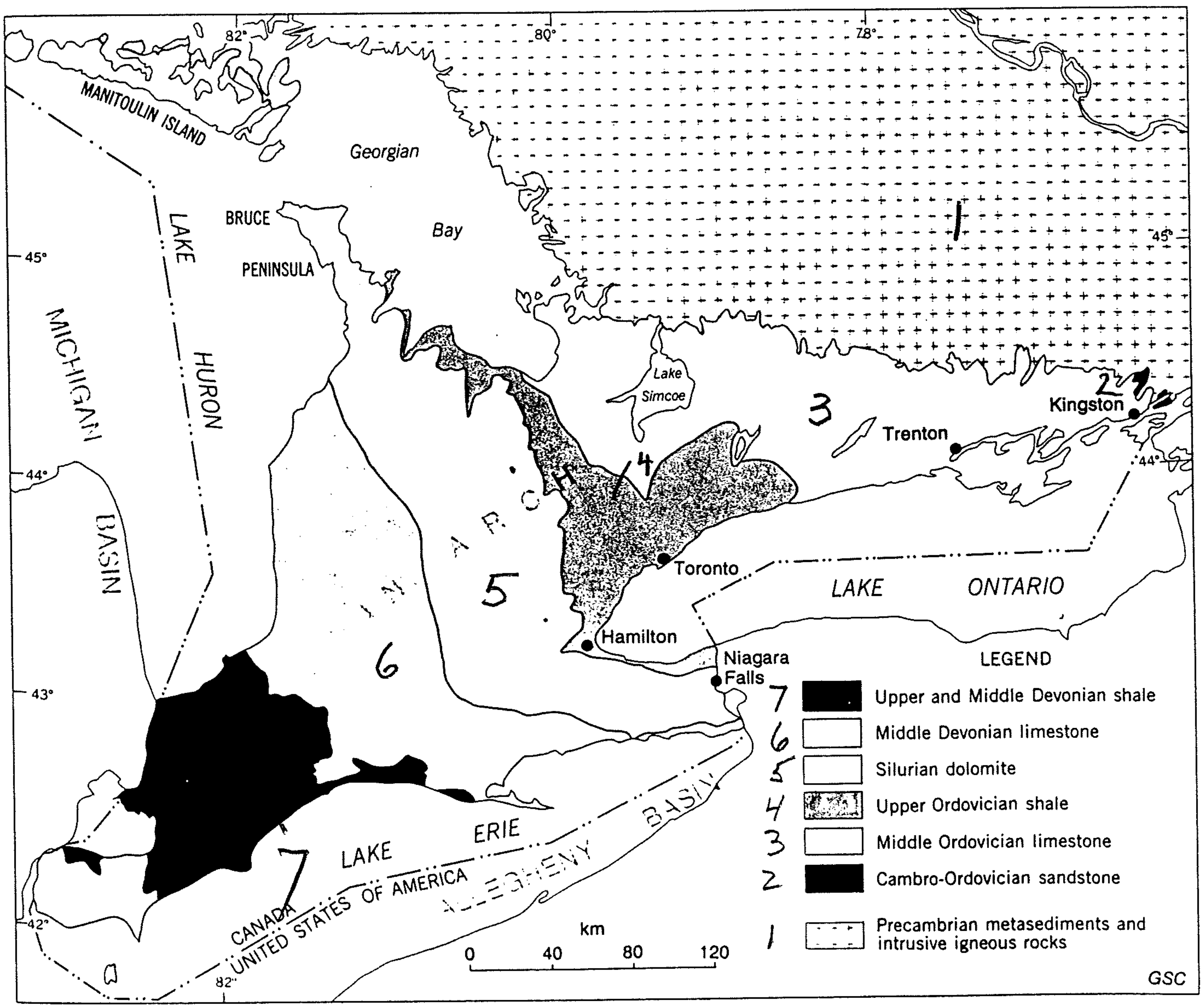
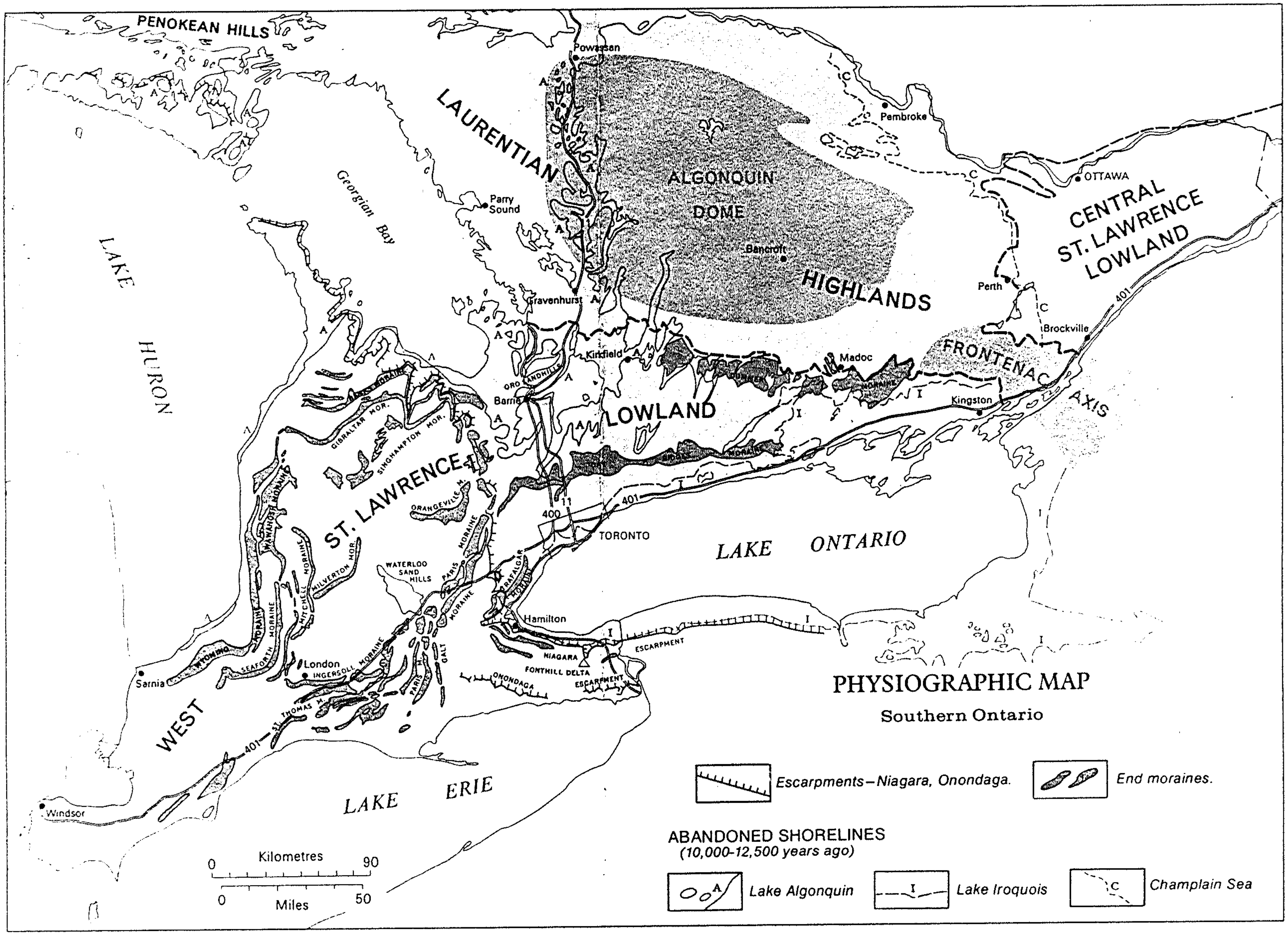


Figure 4.4. Bedrock geology of southern Ontario (from map DDM 4114A compiled 1976 by P.G. Teleford, Ontario Geological Survey).


PHYSIOGRAPHIC MAP
Southern Ontario
PENOKEAN HILLS
LAURENTIAN
ALGONQUIN
DOME
HIGHLANDS
CENTRAL
ST. LAWRENCE
LOWLAND
FRONTENAC
AXIS
LOWLAND
ST. LAWRENCE
WEST
LAKE HURON
Georgian Bay
LAKE ONTARIO
LAKE ERIE
Powassan
Pembroke
OTTAWA
Parry Sound
Bancroft
Perth
Brockville
Gravenhurst
Kirkfield
Madoc
Kingston
Barrie
ORO
TORONTO
Hamilton
London
Sarnia
Windsor
GIBRALTAR MOR.
SINGHAMPTON MOR.
ORANGEVILLE M.
WATERLOO SAND HILLS
PARIS MORAINE
TRAFALGAR
WAWANOSH MORAINE
MITCHELL MORAINE
MILVERTON MOR.
SEAFORTH MORAINE
WYOMING
INGERSOLL MORAINE
ST. THOMAS M.
GALT
PARIS
NIAGARA
FONTHILL DELTA
ESCARPMENT
ONONDAGA
ESCARPMENT
401
400
11
Kilometres
0
90
0
Miles
50
Escarpments–Niagara, Onondaga.
End moraines.
ABANDONED SHORELINES
(10,000-12,500 years ago)
Lake Algonquin
Lake Iroquois
Champlain Sea

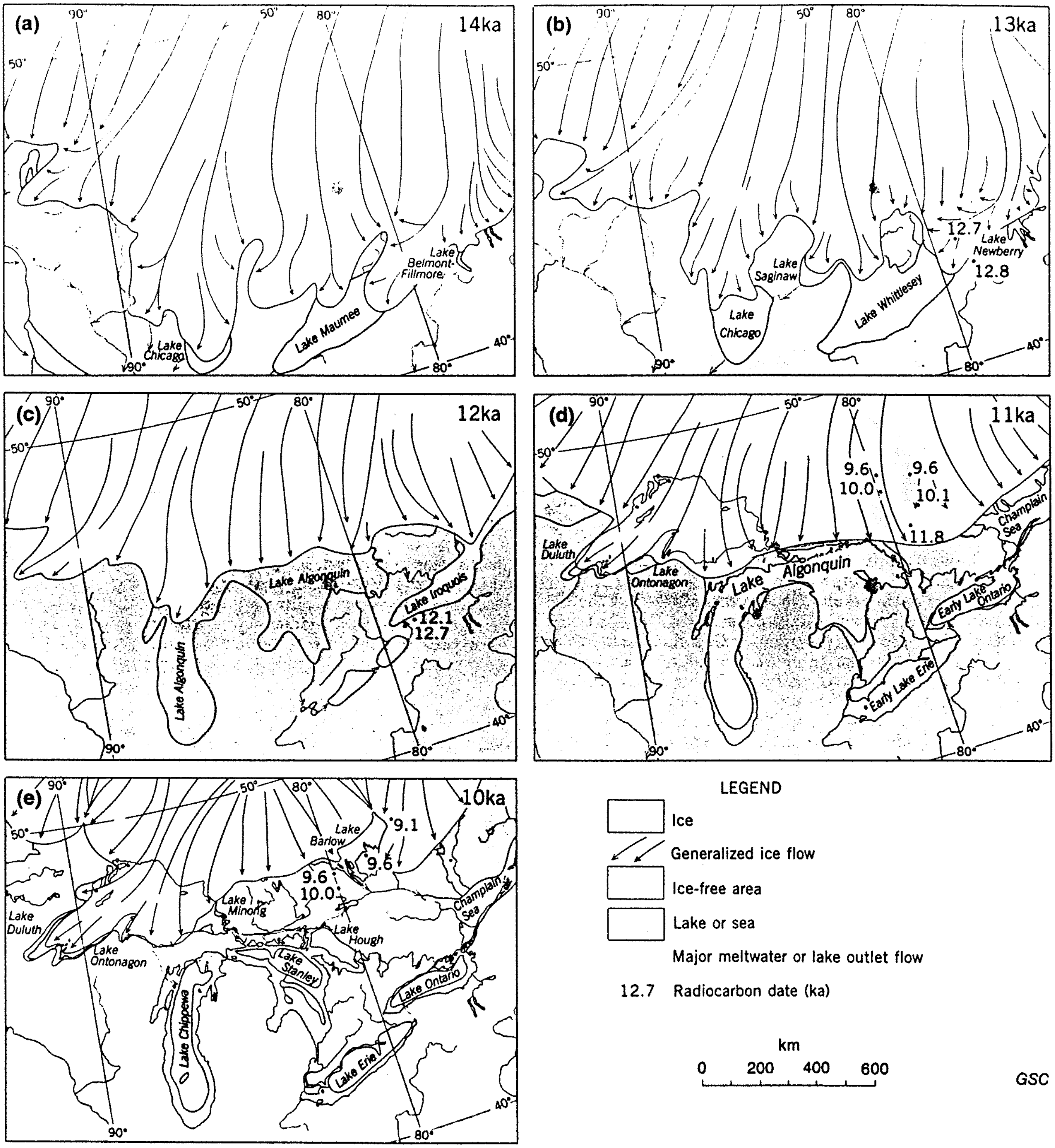


Figure 4.19. Paleogeographic maps showing late glacial development of the Great Lakes: (a) Port Bruce Stade (about 14 ka); (b) Port Huron readvance (about 13 ka); (c) Stage of deglaciation during Two Creeks Interstade (about 12 ka); (d) Lake and ice configuration (about 11 ka), shortly before opening of North Bay outlet; and (e) Great Lakes shortly after opening of North Bay outlet and shortly before culmination of Marquette advance in the Lake Superior basin (about 10 ka).

Karrow 1989

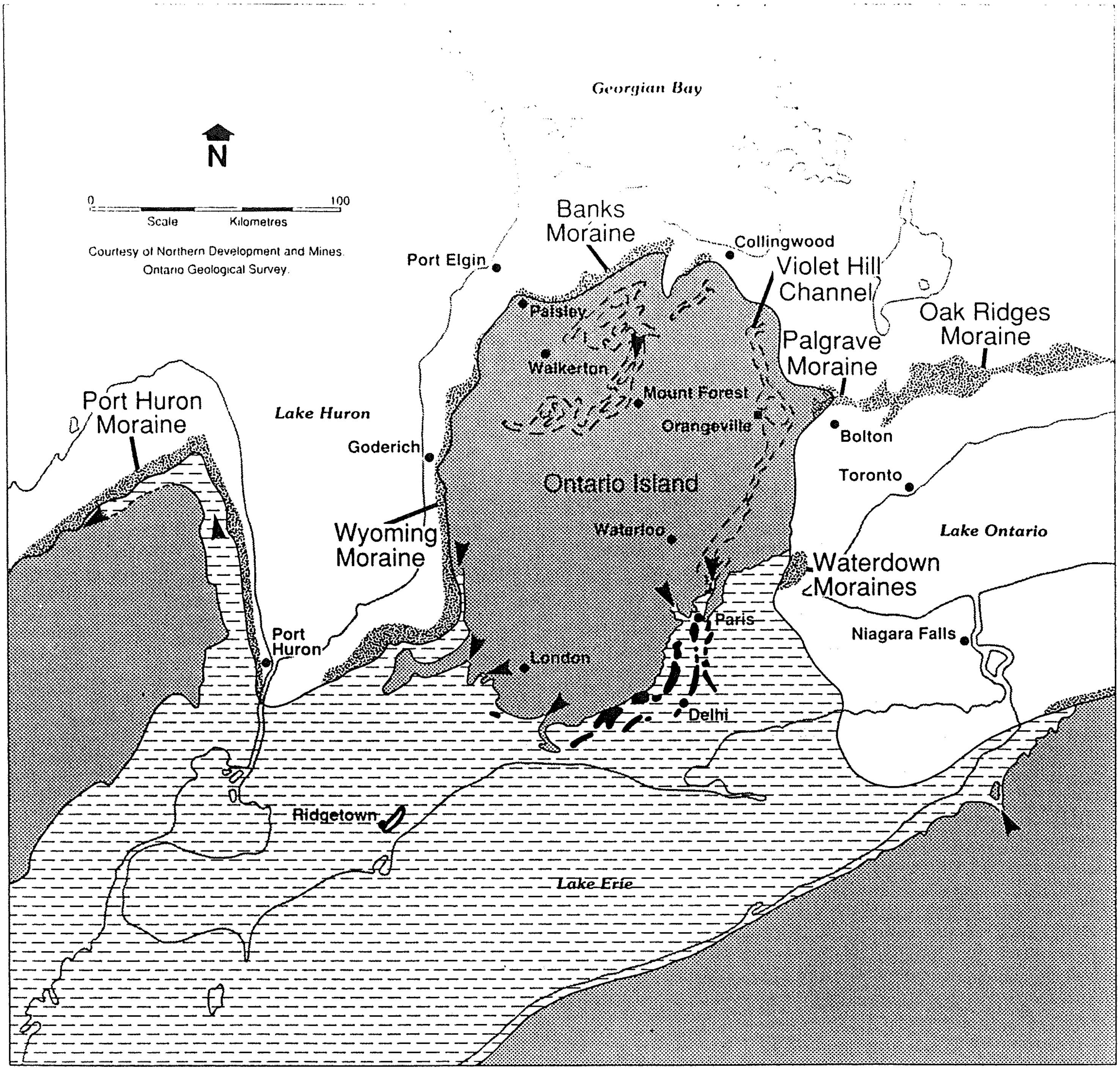


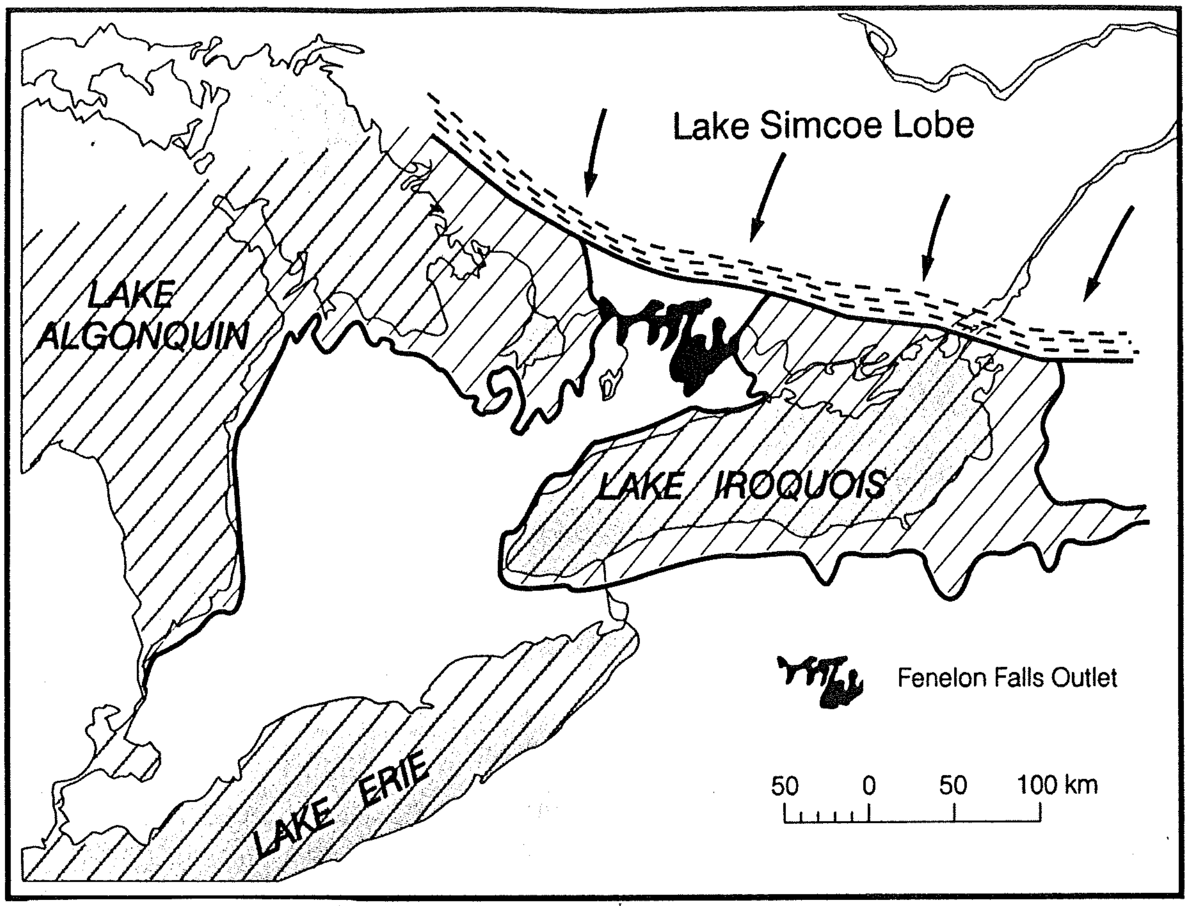
Figure 4-12 SOUTHWESTERN ONTARIO 13,000 YEARS AGO

Land — Glacial Lake Whittlesey — Glacial Ice

Meltwater Channels — Sand and Gravel — Moraine

The Dundalk Plain, the highland of southwestern Ontario, is surrounded by moraines that form a horseshoe pattern. The meltwaters from the glaciers drained in several well developed channels into Proglacial Lake Whittlesey which occupied the Lake Erie Basin at that time. The meltwater channels contain extensive deposits of sand and gravel.

Tovell 1992



Glacial Lake Algonquin drained through the Trent-Severn into Lake Iroquois via an outlet near Fenelon Falls. Adapted from Chapman and Putnam, 1973.

Table 1.1. Selected Climatic and Climatostratigraphic Subdivisions of the Last Glacial-Interglacial Cycle[a,b]

Glacial-Interglacial cycle	Global climate	Marine oxygen isotope stage	Substage	Terrestrial climatostratigraphic units: N.W. Europe	British Isles	North America	European Interstadials	European Stadials	Age estimate
A	Interglacial	1	Recent	Holocene	Flandrian	Holocene			
B	Glacial	2	Late-glacial	Late Weichselian	Late Devensian	Late Wisconsinan		Younger Dryas	11-10 ka BP
							Allerød		11.8-11 ka BP
								Older Dryas	12-11.8 ka BP
							Bølling		13-12 ka BP
								Oldest Dryas	>13 ka BP
		3	Pleniglacial	Middle Weichselian	Middle Devensian	Middle Wisconsinan	Denekamp		32-28 ka
							Hengelo		39-36 ka
							Moershoofd		46-44 ka
							Glinde		51-48 ka
							Oerel		58-54 ka
		4			Early Devensian	Eowisconsinan			
		5a	Early glacial	Early Weichselian			Odderade		84-74 ka
		5b							92-84 ka
		5c					Brörup/Amersfoort		105-92 ka
		5d							115-105 ka
	Interglacial	5e	Last-interglacial	Eemian	Ipswichian	Sangamonian			130-115 ka
C	Glacial	6	Penultimate glacial	Saalian	Wolstonian	Illinoian			190-130 ka

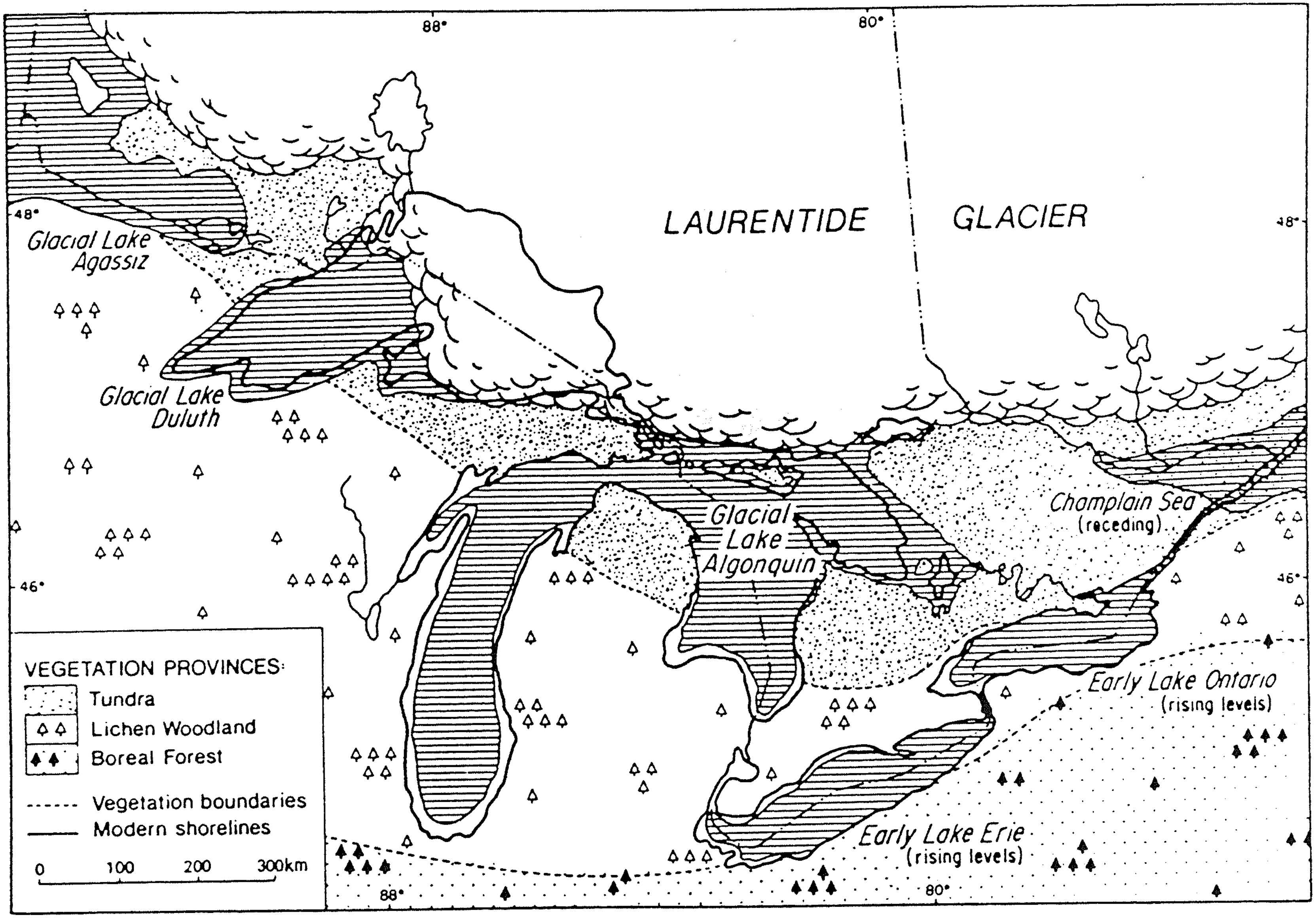


Fig. 3. — Niveaux de l'eau des Grands Lacs, étendue de l'inlandsis et provinces végétales pour la période de 11 000 à 10 500 BP.

Fig. 3. — *Great Lakes levels, glacier margins, and vegetation provinces ca 11 000 to 10 500 BP.*

Julig + McAndrews 1993

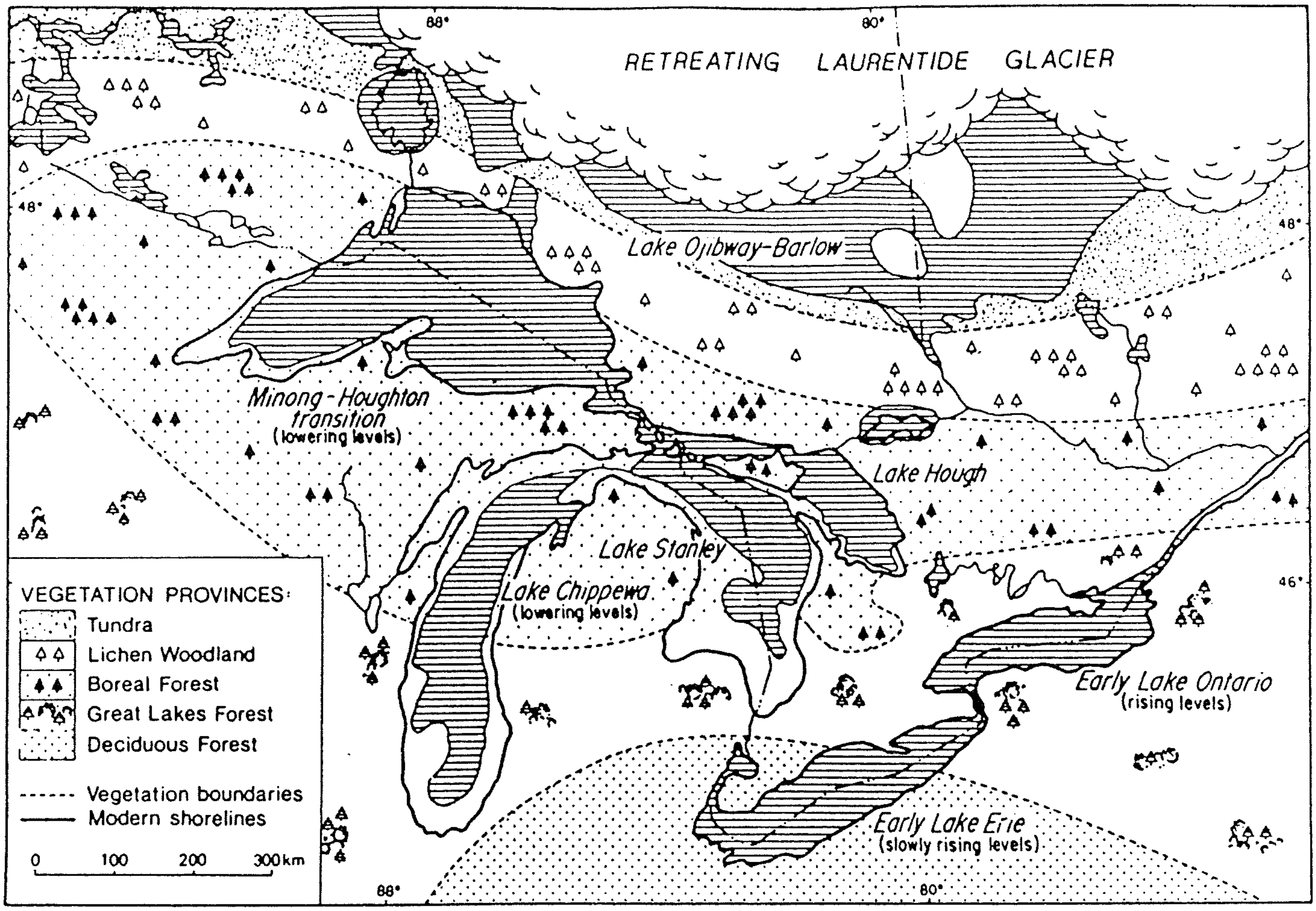
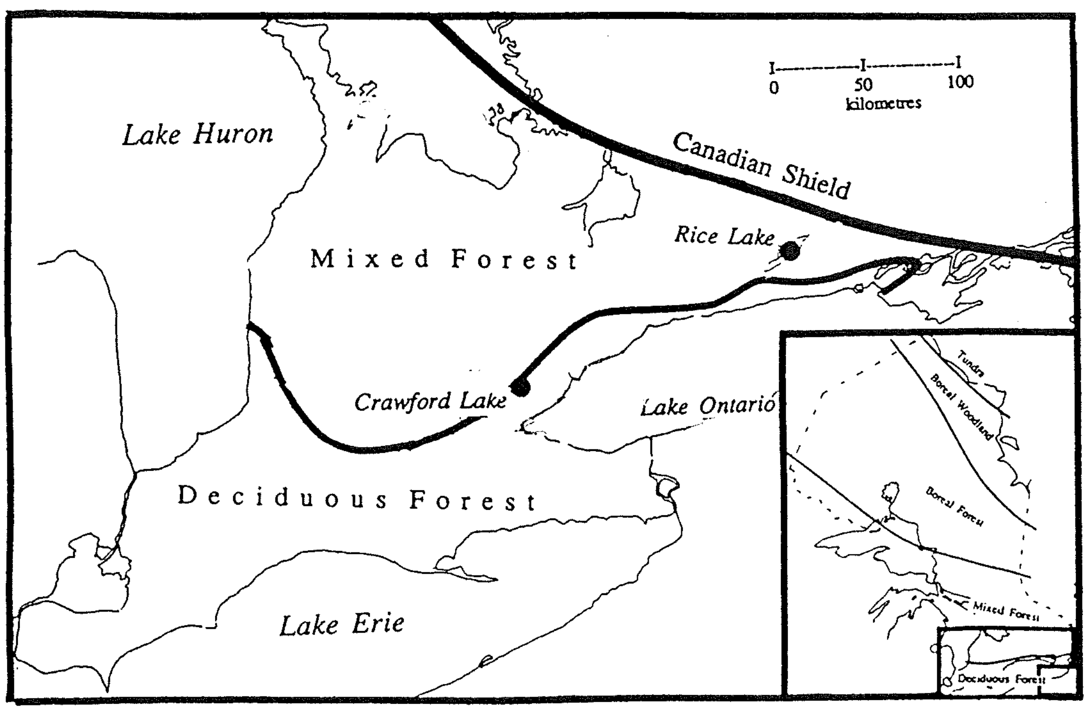


Fig. 4. — Niveaux de l'eau des Grands Lacs, étendue de l'inlandsis et provinces végétales pour la période de 9 500 à 9 000 BP.

Fig. 4. — *Great Lakes levels, glacier margins, and vegetation provinces ca 9 500 to 9 000 BP.*

Julig + McAndrews 1993

Map of Ontario showing modern vegetation zones



adapted from McAndrews 1994

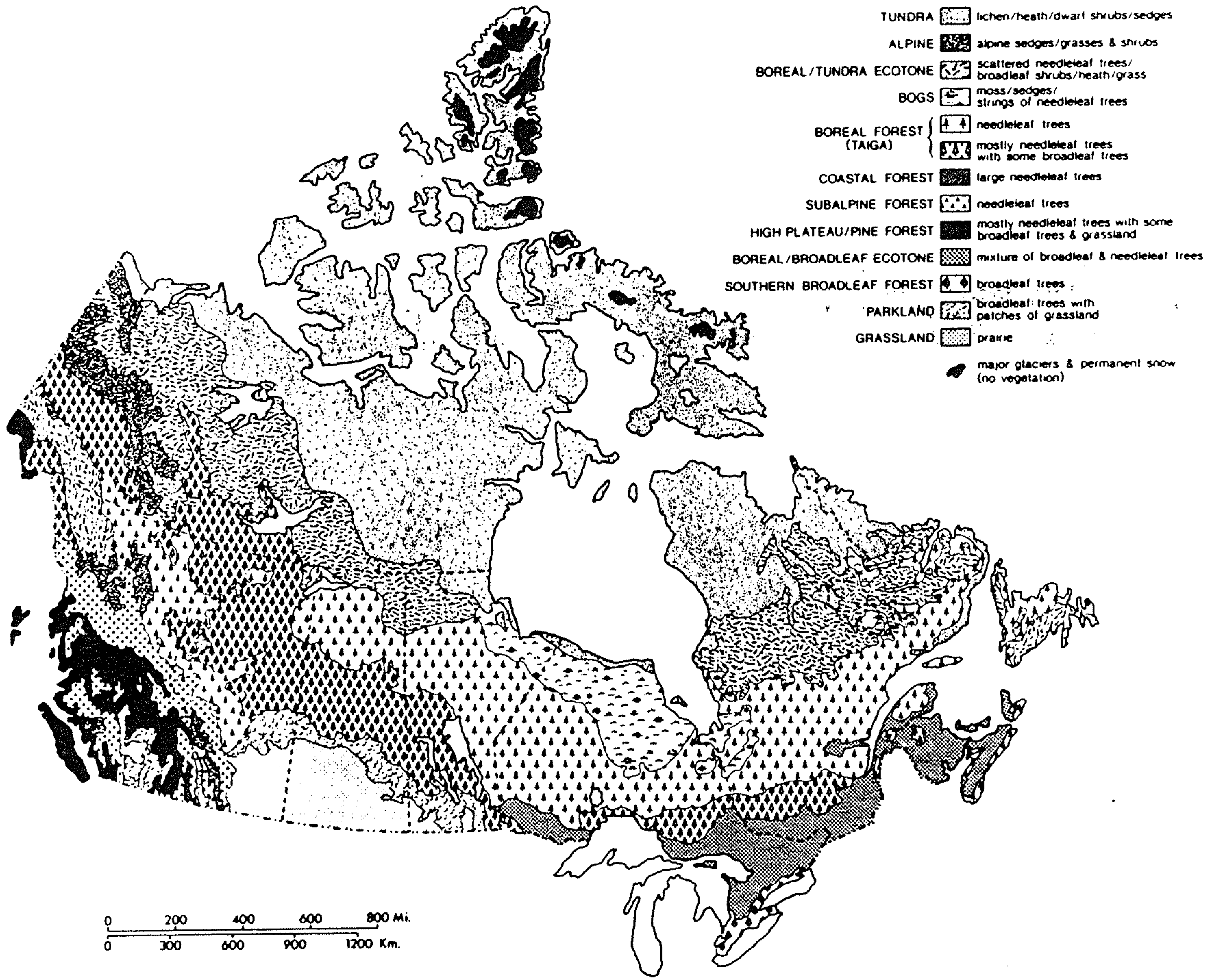
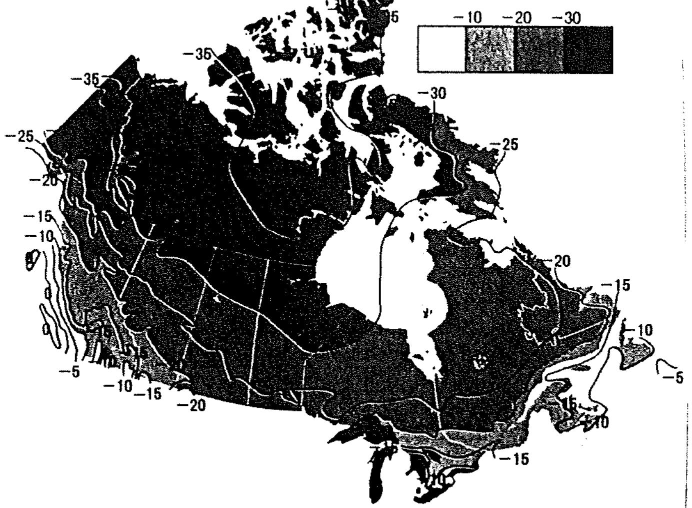
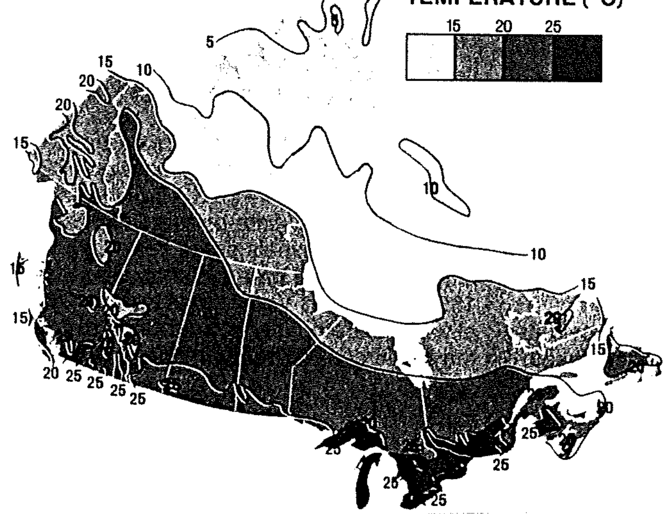


Figure 1.3
Vegatation Formations in Canada (after Canada, Department of Energy, Mines and Resources, 1973). See Energy, Mines and Resources Canada (1993) for cover types map based on satellite data.

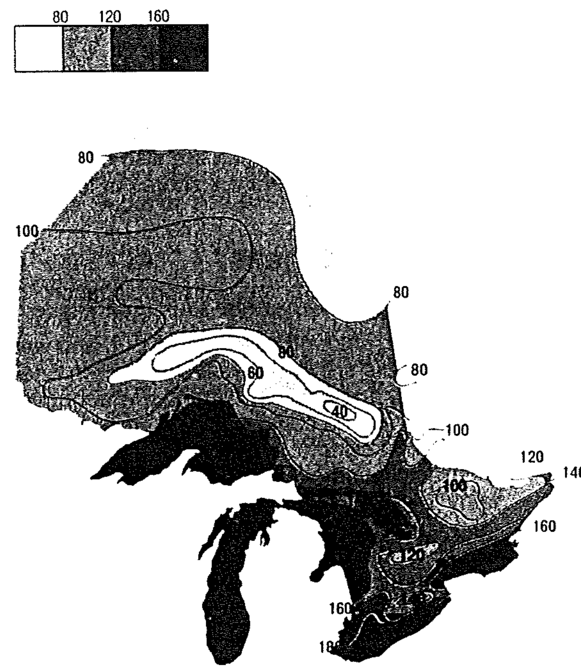
JANUARY AVERAGE NIGHT-TIME TEMPERATURE (°C)



JULY AVERAGE AFTERNOON TEMPERATURE (°C)

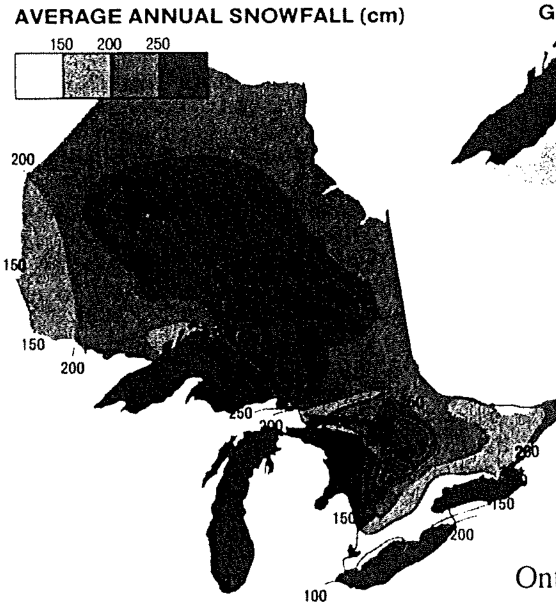


AVERAGE FROST-FREE PERIOD (DAYS)

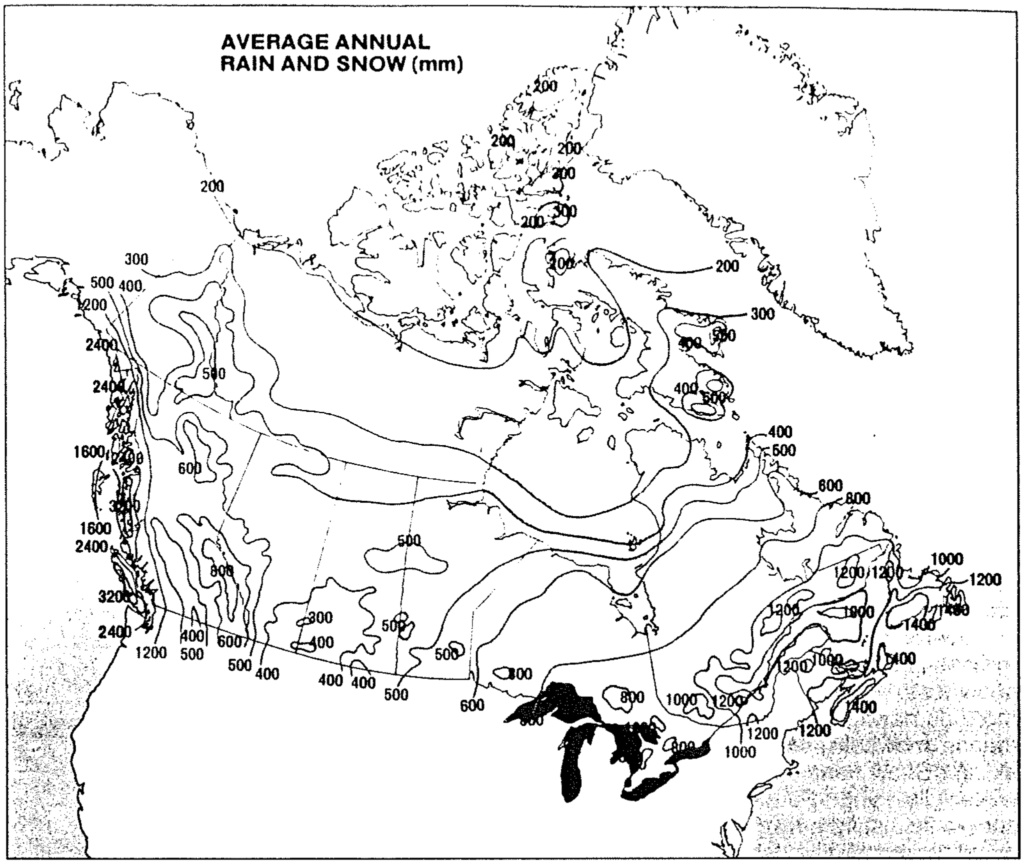


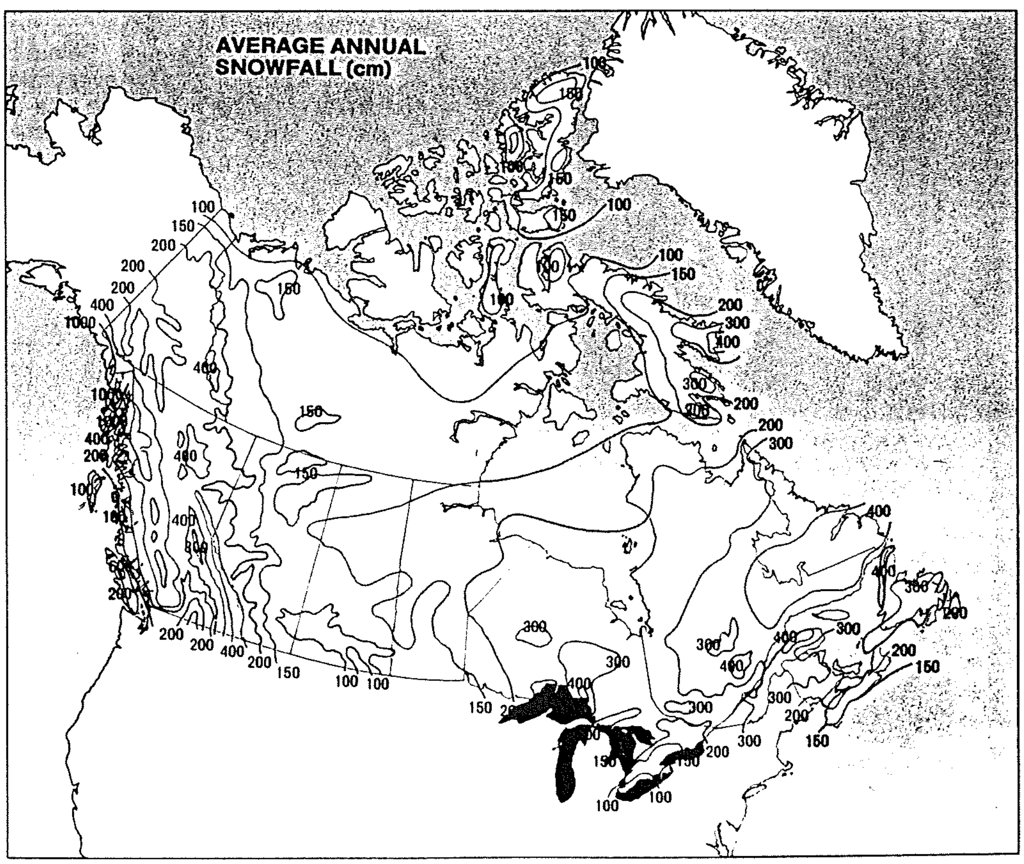
from: *THE CLIMATES OF CANADA* 1990

AVERAGE ANNUAL SNOWFALL (cm)



GREAT LAKES SNOWBELTS


AVERAGE ANNUAL
RAIN AND SNOW (mm)


AVERAGE ANNUAL
SNOWFALL (cm)

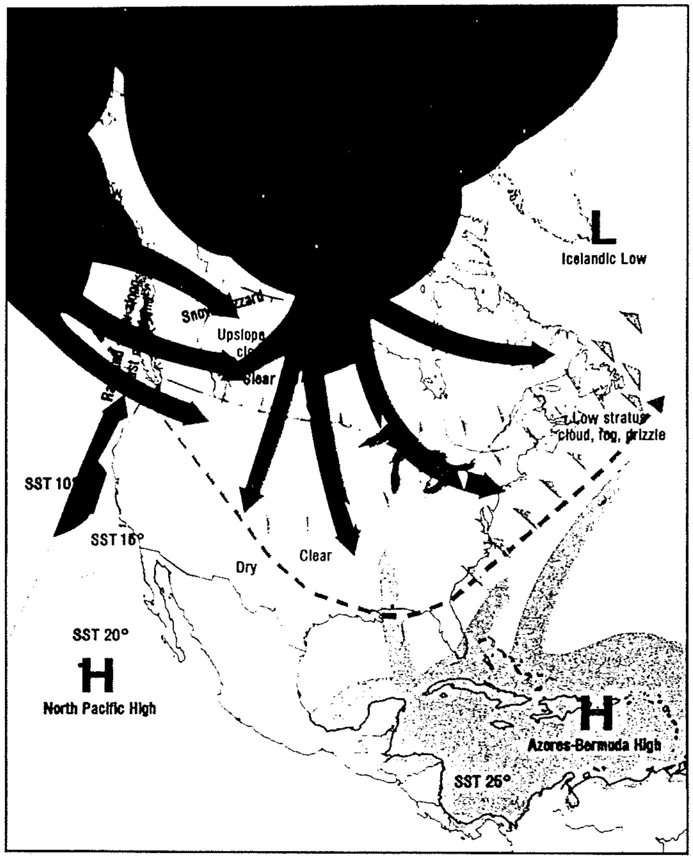
WINTER AIR MASSES AND CIRCULATION

- - - Polar jet stream

Primary storm tracks

- Continental Arctic
  - very cold −25 to −50°C
  - dry very stable
  - pronounced temperature inversion
- Maritime Arctic
  - very unstable
  - clouds, frequent showers or flurries
  - visibility good except in showers
- Maritime Polar
  - milder and more stable than Arctic air
- Pacific Maritime Tropical
  - light winds, cooler than Atlantic air
  - comes to North America from west or northwest
  - stable in lower 1000 m (marine stratum)
- Atlantic Maritime Tropical
  - comes to North America from south or southeast
  - warm and humid

SST Sea surface temperature



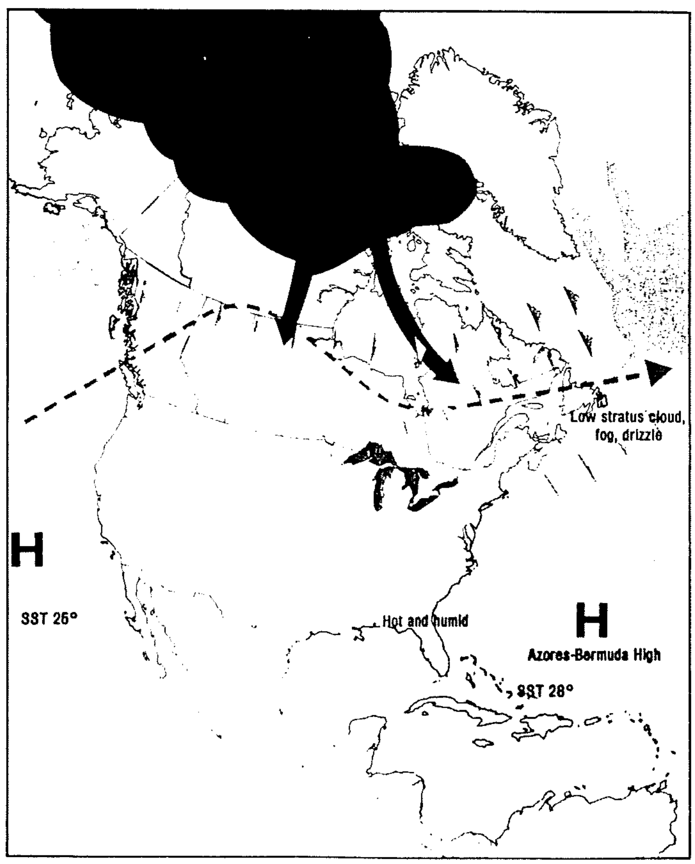
SUMMER AIR MASSES AND CIRCULATION

- - - Polar jet stream

Primary storm tracks

- Pacific Maritime Tropical
  - H pressure precludes moist air
- Atlantic Maritime Tropical
  - oppressively hot and humid
  - unstable, frequent thunderstorms
- Maritime Arctic
  - continental air modified by open seas, lakes and swamps
- Maritime Polar
  - warmer and more stable than Maritime Arctic air
- Continental Tropical
  - hot, dry, unstable

SST Sea surface temperature

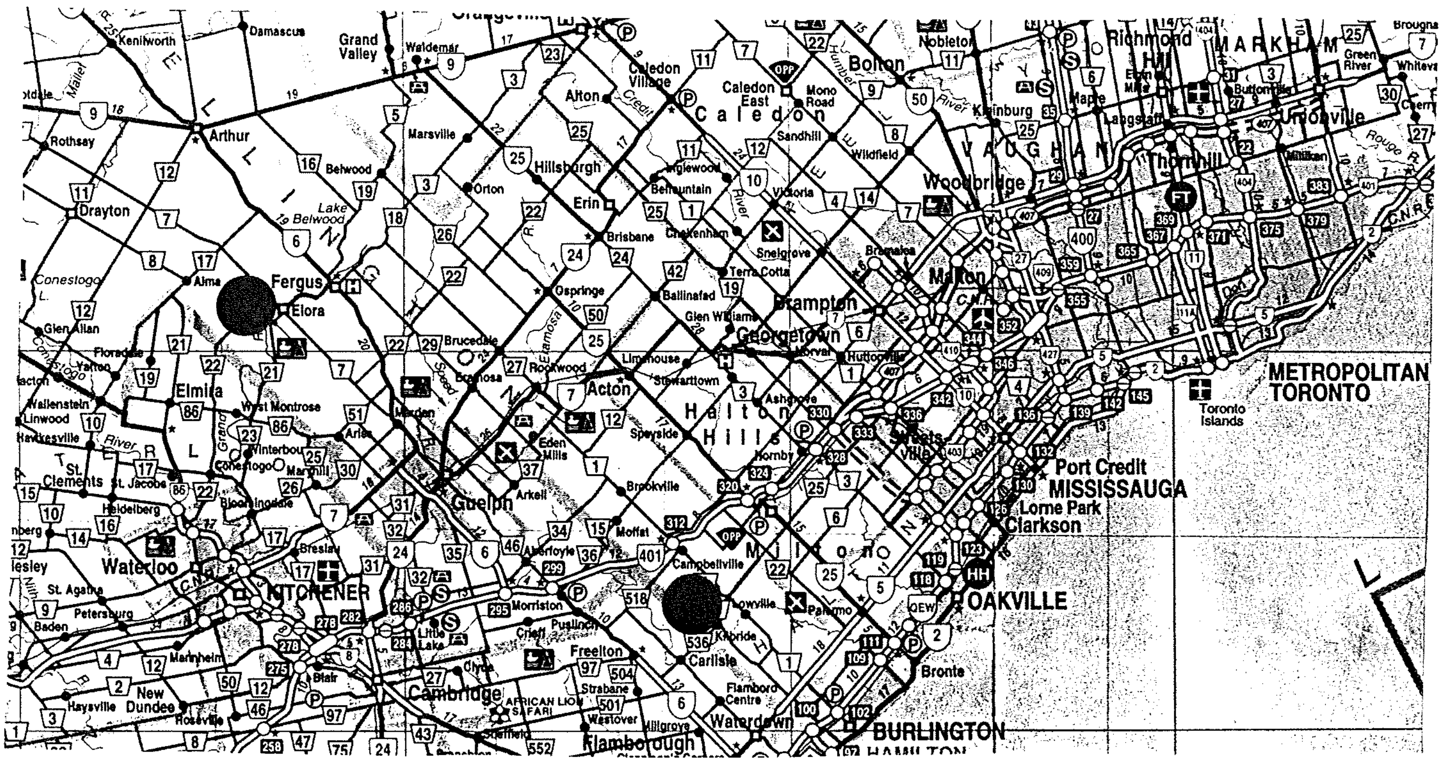


Bressani's 1657 map confuses the relationship of Georgian Bay and Lake Huron, but is most interesting for its illustrations of Indian life, which may be reasonably authentic. —National Archives of Canada C 85845

August 21

Main themes:

General Introduction
&
Prehistoric Indians: Hunter/gatherer and farming
&
European Agriculture since 150 yrs.



Breakfast at your own at the Hart House.

8 a.m.:	Departure for **Crawford Lake** Conservation Area: Introduction to the Late Quaternary vegetation history of S-Ontario. Laminated sediments and Indian farming. Visit to old growth Esquising Forest (with up to 1000-years-old white cedar / *Thuja occidentalis*).
Lunch	near the Crawford Lake Visitors Centre.
2 p.m.:	Visit to the reconstructed Iroquoian Indian Village (14th and 15th century AD; pre-contact period) / Indian crops. Optional walk to Crawford Bog

Overnight in Elora (Village Inn, Tel. -519-846-5333), Dinner on your own in Elora.

Geological, vegetational and human history at Crawford Lake

How did the lake basin form?
Is there a Younger Dryas climatic fluctuation?
What impact did the farming Indians have on the forest, especially through fire?

Crawford Lake is near the edge of the Niagara Escarpment at 279 m asl. It has a surface area of 2.4 ha and maximum depth of 22.5 m. The basin probably originated by hydraulic mining of the bedrock during a subglacial flood about 13,500 BP. Upon glacier retreat a shallow arm of Glacial Lake Whittlesey of the Erie basin covered the area and waves washed away glacial drift exposing the surface bedrock.

Locally there is 600 m of Palaeozoic rock of Silurian and Ordovician age. Silurian Amabel dolostone cliffs up to 6 m high nearly surround the lake and also extend below the surface, rather like an old stone quarry. Beneath this massive, flat-lying, erosion-resistant dolostone are the relatively easily eroded limestone, dolostone, sandstone, and especially the red Queenston shale that outcrops at the base of the Escarpment.

After ice retreat about 13 ka ago clay was deposited in the lake. Fossil pollen indicates the earliest vegetation was a shrub tundra dominated by Alnus crispa, Salix, and Juniperus and herbs such as Carex and Gramineae. A Picea woodland developed after several hundred years and lasted for about 2000 years. A Pinus-dominated forest, first P. banksiana/P. resinosa and then P. strobus pine, succeeded about 10,000 years ago. This forest was replaced by a mixed forest of Fagus, Quercus, Ulmus, Acer, and Tsuga about 8,000 years ago which lasted until 600 years ago when P. strobus again took over. Climatic change drove succession and accompanying lake level fluctuations.

Pollen analysis from top 90 cm of varved sediments reveal detailed and well-dated vegetation history for the past 1800 years. The Indian farming period from A.D. 1360-1650 is signalled by Zea, Gramineae and Portulacca. Subsequently, an archaeological survey located several Indian farming village sites, the nearest was 150 m from the lake. Eurocanadian forest clearance and farming since A.D. 1820 is indicated by the appearance of Rumex acetocella and abundance of Ambrosia pollen.

The varve-dated pollen diagram from 1990 back to AD 212 shows a pollen succession typical of southern Ontario. Zone 3c indicates dominance by cool-mesic forest that in zone 3d was succeeded by Quercus followed by Pinus strobus beginning in AD 1390. A few decades before this succession Gramineae including Zea and also Portulacca appear in the record suggesting forest disturbance by Indian farmers. Furthermore, there is an increase in sediment charcoal. Alternatively, the forest succession could have been initiated by the climate of the medieval warm period which seems to have deteriorated into the cold climate of the Little Ice Ago.

Campbell, I.D. and J.H. McAndrews. 1993. Forest disequilibrium caused by rapid Little Ice Age cooling. Nature 366:336-338.

Campbell, I.D. and J.H. McAndrews, 1995. Charcoal evidence for Indian-set fires: a comment on Clark and Royall. the Holocene. 5:369-370.

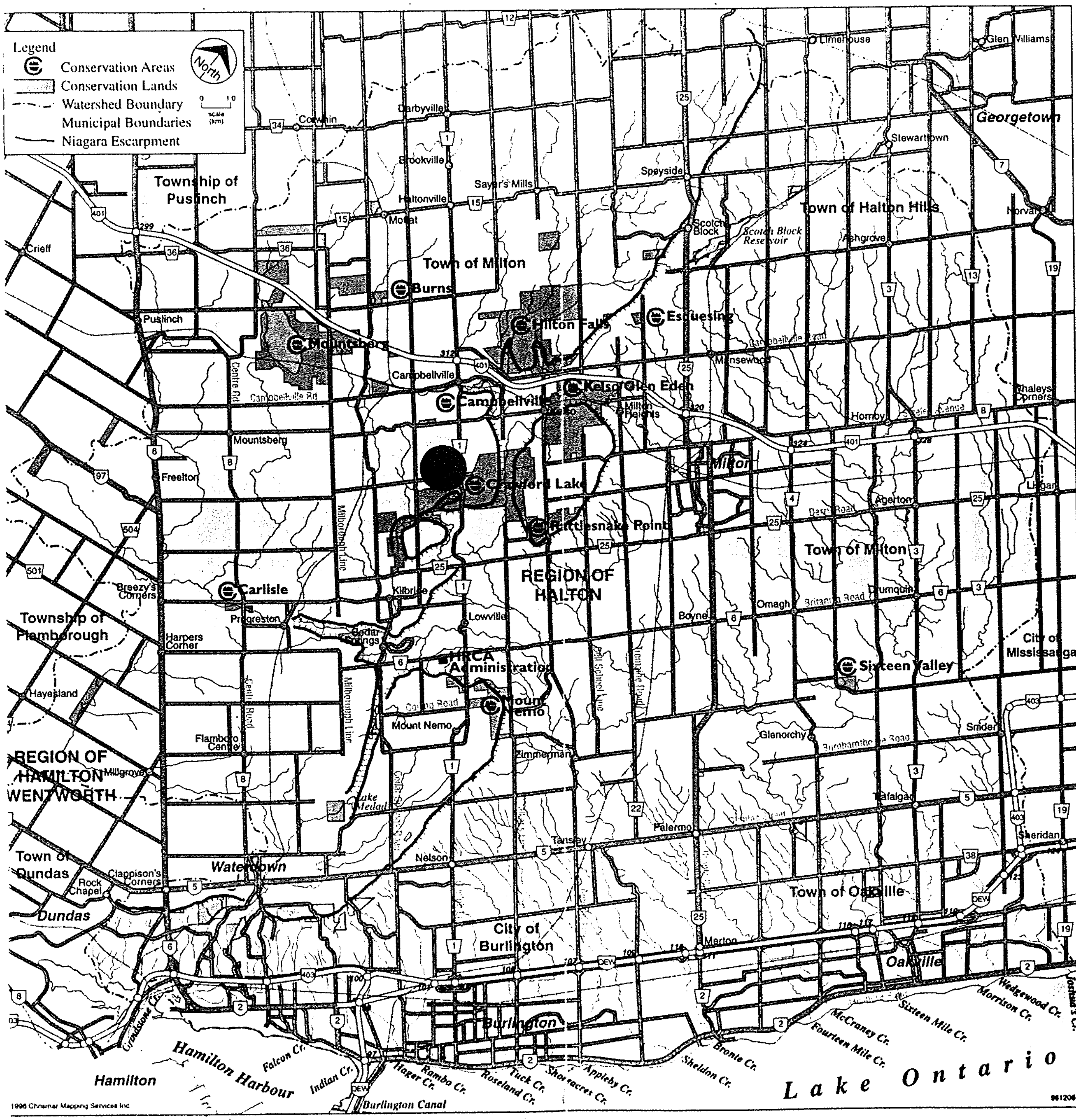
Clark, J.S. 1995. Climate and Indian effects on southern Ontario forests: a reply to Campbell and McAndrews. The Holocene 5:371-379.

Clark, J.S. and P.D. Royall. 1995. Transformation of a northern hardwood forest by aboriginal (Iroquois) fire: charcoal evidence from Crawford Lake, Ontario Canada. The Holocene 5:1-9.

McAndrews, J.H., and M. Boyko-Diakonow. 1989. Pages 528-530 in R.J. Fulton (ed). Quaternary Geology of Canada and Greenland. Geological Survey of Canada.

C:\texts\env234\craw98.ft

Follow these signs for a natural day in the country.



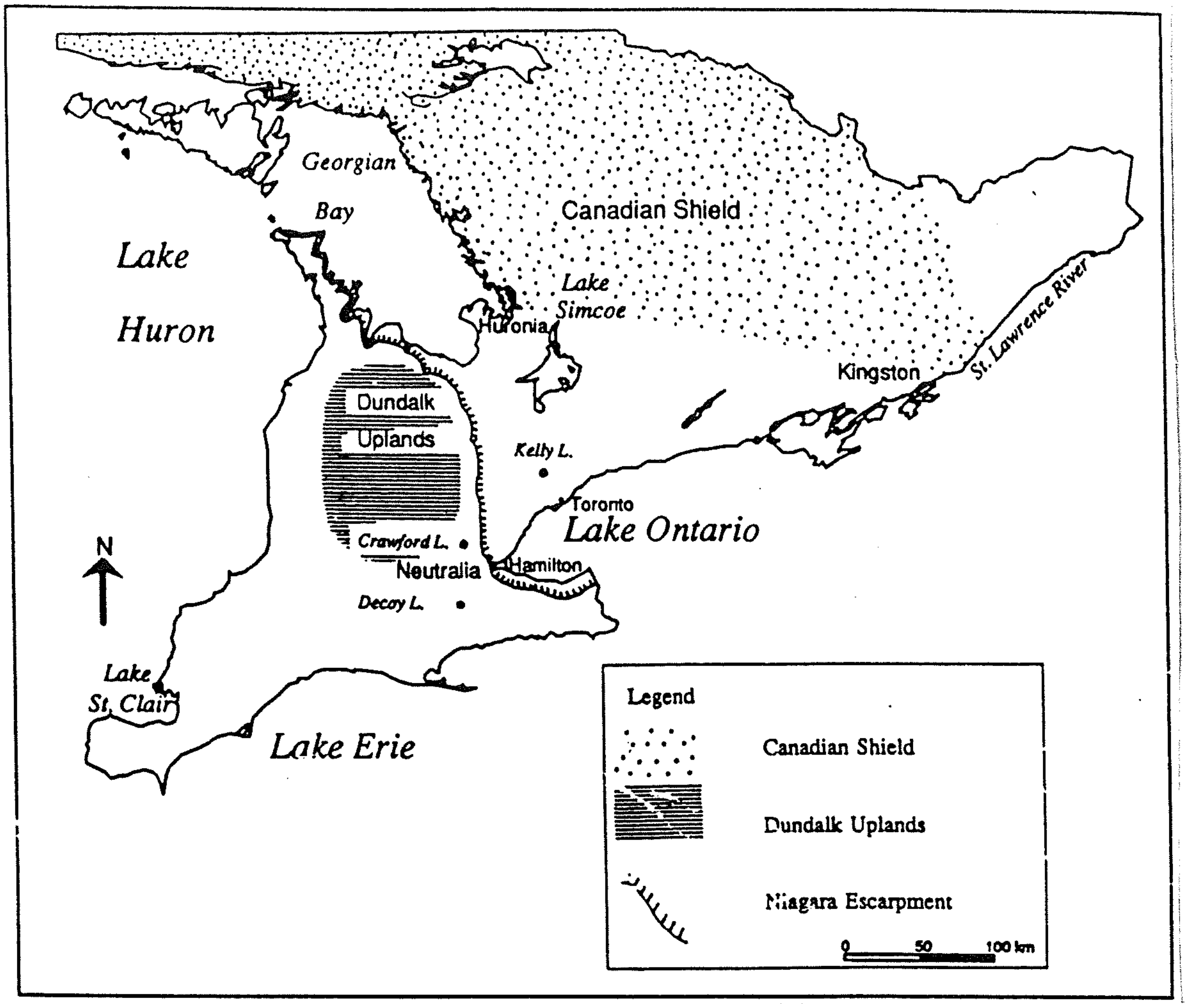


Figure 1a. Important Study Locations in Southern Ontario

Campbell + Campbell 1994

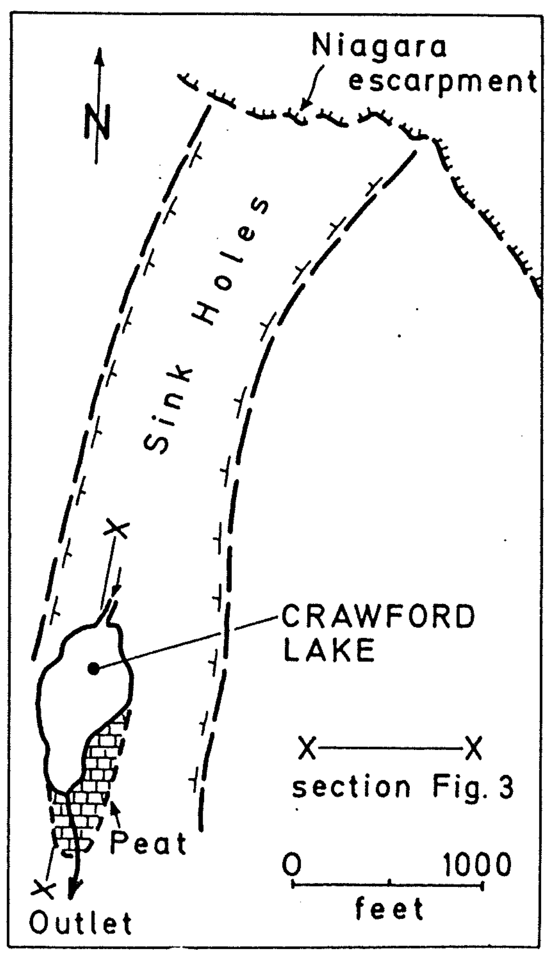
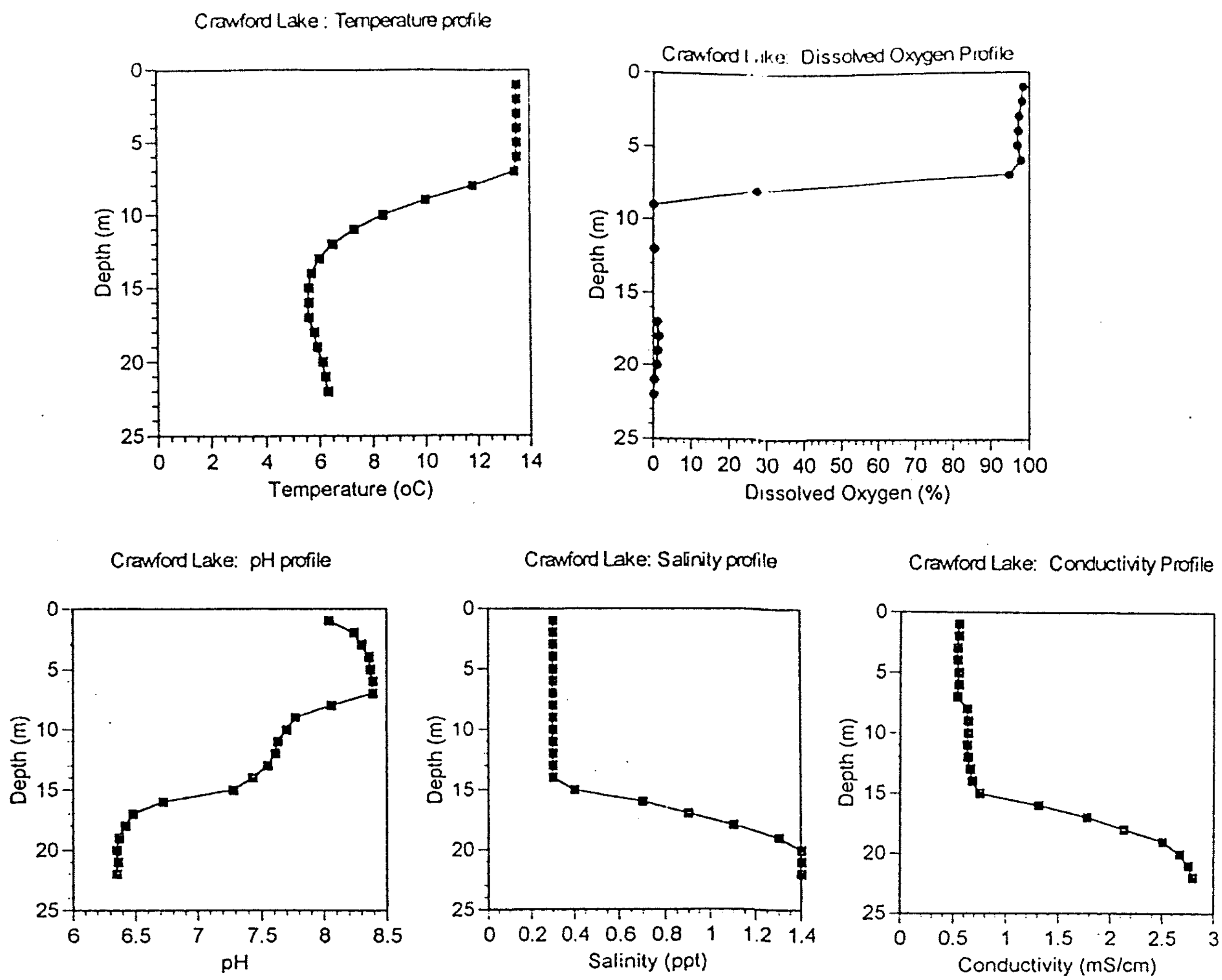


Figure 2. Crawford Lake - situated in a sinkhole area close to the Niagara Escarpment

Boyko-Diakonow 1979

Data collected by C. Norcross, 13 Oct 1994
Dept. of Geology, U. of Toronto



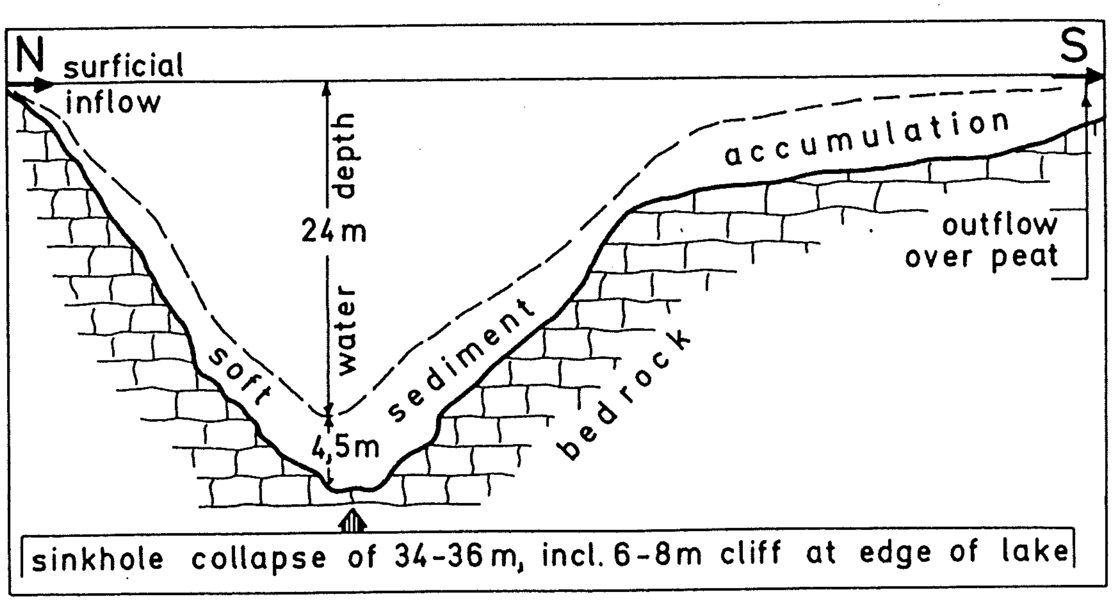


Figure 3. Crawford Lake - longitudinal section and bathymetry

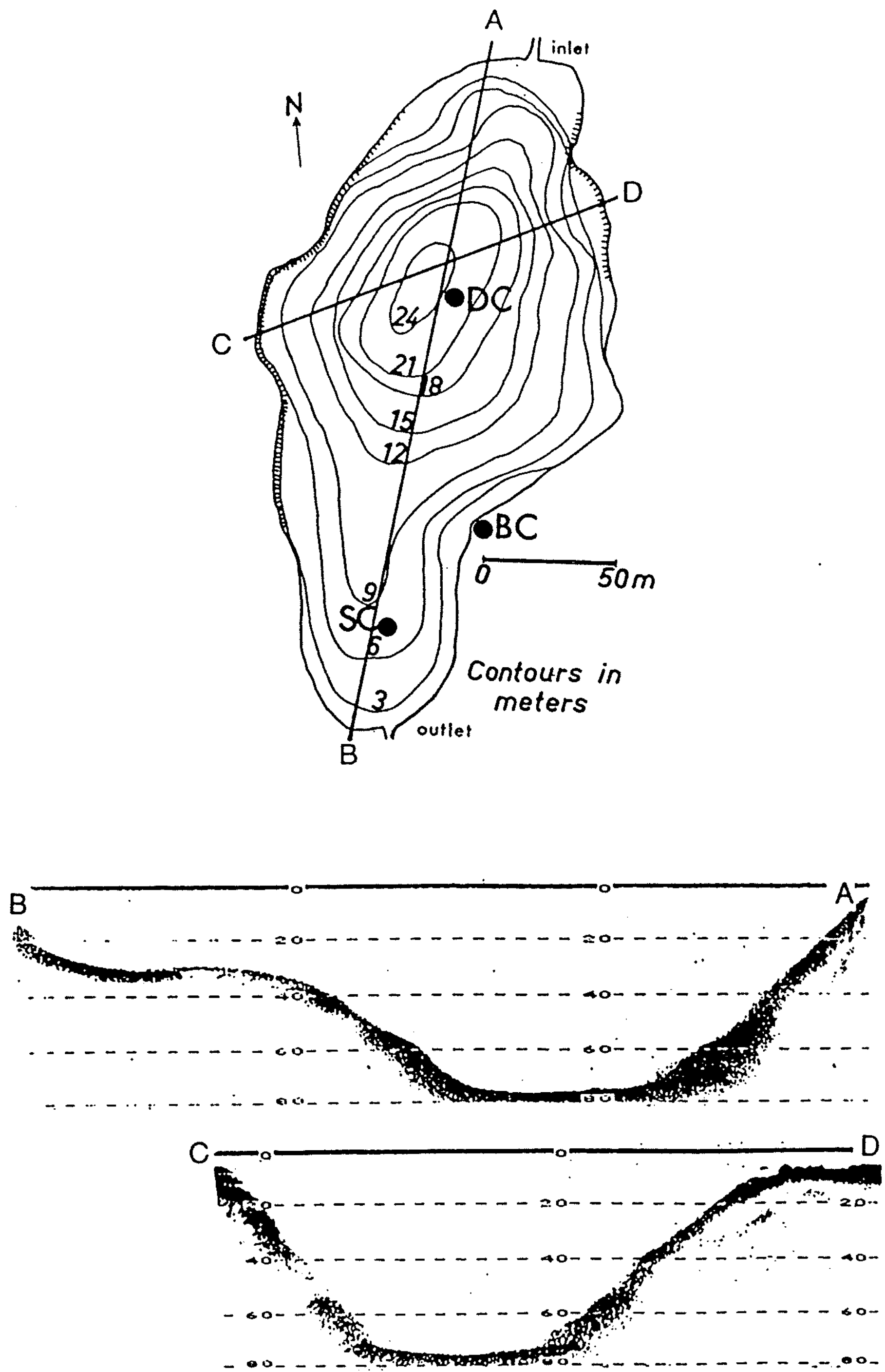
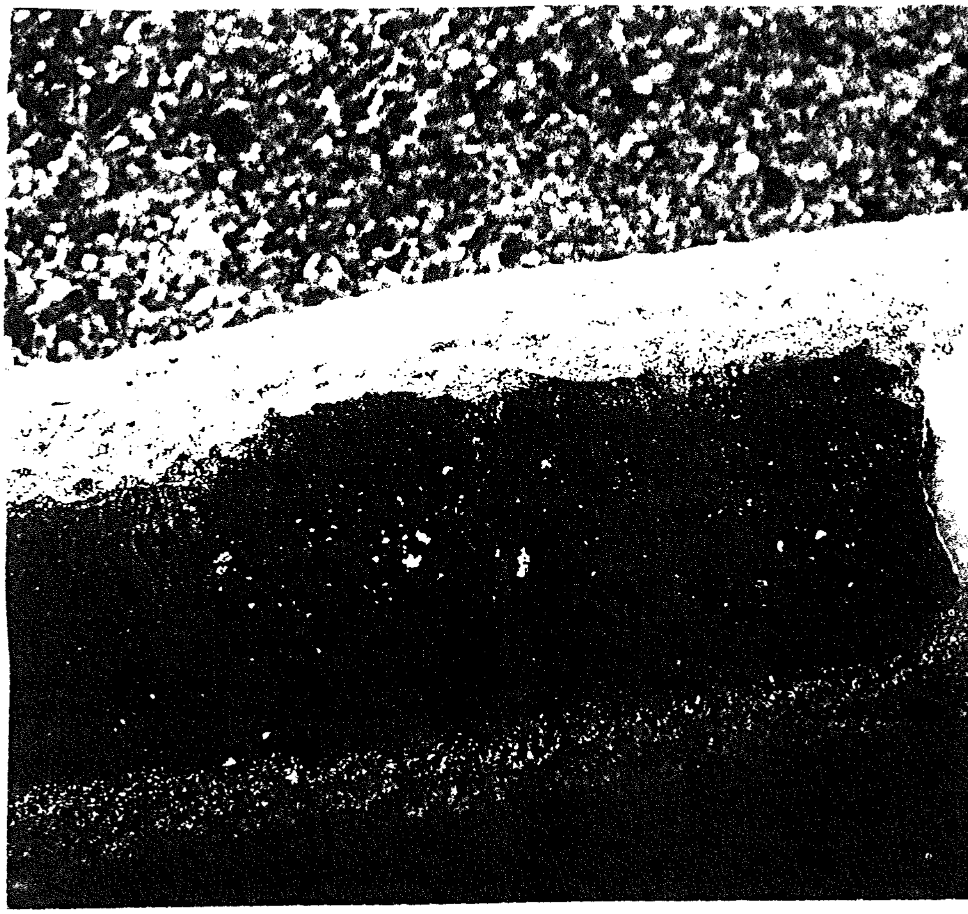
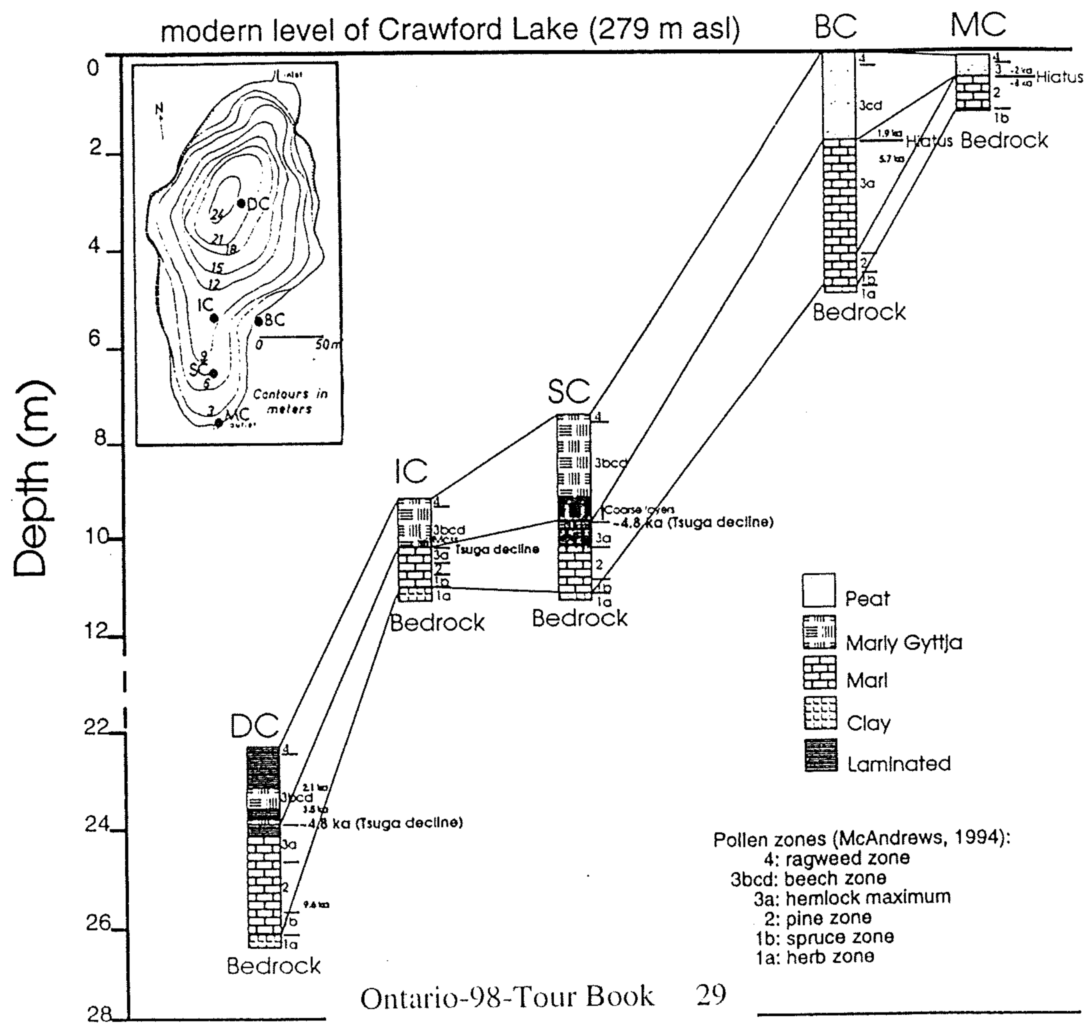


Figure 4.5. (Upper) Bathymetry map of Crawford Lake (after Boyko, 1973) showing the location of coring sites for cores DC, SC and BC. (Lower) Two cross-profiles (B-A and C-D as shown above) showing the flat-bottomed feature of the lake (vertical scales are feet; 1 metre = 3.28 feet).

Yu, Z. (1997): Late Quaternary paleoecology of the southern Niagara Escarpment, Ontario, Canada: A multiple proxy investigation of vegetation and climate history. PhD Thesis, University of Toronto, 380 pp.



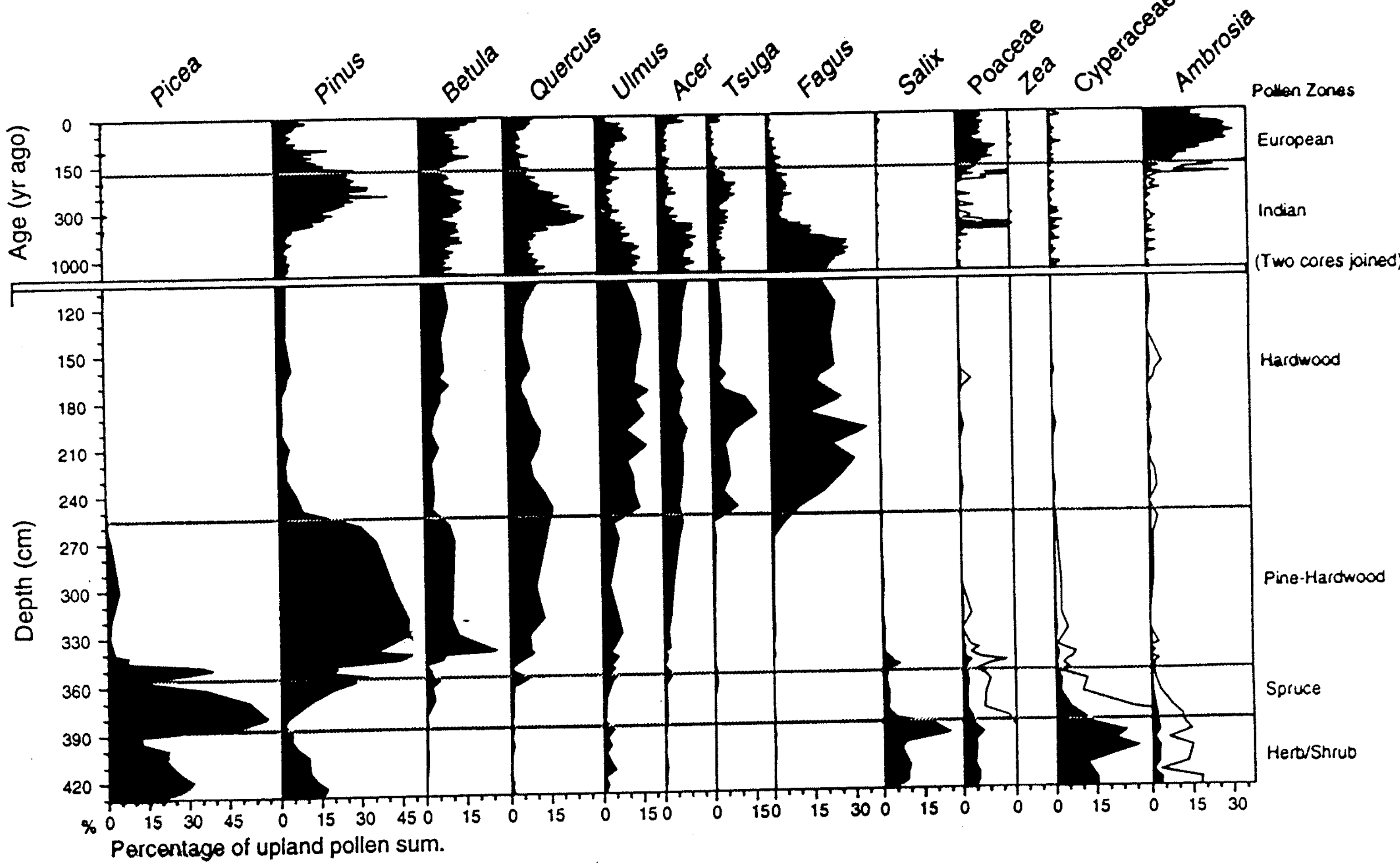
Dr. McAndrews from the Royal Ontario Museum, and an assistant, retrieve a three metre long aluminum tube from the depths of Crawford Lake in Southern Ontario. Undisturbed layers of sediment from the meromictic lake freeze to the tube packed with dry ice. The layers or "varves" (left), two per year, helped scientists date the Crawford Lake Indian Village more accurately than any other.



Sediment stratigraphies for cores DC, IC, SC, BC, and MC from Crawford Lake (43°28'N; 79°57'W) showing lithology, ^{14}C ages, and regional pollen assemblage zones. Insert shows the bathymetry and locations of coring sites.

Crawford Lake Pollen Diagram

April 6, 1996. by J.H. McAndrews, M. Boyko, & Z. Yu



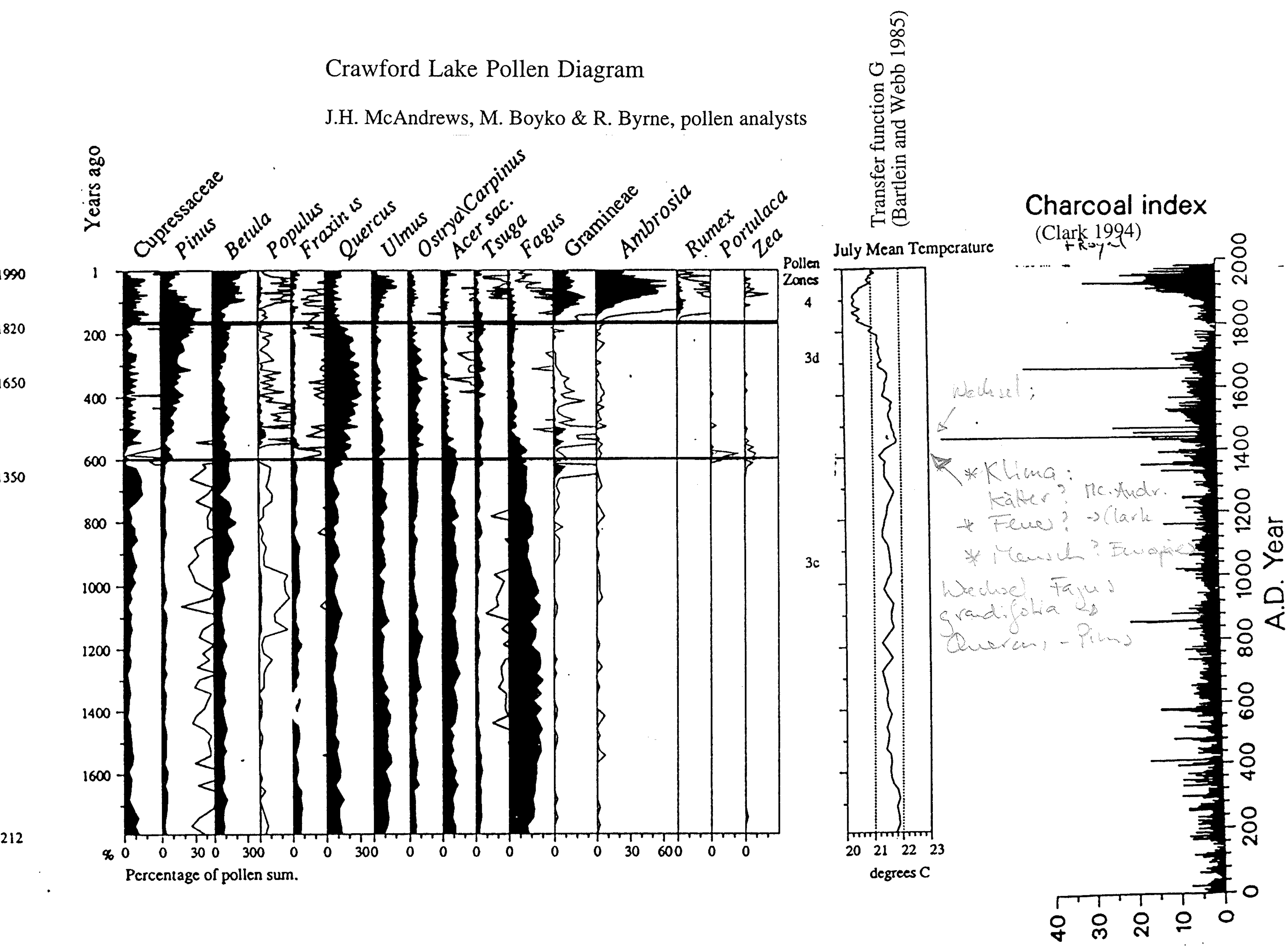

Crawford Lake Pollen Diagram
J.H. McAndrews, M. Boyko & R. Byrne, pollen analysts
Years ago
Cupressaceae
Pinus
Betula
Populus
Fraxinus
Quercus
Ulmus
Ostrya\Carpinus
Acer sac.
Tsuga
Fagus
Gramineae
Ambrosia
Rumex
Portulaca
Zea
Pollen Zones
4
3d
3c
1990
1820
1650
1350
212
1
200
400
600
800
1000
1200
1400
1600
% 0 0 30 0 300 0 0 300 0 0 0 0 0 0 30 600 0 0
Percentage of pollen sum.
Transfer function G
(Barlein and Webb 1985)
July Mean Temperature
20 21 22 23
degrees C
Charcoal index
(Clark 1994)
A.D. Year
2000
1800
1600
1400
1200
1000
800
600
400
200
0
40 30 20 10 0

Figure 1. Map of North America showing Indian population densities at the time of European contact (15th-18th centuries) and the area of prehistoric Indian *Zea* cultivation. The shaded area had an estimated population of over 0.60 persons km^{-2} (from Driver, 1969). The dotted line indicates the northern limit of *Zea* cultivation (northeastern Mexico lacked *Zea*). Selected sites of pollen stratigraphic studies are shown.

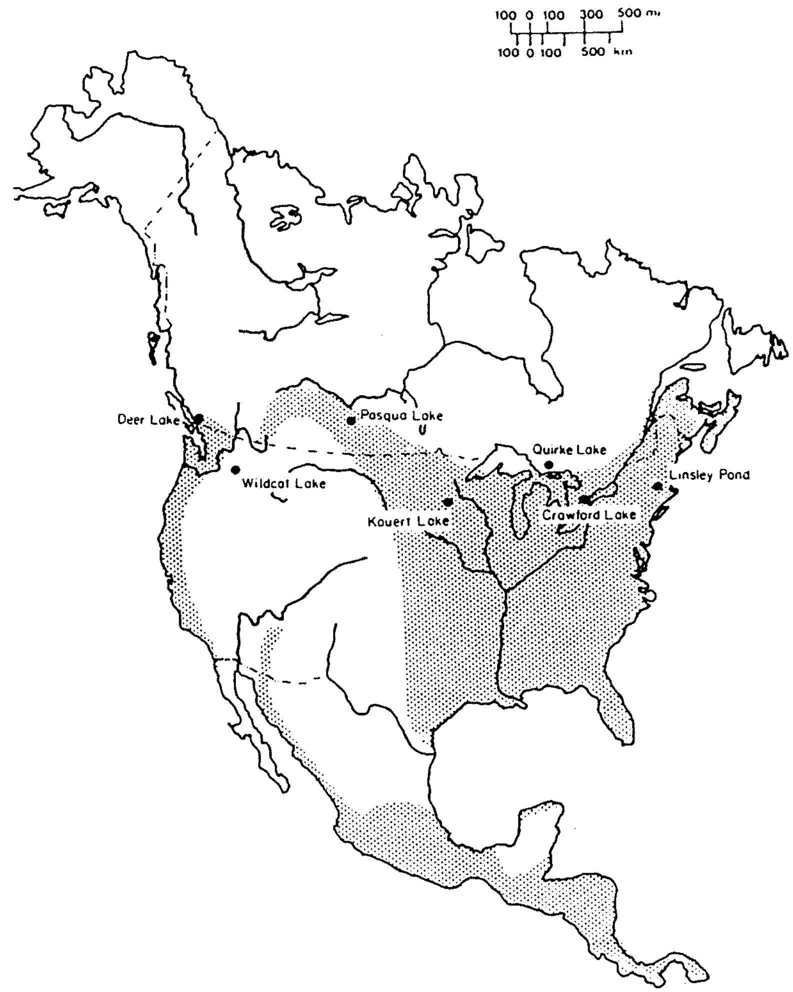


Figure 6. Map of North America showing population densities in the late 20th century. The shaded areas have a population of over 2.00 persons km^{-2} (Times Atlas, 1981). Pollen stratigraphic sites figured in the text are labelled.

McAndrews 1988

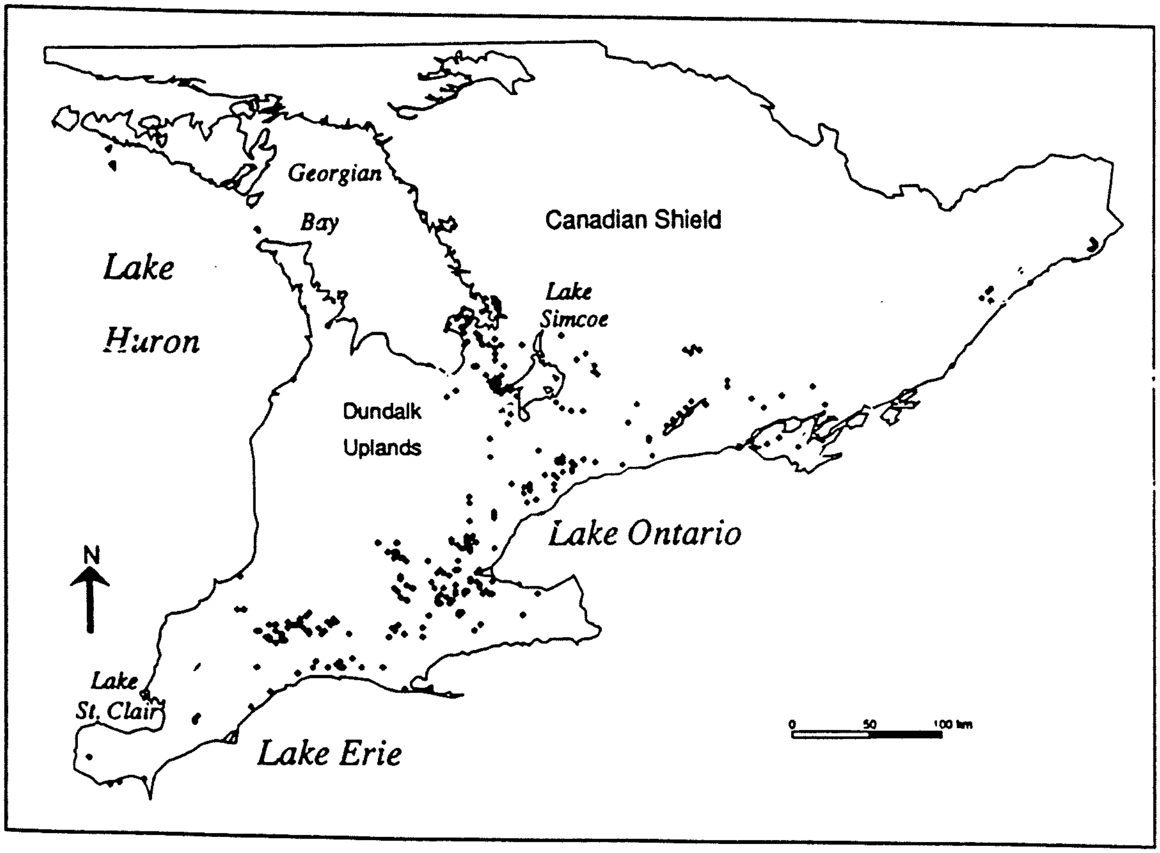
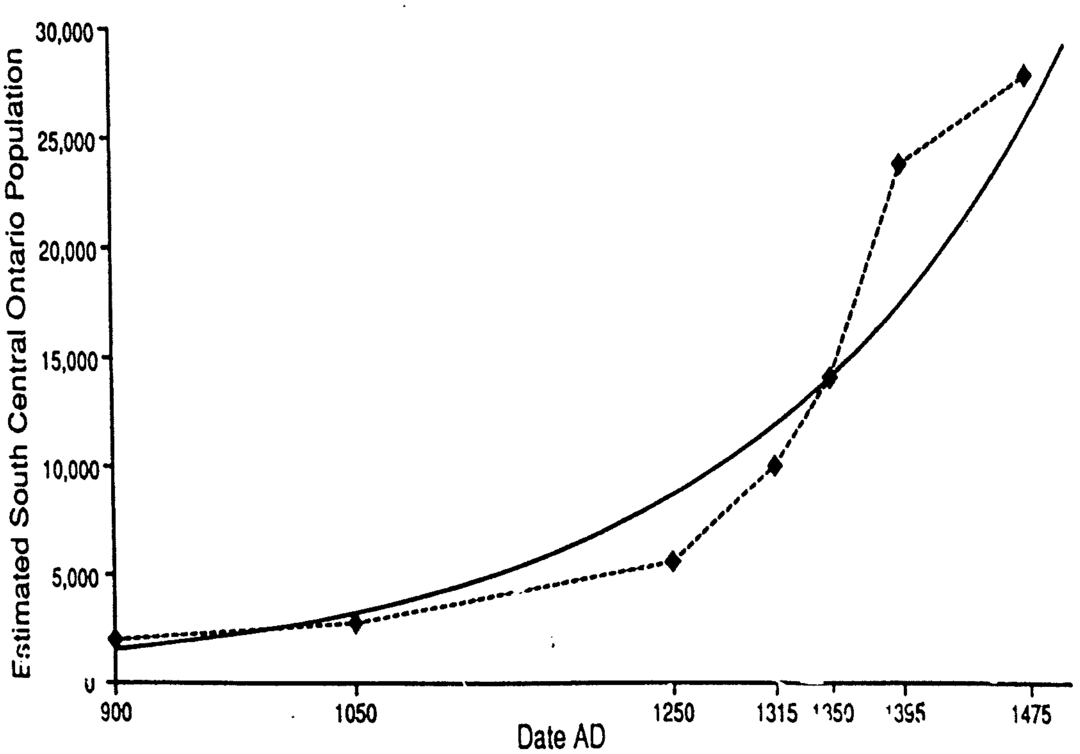


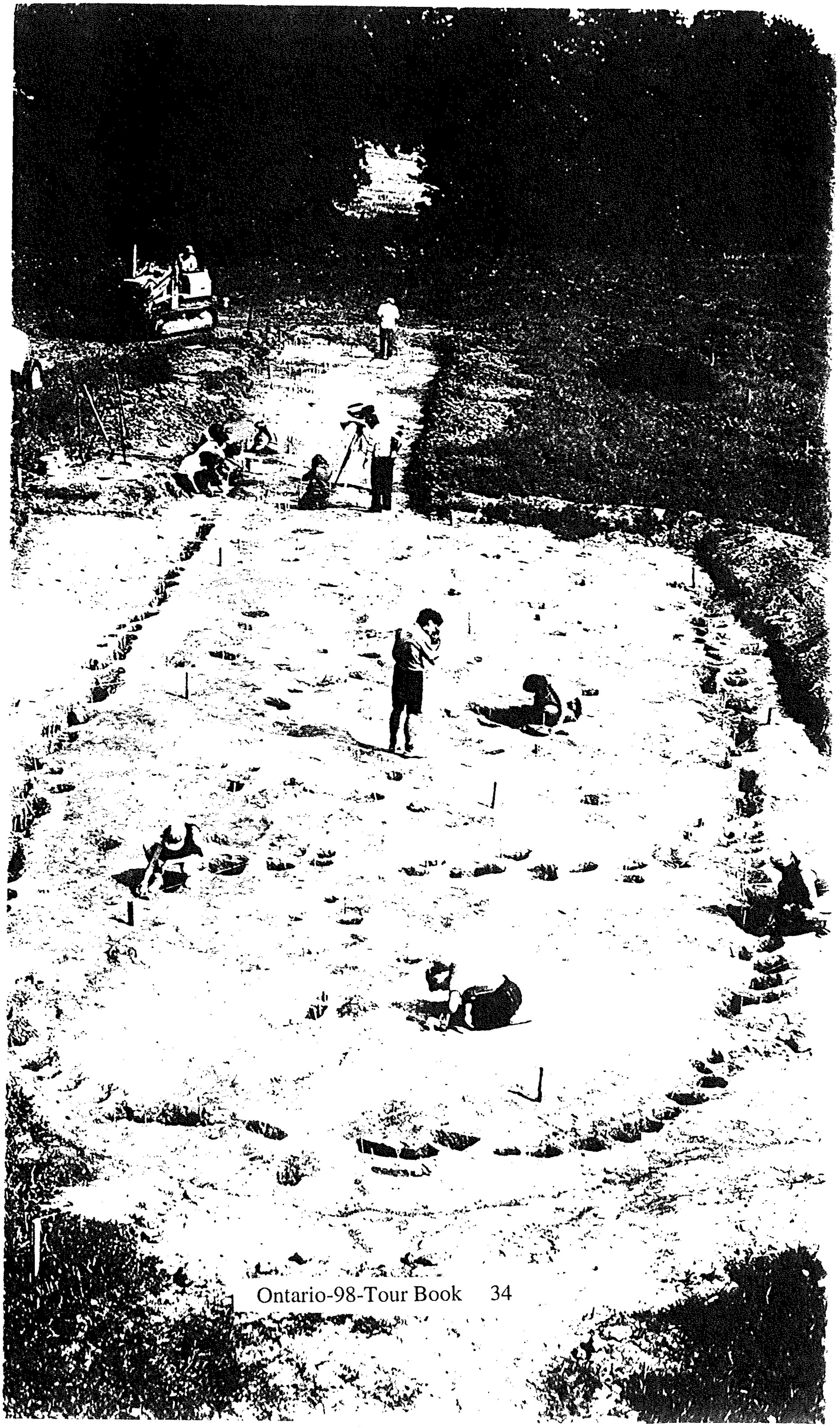
Figure 1b. 333 prehistoric horticultural village sites ca. A.D. 900-1600 (Campbell, 1991).



Black diamonds are Warrick's estimates for the period A.D. 900-1500; the solid line is a fitted exponential curve with formula ln(pop) = 2.968 + 0.004863 Y; pop = population, Y = year A.D.; r^2 = 0.94.

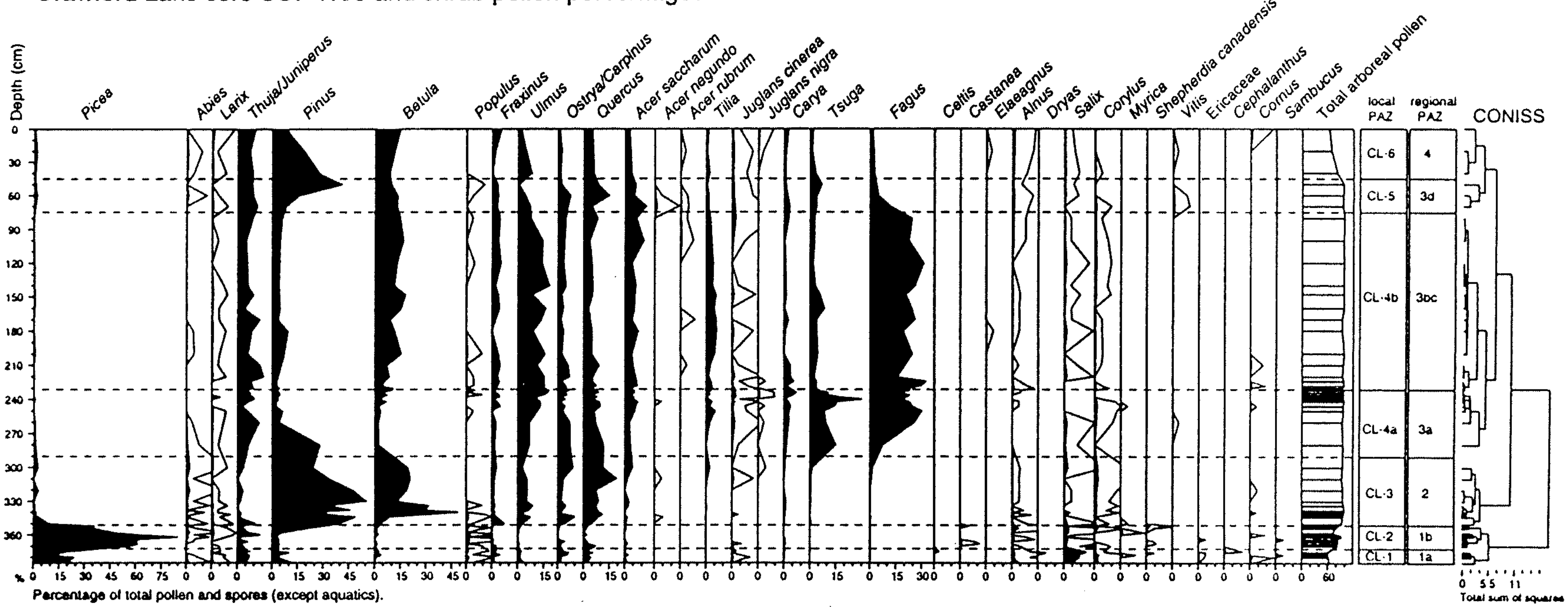
Figure 2. Estimated population through time (after Warrick, 1990).

Campbell + Campbell 1994

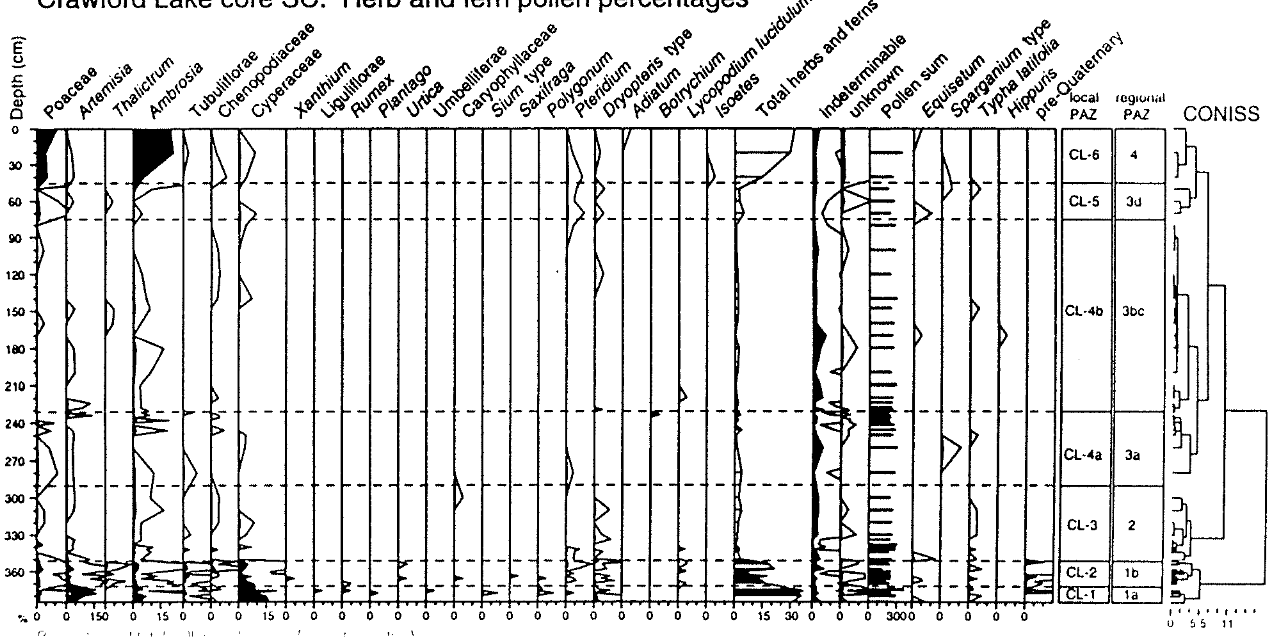


Yu, Z. (1997): Late Quaternary paleoecology of the southern Niagara Escarpment, Ontario, Canada: A multiple proxy investigation of vegetation and climate history. PhD Thesis, University of Toronto, 380 pp.

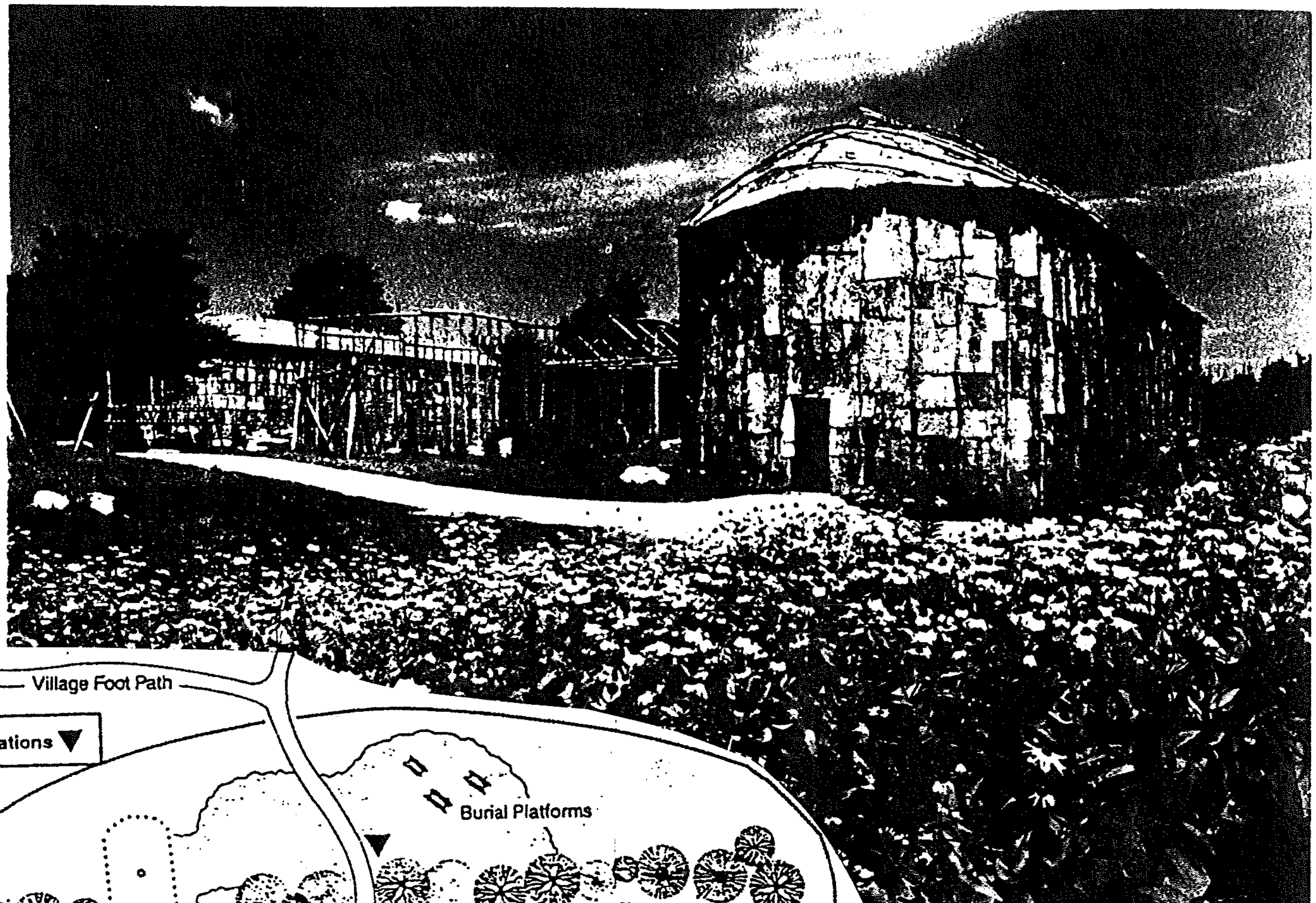
Crawford Lake core SC: Tree and shrub pollen percentages

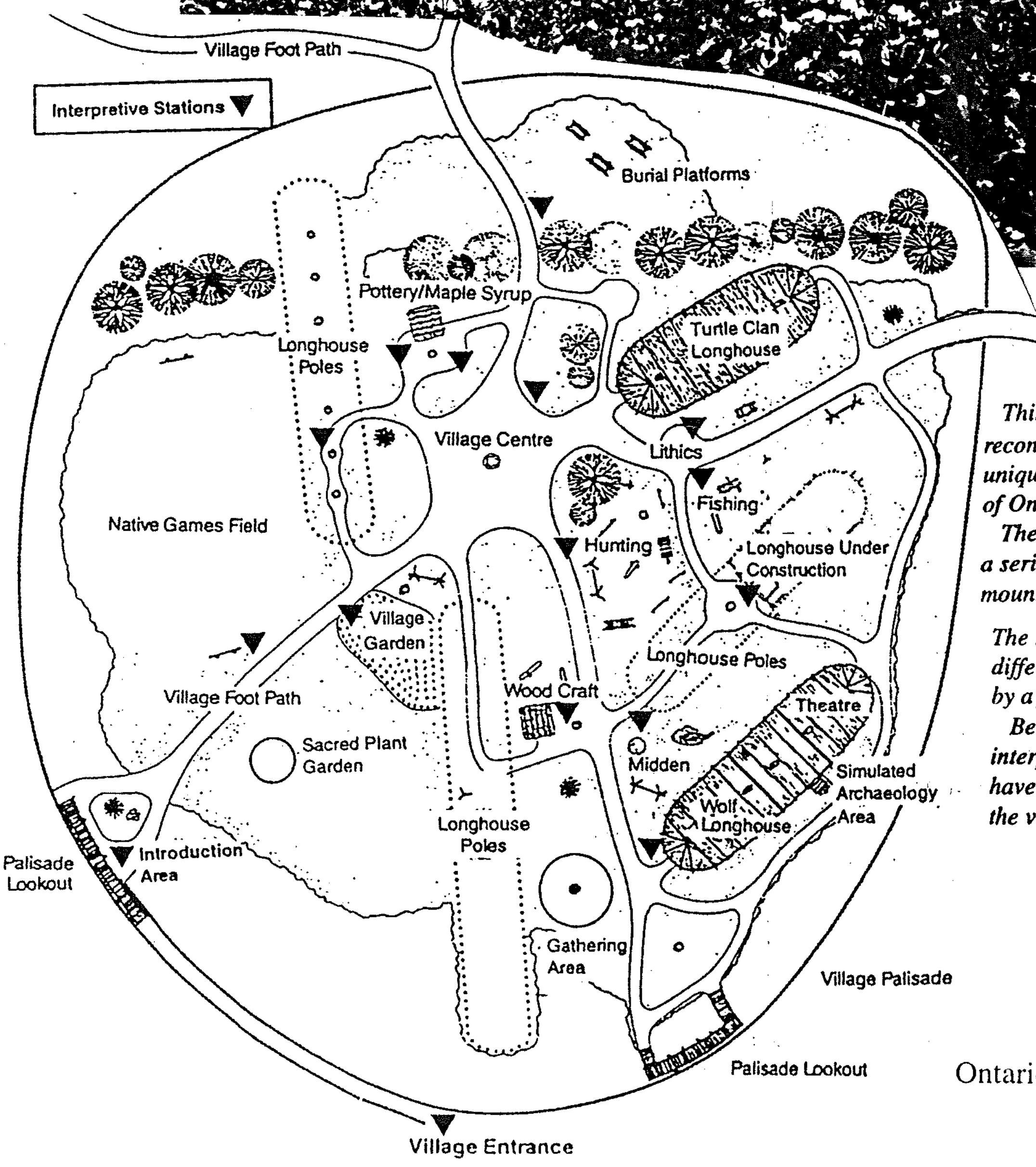


Crawford Lake core SC: Herb and fern pollen percentages



Reconstructed Iroquoian Village





This fifteenth century Iroquoian Village was reconstructed on its original site to create a unique opportunity to expand our understanding of Ontario's First Peoples.

The interpretive program in the village includes a series of information plaques that have been mounted on cedar posts throughout the site.

The text, illustrations and artifacts portray different aspects of Iroquoian culture presented by a fictional character named Silent Waters.

Be sure to ask the interpretive staff if you have any questions about the village or its people.

LEARNING FROM ANCIENT CEDARS

Dwarfed and gnarled, these trees have hung on to the escarpment's cliffs for hundreds of years. What secrets do they hold?

BY LORRAINE BROWN

From Niagara to Tobermory, the strong, weathered profile of the Niagara Escarpment is a welcome sight. In an age where so much seems transitory, the escarpment's ragged cliffs represent the ability of nature to endure.

Now, thanks to Doug Larson, that familiar sight has new meaning. In the summer of 1988, Larson, a botany professor at the University of Guelph, discovered a community of dwarfed, ancient eastern white cedars growing out of the escarpment cliff face. The cedars ranged in age from a few hundred to several hundred years. One tree was dated at 700 years—considerably older than any previously known cedar and twice the age of the existing oldest living tree in Ontario. The discovery was made near Rattlesnake Point in the Kelso Conservation Area, just outside Milton.

At the time, the dramatic shattering of the age-record seemed to be what caught the public's attention. But for Larson, the significance of the discovery "is not the age of one or two very old trees, but the fact that there's a forest of tiny, ancient trees in a place familiar to us."

The summer of 1988 was the fourth field season for Larson's study of the ecosystem at the edge of the Niagara Escarpment cliffs and on the cliff face. As part of his research, Larson took core samples from the trunks of a few cedars to determine their age and growth rates. Back at the lab, he put one of the cores under a microscope to count the annual rings. He couldn't believe his eyes. Tree rings can normally be seen with the naked eye, or at most with a low-power microscope. But these rings were so tiny that Larson had to sand the core down with fine emery paper and magnify it 400 times before he could count them. Some of the rings were only two cells thick, revealing a growth rate normally found only in very slow-growing species, such as lichens and mosses.

Larson spent the next few days wondering whether his results could be correct. It occurred to him that the cedars might have "false rings," which develop when a tree grows rapidly in the spring, slows down in the summer, then undergoes another burst of growth later in the season. But experts who work with cedars told him that the species doesn't produce false rings. Larson gradually came to realize the significance of his discovery.

The cedars' infinitesimal growth rate is a result of the rigorous conditions in which they have been living over the centuries. Exposed on the bare limestone, the trees' roots pick up what nutrients they can from rain and from the limestone as it slowly dissolves. It's a far cry from the rich soil full of minerals and mycorrhizal relationships in which most trees thrive.

But in exchange for their harsh living conditions and impossibly slow growth rates, these trees have achieved long life. Clinging to the inaccessible cliff face, they have managed to avoid the logger's axe, the ravages of forest fire, and the widespread clearing of forests that began in southern Ontario 200 years ago. Of no value to anyone, and out of harm's way, the trees lived on.

Larson wasn't the only Canadian scientist to find old cedars last summer. Dr. Yves Bergeron, of the University of Quebec at Montreal, found trees of similar age on a gravel bar at the edge of a lake in subarctic Quebec. Larson thinks that those trees, along with others found by American scientists on gravel bars in the Gaspe and stands of old-growth cedar forest on the shores of Lake Michigan, may all be part of a recurring pattern.

All the trees are growing in similar conditions—in rocky areas, often near water, that are wind-swept and offer a minimum of nutrients. Why cedars can not only withstand those conditions but even live to a remarkable age in them is something Larson and his students are trying to find out.

Larson uses an increment borer, a drill-like device that extracts a narrow cylinder of wood, which can then be dated. The sampling does not harm the tree

Additional reference:

P.E. Kelly, E.R. Cook & D.W. Larson (1994): A 1397-year tree-ring chronology of *Thuja occidentalis* from cliff faces of the Niagara Escarpment, southern Ontario, Canada. *Can J. For. Res.* 24: 1049-1057.

Could their slow growth rate be a factor contributing to their longevity? "It's tempting to put those facts together, but they may not be related at all," says Larson. "But being small, the trees would be less likely to be blown over or damaged by wind or ice storms."

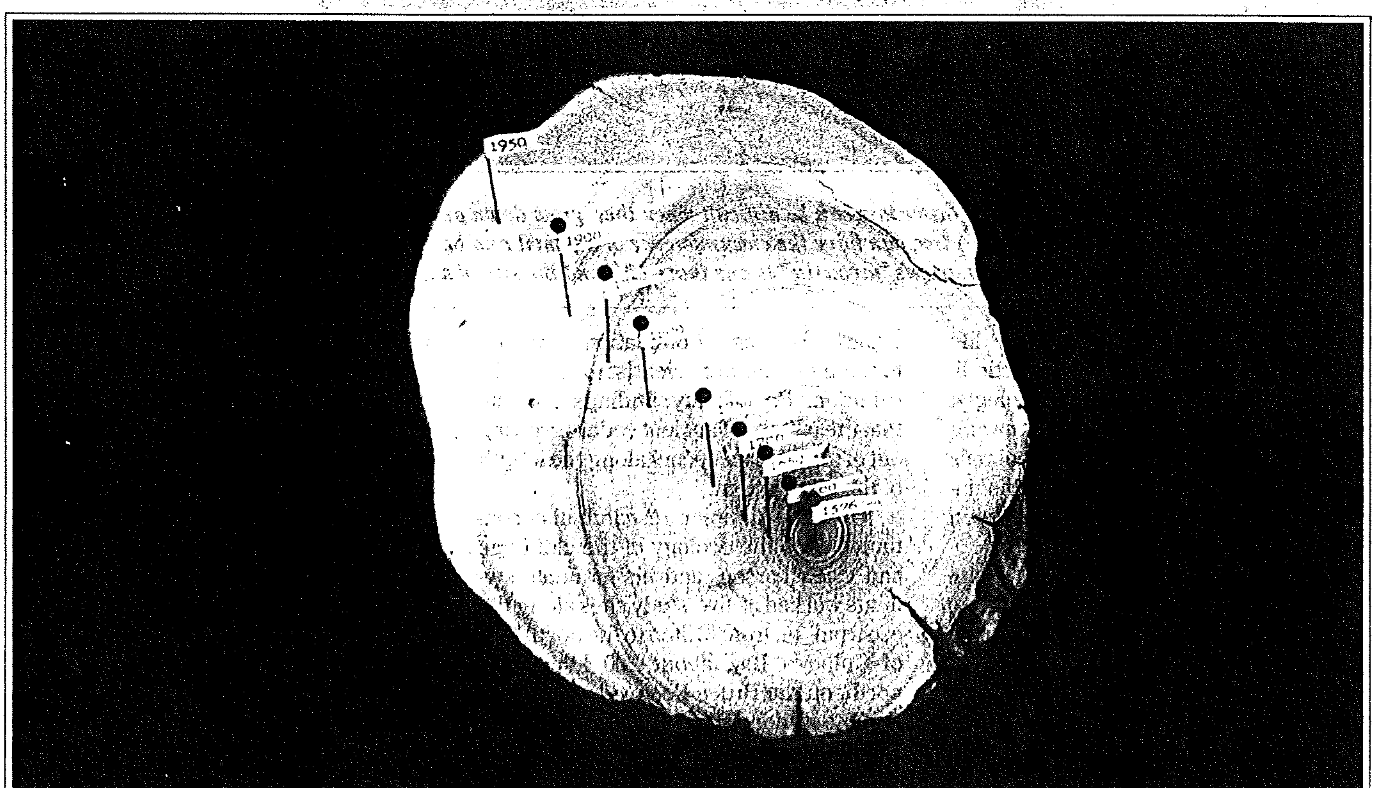
Larson's discovery will give Bruce Trail hikers a new appreciation for the gnarled, insignificant-looking trees growing out of bare rock. But the main benefactors will be dendrochronologists, who study the growth rings of trees to learn about past climates and to date past events.

Up until now, there has been a major gap in the dendrochronological record for northeastern North America. This intriguing science originated in the southwestern United States, where bristlecone pines, the longest-lived of all trees, have been dated at 5,000 years. The northwest has its Sitka spruce and western red cedar, which can live for up to 2,000 years. In the southeast, the annual rings of bald cypresses in Florida and Georgia provide a record that goes back over 1,000 years. But in northeastern North America, partly because the area was logged and cleared for farming and settlement, and partly because many of the forests are composed mainly of deciduous trees, which are short-lived compared with conifers, there has been no reliable sample of trees on which to base dendrochronological studies.

Of the 450 cedars that Larson dated last year, there were dozens 100–200 years old, and about fifteen 300–400, ten 400–500, five 500, two 550, one 610, one 650, and one about 700. Some of the growth rings in these trees were only two cells thick

Larson's cedars might fill that gap. Because they are starved, they are particularly well suited to dendrochronological studies. "When a plant is growing in very poor conditions, its rings are small," says Larson. "But when the conditions improve even a little bit, the change in the annual rings is really noticeable." He provides an analogy: "If you feed a child with malnutrition properly for two days, you'll notice much more of a difference than you would in a well-fed child whose diet was varied by the same absolute amount."

Tree rings can indicate fluctuations in climatic conditions such as rainfall or temperature. In the arid southwestern United States, tree rings are a better



All photos by Doug Larson

indicator of rainfall than temperature, since rainfall is the more limiting factor to growth there. But here in the northeast, where rainfall is not as limiting, tree rings are more likely to signal temperature fluctuations.

Dendrochronology could become particularly important as meteorologists try to predict global warming trends. Since meteorological records only go back about 100 years they are of limited value for determining the past trends on which to base these predictions. But if tree rings going back 700 years could point to some major long-term climatic fluctuations, we might learn to what extent the current warming trend is a natural phenomenon and to what degree it is caused by humans.

Will the Niagara Escarpment cedar trees advance the study of dendrochronology? Larson hopes they will. A grant from the Natural Sciences and Engineering Research Council (NSERC) is enabling a researcher to study the dendrochronological aspects of the cedars.

Larson is to be commended for his thoroughness. Some scientists might not have bothered dating the cedars because these trees are not large and do not seem to be particularly unusual. They might have assumed the trees were of normal age—perhaps up to 200 years old—simply counted them, added them to the survey, and forgotten about them. But Larson, who is used to looking at much smaller and more primitive life forms (his PhD thesis was on Arctic lichens), considers himself an ecologist first. As such, he is interested in knowing everything about the plants and animals that make up an ecosystem, and this includes knowing how long they've been there.

As an ecologist, Larson is also concerned about the welfare of this unique old-growth forest. He has already noticed that young seedlings—the future ancient cedar trees—trying to take root in the spring are being trampled. He realizes that hundreds of hikers walking close to the edge of the escarpment to see the trees could spell disaster for them. As a result, he has become publicly outspoken about the need to preserve the delicate ecosystem at the edge of the escarpment.

This past summer, research on the cedars continued. The first priority was to determine the extent and distribution of the forest. Larson had already found cedars about 500 years old near Lion's Head on the Bruce Peninsula. He expected there might be more pockets of old-growth cedar forest between there and Milton. The Ontario Heritage Foundation provided funding for another scientist to study distribution. Preliminary findings indicate that the pattern of ancient cedars growing out of the cliff face recurs along the length of the escarpment.

Access to the cedars can be difficult when they grow down out of the rock face. A tree can have the circumference of a pencil and be 100 years old. Larson's "favourite" is one that's 155 and the size of a quarter

Over the summer, research also continued into the ecology of the cliff edge and face. Larson and his graduate students worked at five study sites along the escarpment, from Milton to the north side of Colpoy's Bay, about 200 kilometres north, on the Bruce Peninsula.

One student studied the microclimate of the area with equipment that monitored ten variables, including temperature and rainfall, every ten minutes. Da confirmed that conditions away from th cliff edge were less severe than at th edge, which endured lower soil tempera tures and soil moisture, for example.

Another student looked at the distu bance caused by hundreds of hikers alon the Bruce Trail. Where disturbance wa high, fewer plant species were found. I areas with an intermediate level of tran pling, there were different, but not fewe species than in untrampled areas.

Larson studied the ce dars' productivity (th amount they grow eac year). Away from the cli edge, productivity wa higher in trampled area presumably because th decrease in understory spe cies decreases competitio for water and light. At th cliff edge, where the envi ronment is more extreme productivity was similar i disturbed and undisturbe areas.

A fit, lanky 40-year-old Larson learned how to rap pel this summer to be able to reach trees growing i less accessible areas and t avoid incidents like the one he experienced last year While trying to extract hi $200 core-drilling tool fron a stubborn cedar trunk Larson pulled a little to hard, and suddenly found himself swinging from a rope across the cliff face He ended up in a face-to face confrontation with the escarpment.

Last fall, Larson re turned to his Milton re search area and picked u a fallen cedar branch. Back at the lab, h counted 200 rings in the outer 1.8 centi metres. If that density of rings continue across the branch, the tree it came fron will be several hundred years old.

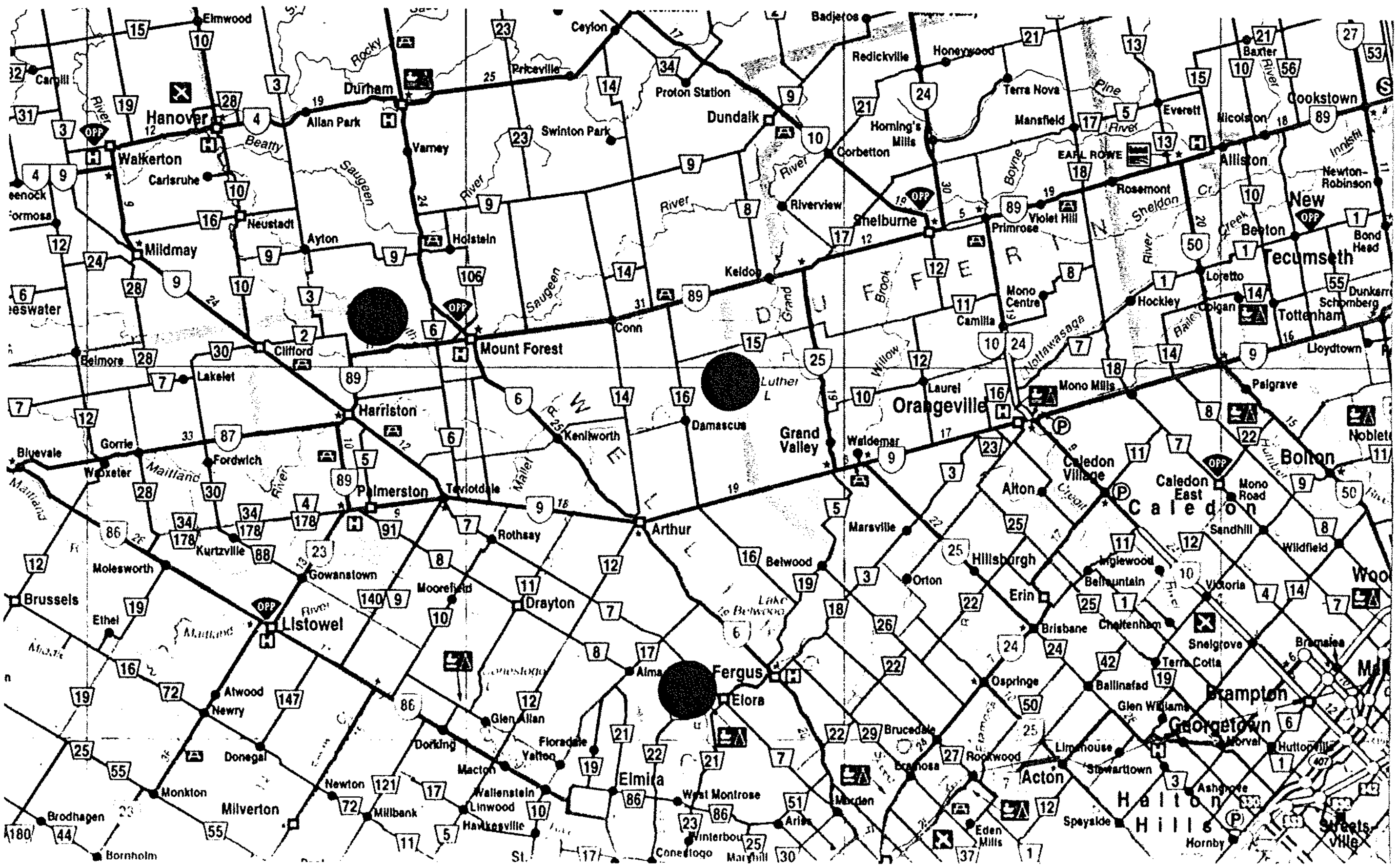
"It's like walking through a dinosau graveyard and finding a tooth," says Lar son. "You know the rest of the animal ha to be there somewhere." This tree is Lar son's "tooth." Now he wants to learn everything he can about the rest of the for est.

A biologist and writer, Lorraine Brown i a founding member of the Owen Soun Field Naturalists.

August 22

Main theme:

Ombrogenous boreal-type bog development



Breakfast at the Village Inn.

8.30 a.m.:	Departure for Luther Lake Conservation Area
9 a.m.	**Wylde Bog** to visit a large ombrogenous boreal-type, +/- undisturbed bog. Sphagnum-heath peatland, invading Larix and Pinus sylvestris. Vegetation History of Wylde Bog and **Wylde Lake**. Coring of Wylde Bog.
Lunch	in bag
2 p.m.:	Departure for **Pike Lake**: Vegetation History and lake level fluctuations.
4 p.m.:	Departure for Lion's Head on Bruce Peninsula

Overnight in Lion's Head (Lion's Head Beach Motel Tel. -519-793-3155 and Mom's Motel Tel. -519-793-3555), Dinner on your own at Mom's Restaurant in Lion's Head.

Wylde Bog and Wylde Lake

Why did the lake and bog succeed fen; what induced ombrotrophism?
What is the dynamic between the bog and lake?
What is the mechanism of hummock and hollow formation and maintenance?

This domed (ombrotrophic) bog of 700 ha area encloses a shallow lake (<1 m deep); they are part of the Luther Marsh Conservation Area. This wetland lies on a plateau till plain (480 m asl) overlain by up to 1 m of loess-like silt which impedes soil drainage (Chapman and Putnam 1984). Because the wetland straddles a drainage divide, creeks flow from it in several directions. A 2 m high dam built at the principle outlet in 1952 to enhance water storage has had no apparent affect on the bog. Because the plateau is relatively high and downwind from Lake Huron it has an unusually wet and cool climate (Table 1): it has the most precipitation days in Ontario.

In the late 19th century there was an attempt to drain and farm the wetland; old ditches are present. A fire in the 1880's produced a partly-charred tamarack "stick layer" now buried within the upper meter of peat (Irwin 1989). Today the nutrient-poor bog is dominated by sphagnum moss and heaths (Ericaceae), especially leatherleaf (*Chamaedaphne calyculata*) but also including *Vaccinium angustifolium, Ledum groenlandicum, Kalmia polifolia* and *Andromeda glaucophylla*. Bog birch (*Betula pumila var. glandulifera* is locally abundant. Black spruce (*Picea mariana*) is restricted to the center of the bog adjacent to Wylde Lake. Tamarack (*Larix laricina)*, mostly less than 40 years old, is invading the bog. White spruce (*Picea glauca*), balsam fir (*Abies balsamea*) and white birch (*Betula papyrifera*) are occasional. Cyperaceae (*Carex, Scirpus*, and *Eriophorum*) occur in the tamarack stands and are especially abundant in trails which conduct mineral-rich water, making them fen-like.

Occasional white pine (*Pinus strobus*), jack pine (*Pinus banksiana*) and especially Scots pine (*Pinus sylvestris*) grow in the bog; they are derived from seed produced in nearby upland plantations (Ritmeester 1996). Scots pine is the more aggressive; pioneer trees are surrounded by one or two generations of offspring.

The upland till plain is mostly farmland with remnant woodlots dominated by sugar maple (*Acer saccharum)* and other deciduous hardwoods with a little hemlock (*Tsuga*). White pine is absent from these relatively wet mineral soils in contrast to adjacent better drained landforms at lower altitude. In prehistoric time these wet soils inhibited the forest fires necessary to open the canopy of shade tolerant hardwoods and hemlock to admit the shade-intolerant pine.

Pollen diagrams were made from bog and lake cores. Thermal analysis and lithology distinguished lake deposits from bog deposits (dy is a lake sediment derived from humic precipitate that is the product of peat decay -- it is not redeposited peat). The pollen sum is 200; *Picea, Larix*, and Cyperaceae are excluded from the regional pollen sum in analyses from the peat and dy but not from the lake gyttja. The diagrams display the standard zonation for southern Ontario (McAndrews 1994) and correlate with each other. Anderson (1971) dated the zone 1-2 boundary in Wylde

Bog at 10,800 years B.P. As the late-Wisconsinan glacier retreated 15,000 to 13,000 years BP, outwash sand and loess was deposited in the lake basin together with recycled pre-Quaternary spores; also recycled was Quaternary pollen which had been deposited on and trapped in the glacier ice (subzone 1p). With further warming herb tundra formed (1a) and was succeeded by spruce woodland (1b) which in turn was followed by jack pine (2a) and white pine forest (2b). The onset of the Hypsithermal was marked by succession to hemlock-sugar maple forest (3a) together with a drop in the water table which caused a sedge (Cyperaceae) fen to replace the lake at 7,390 years B.P. Tamarack dominated the fen until 4,480 years BP when spruce bog and lake succeeded the fen; simultaneously, the upland hemlock died, perhaps due to an epidemic pest (Allison *et al.* 1986), to be succeeded by a deciduous forest dominated by beech (3b). Alternatively, the hemlock crash could have been caused by climate change: extreme winter temperature could have killed the hemlock or the hemlock could have died of draught or have become vulnerable to pest attack (Yu et al. 1997).

The succession from evergreen hemlock to deciduous trees may have caused the fen to bog succession by reducing evapotranspiration and raising the water table. Two non-exclusive mechanisms are proposed. The first is dilution of nutrients in the greater volume of groundwater entering the fen; this dilution would be enhanced by the sensitivity of the small watershed to nutrient flux. The second is the decreased mineralization of the fen peat because of flooding and reduced oxygen at the peat surface. Thus the less nutrient-demanding sphagnum-black spruce bog succeeded the tamarack-Cyperaceae fen, and Wylde Lake was isolated in the middle of the bog. If the hemlock died of draught, then the water table would have become lower, wetland surface water would disappear and the site become nutrient poor with consequent succession to bog.

The *Ambrosia* rise is caused by Eurocanadian farming beginning around AD 1845.

Table 1. Climate at Monticello (located 8 km north of Wylde Lake) for 1951-1980 (Environment Canada 1982).

	May-Oct.	Nov.-April	Total
Total precipitation (mm)	488	451	939
Mean rainfall (mm)	479	218	697
Mean snowfall (mm water)	8	245	253
Days with >0.5 mm precipitation	72	94	166

Mean July temperature 18.1°C Mean January temperature -9.6°C

Table 2. Wetland pollen types in two surface samples as percent upland pollen.

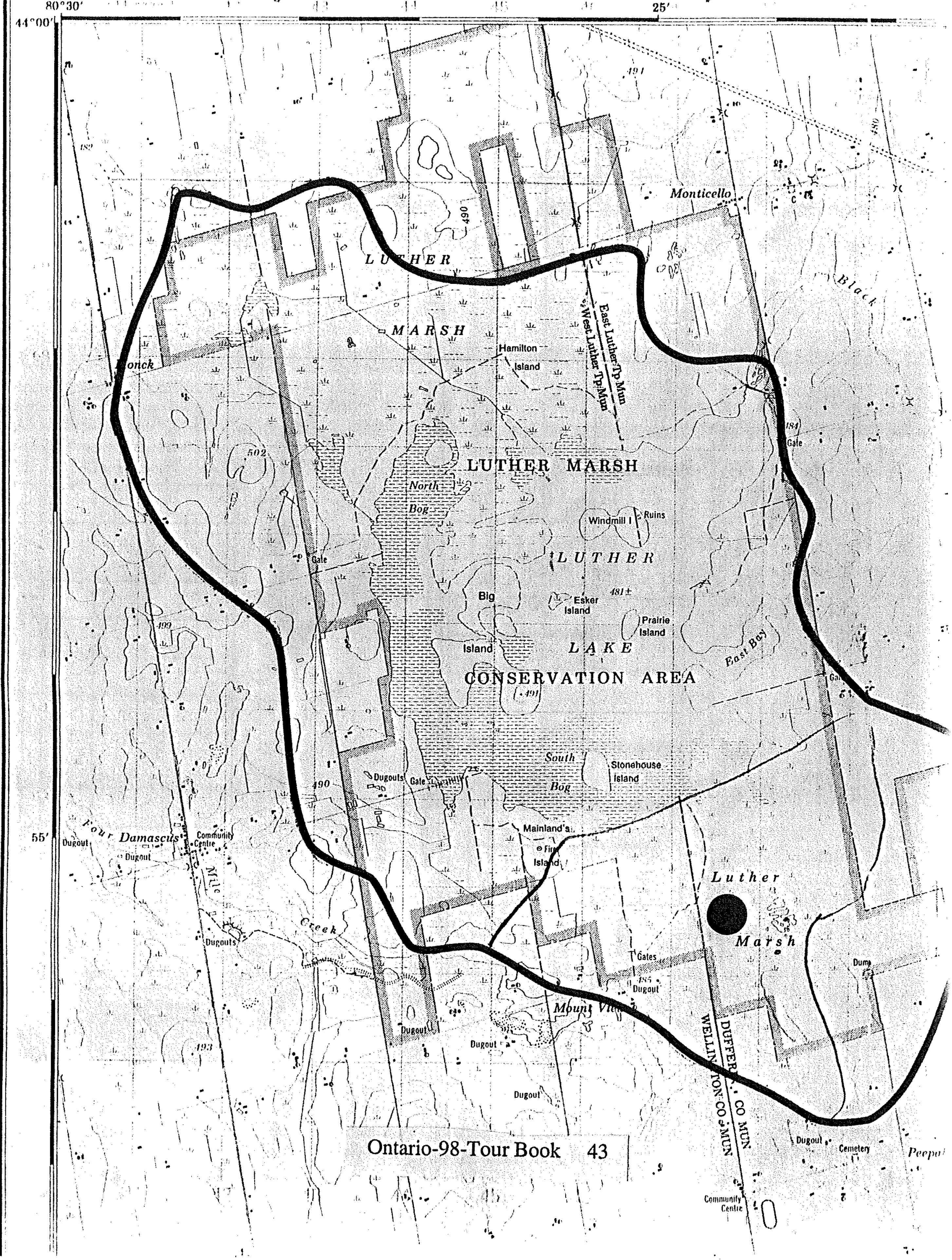
Pollen types	Tamarack forest	Spruce forest
Cyperaceae	1.3	0.0
Larix	6.0	1.9
Salix	0.7	0.0
Alnus	3.4	4.4
Picea	5.4	31.4
Ericaceae	2.0	5.0
Sphagnum	109.4	6.3

Orangeville 40 P/16 1:80 000

40 P/16

EDITION 4

Drainage basin 60 km² Wetland 45 km²

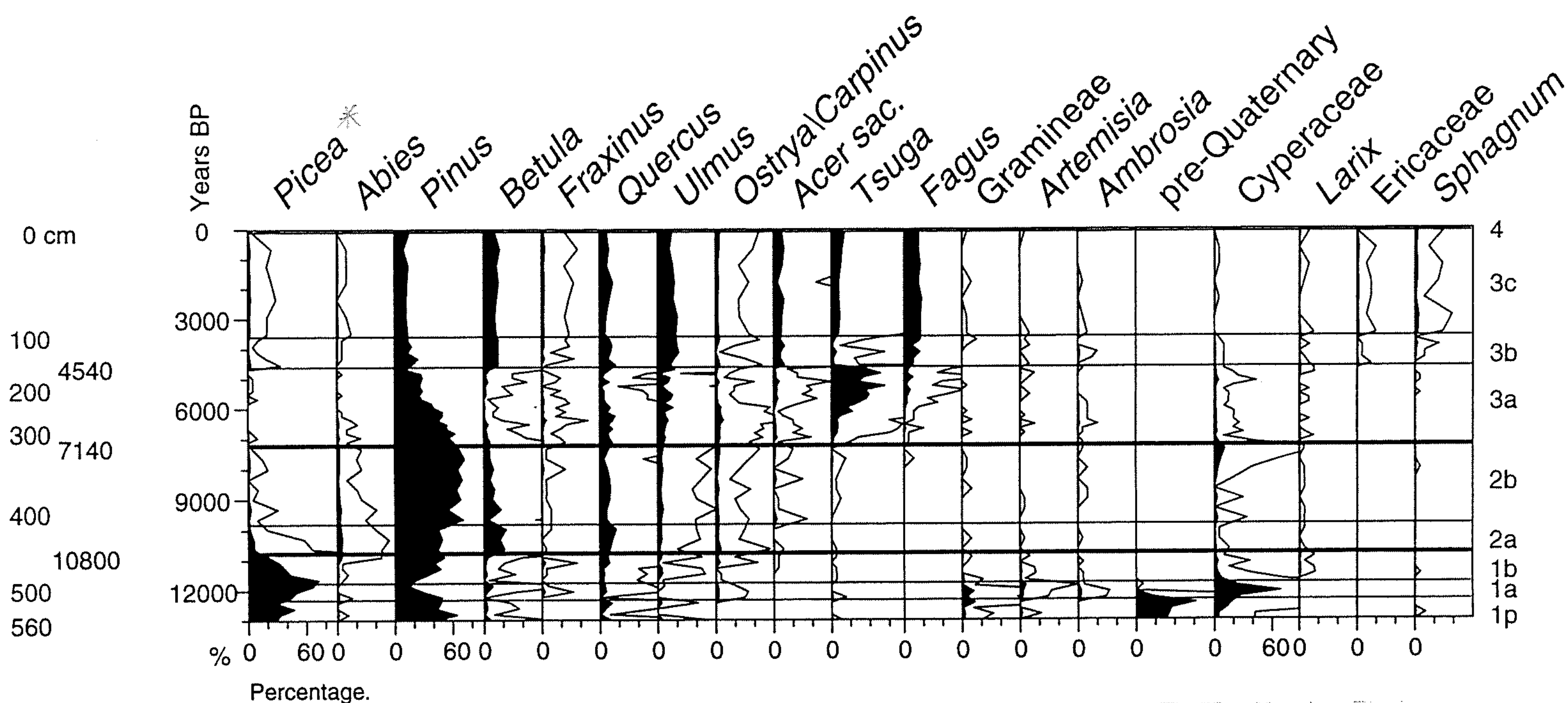


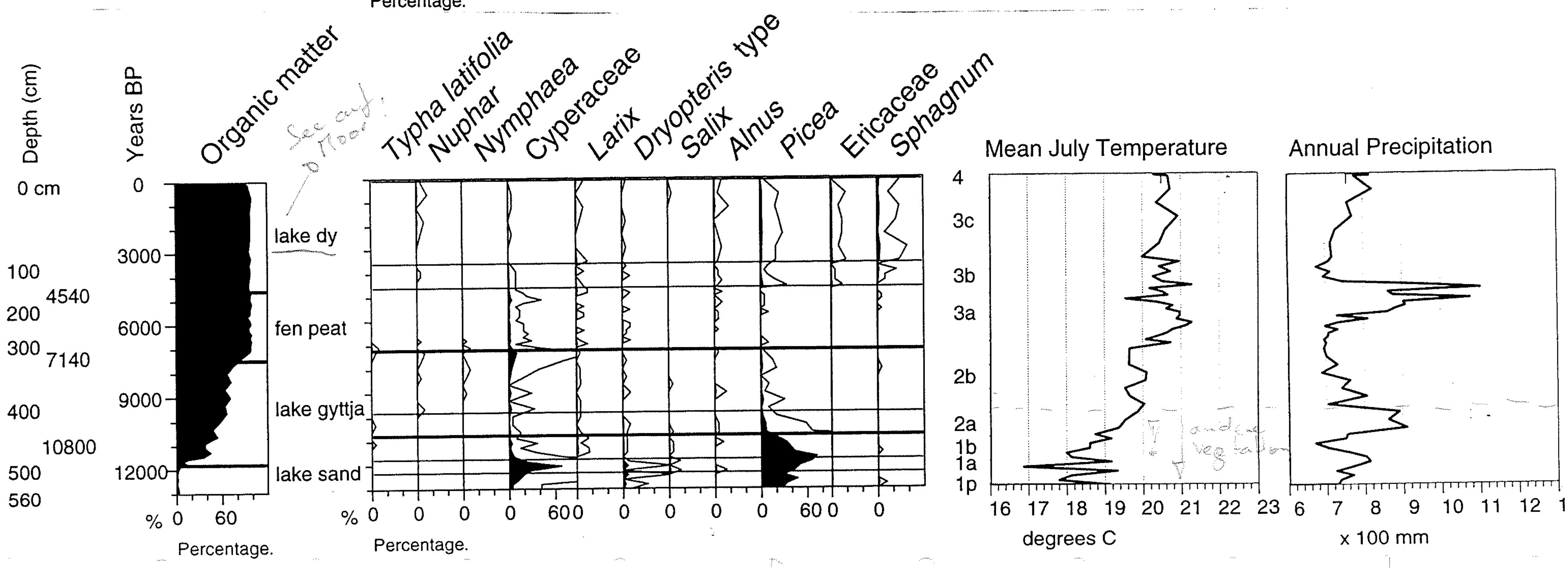
MÉTRIQUE

zeitlich
* 1. Picea glauca

Wylde Lake

wyldelk.pol August 17, 1998. J. McAndrews, analyst. Ontario. 43.91N, 80.40W 484 m asl

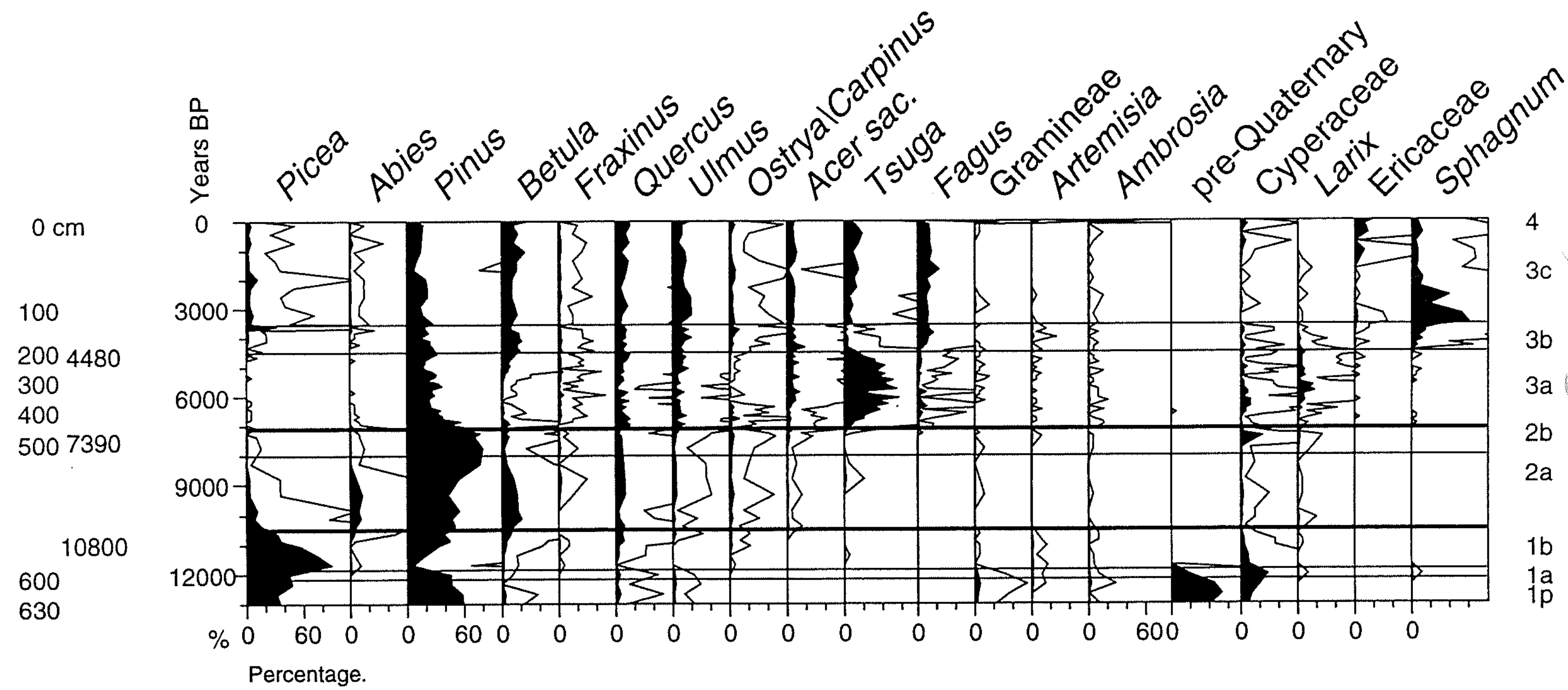


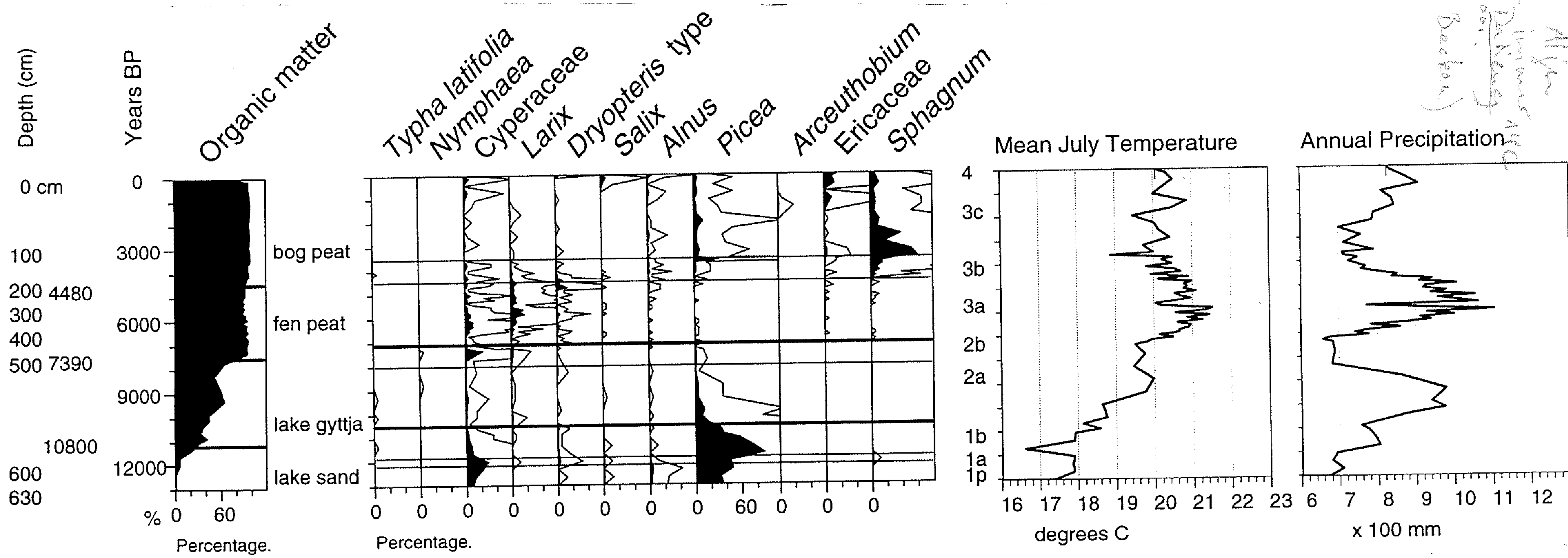


Ontario-98-Tour Book 44

Wylde Bog Wetland

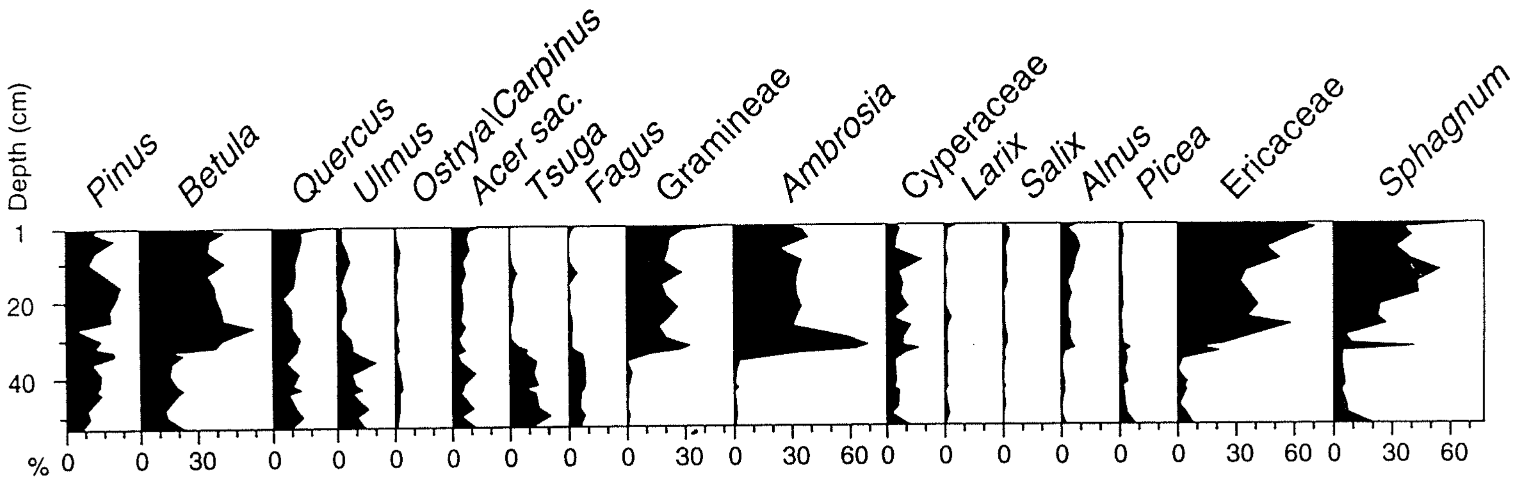
wyldebog.pol August 17, 1998. J. McAndrews, analyst. Ontario. 43.90N, 80.40W 484 m asl.





Wylde Bog Hummock

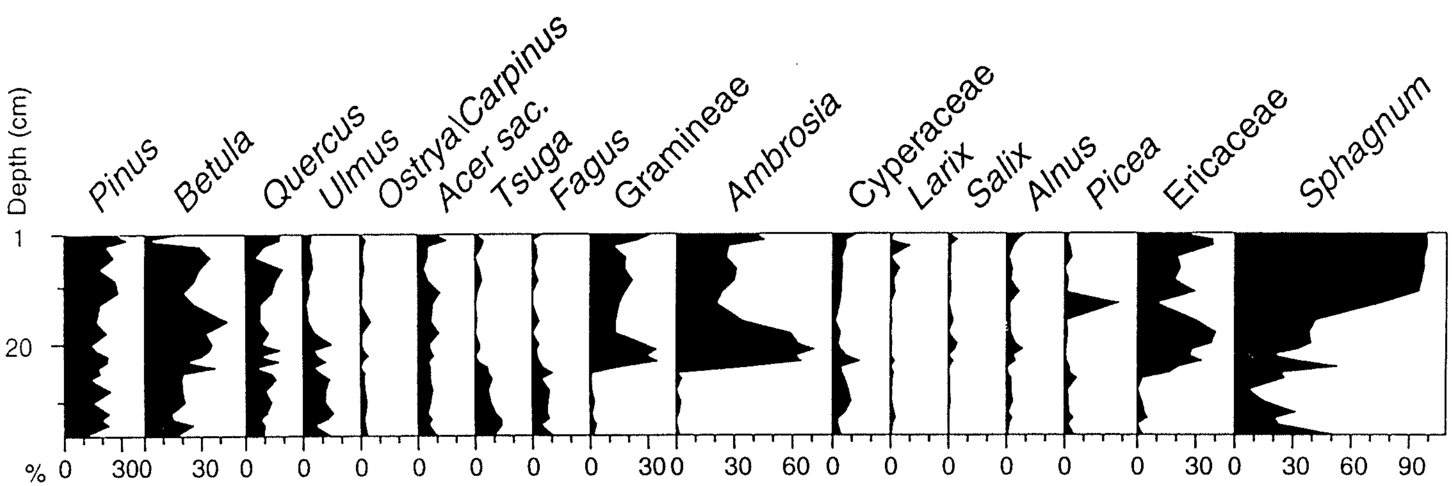
luthhum March 24, 1995. T. Irwin 1988. Ontario. Upland tree sum.



Percentage.

Wylde Bog Hollow

luthhol.pol March 24, 1995. T. Irwin 1988. Ontario. Upland tree pollen sum

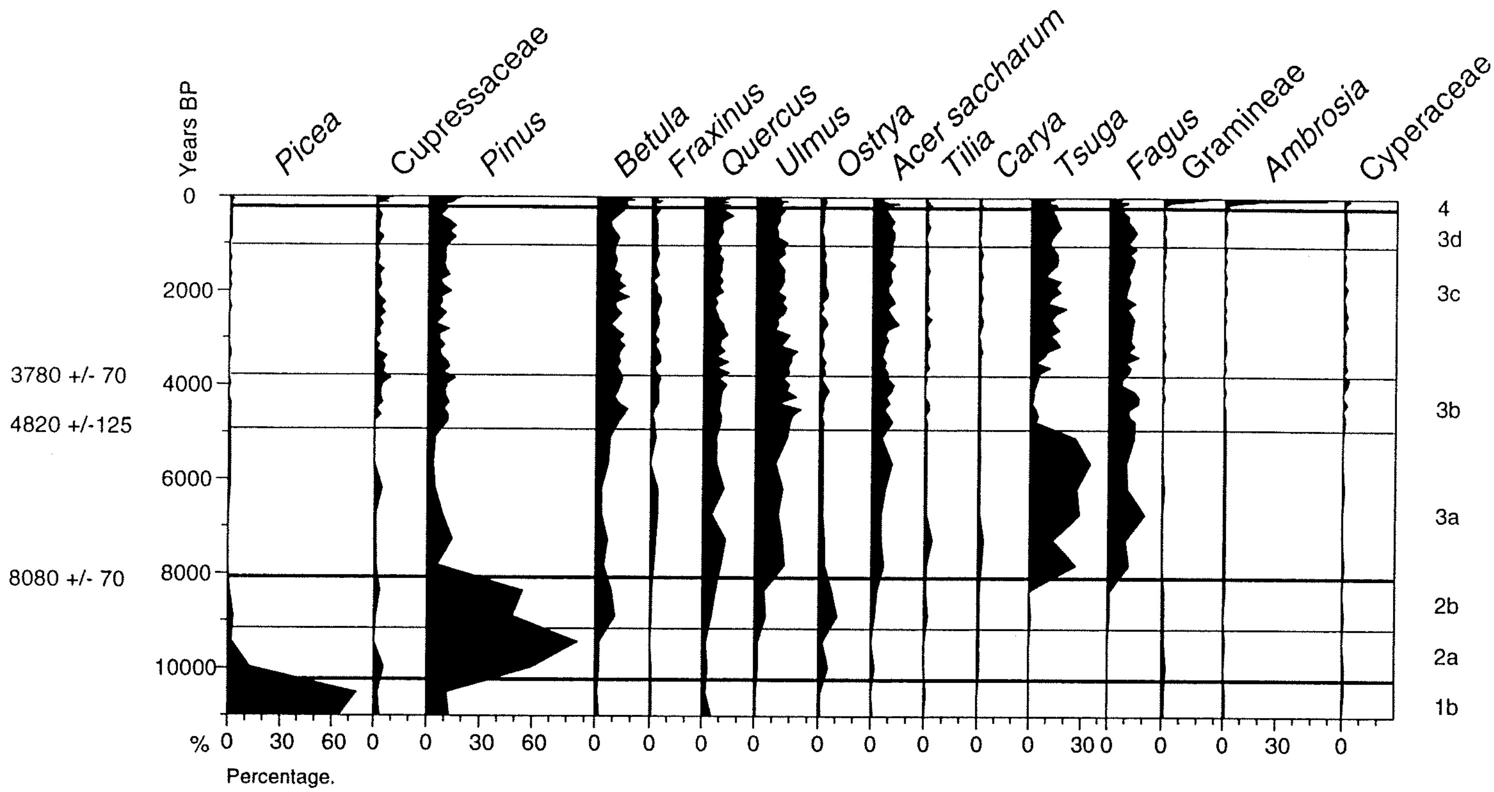


Percentage.

Pike Lake Pollen Diagram

pike.pol August 17, 1998. Digitized from Penny, 1979. Not to NAPD.

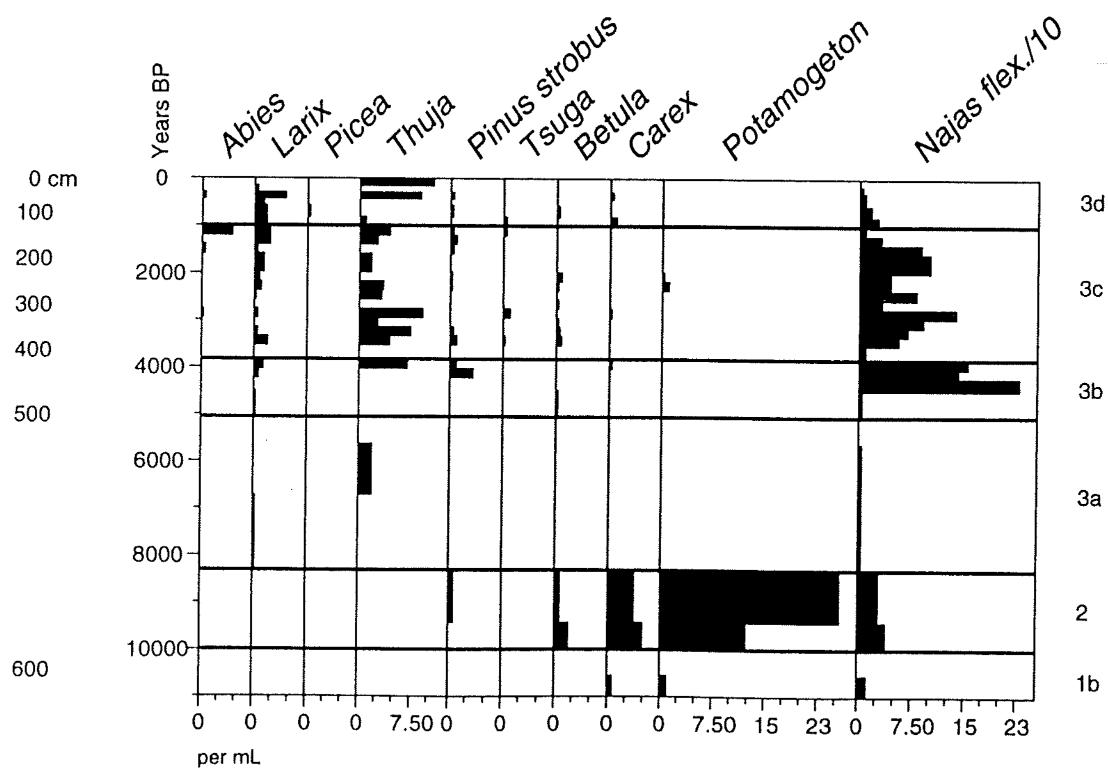
Ontario. 43.95N, 80.82W. 381 m asl. Water is 580 cm deep.



Pike Lake Macrofossils per 100 mL

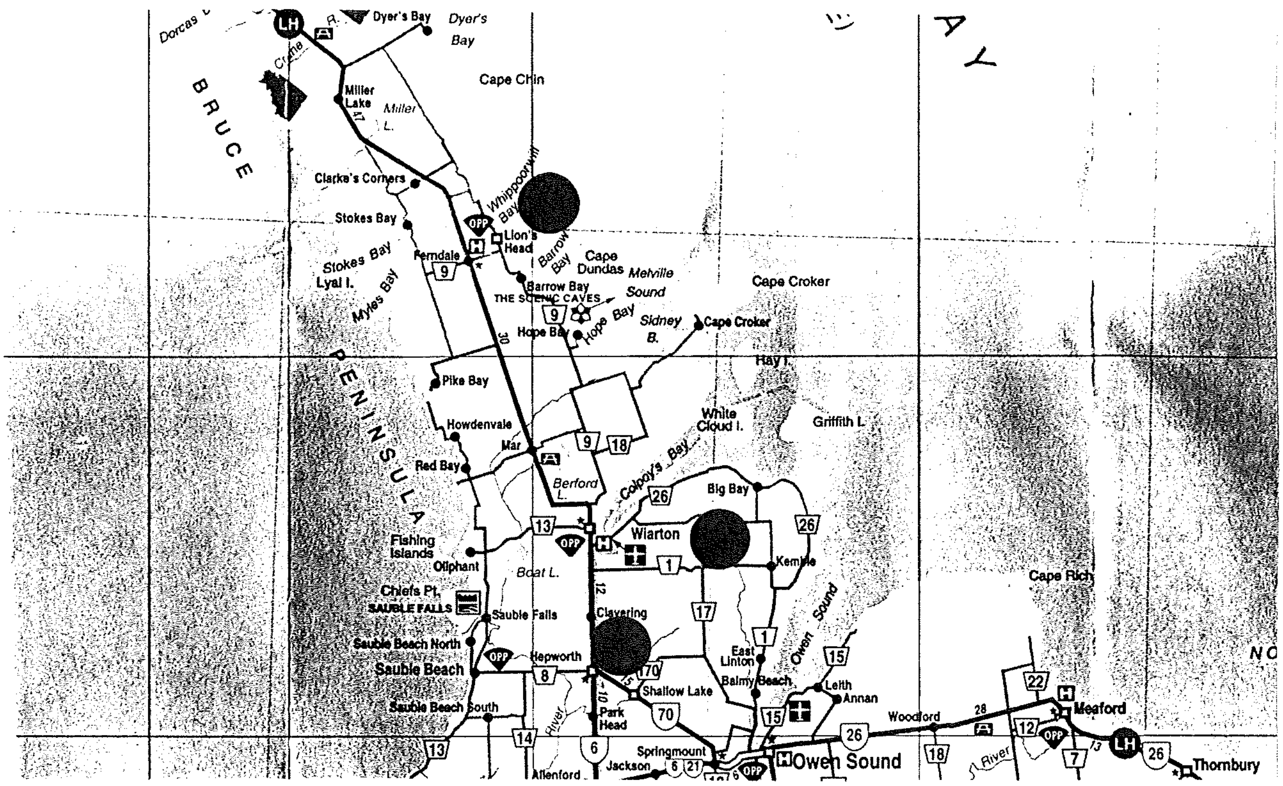
pikem.mac August 17, 1998. D. Siddiqi, analyst.

ON Penny, 1979.



August 23

Main themes:
Holocene climatic change
The hemlock decline 5700 yrs ago: Reasons and consequences



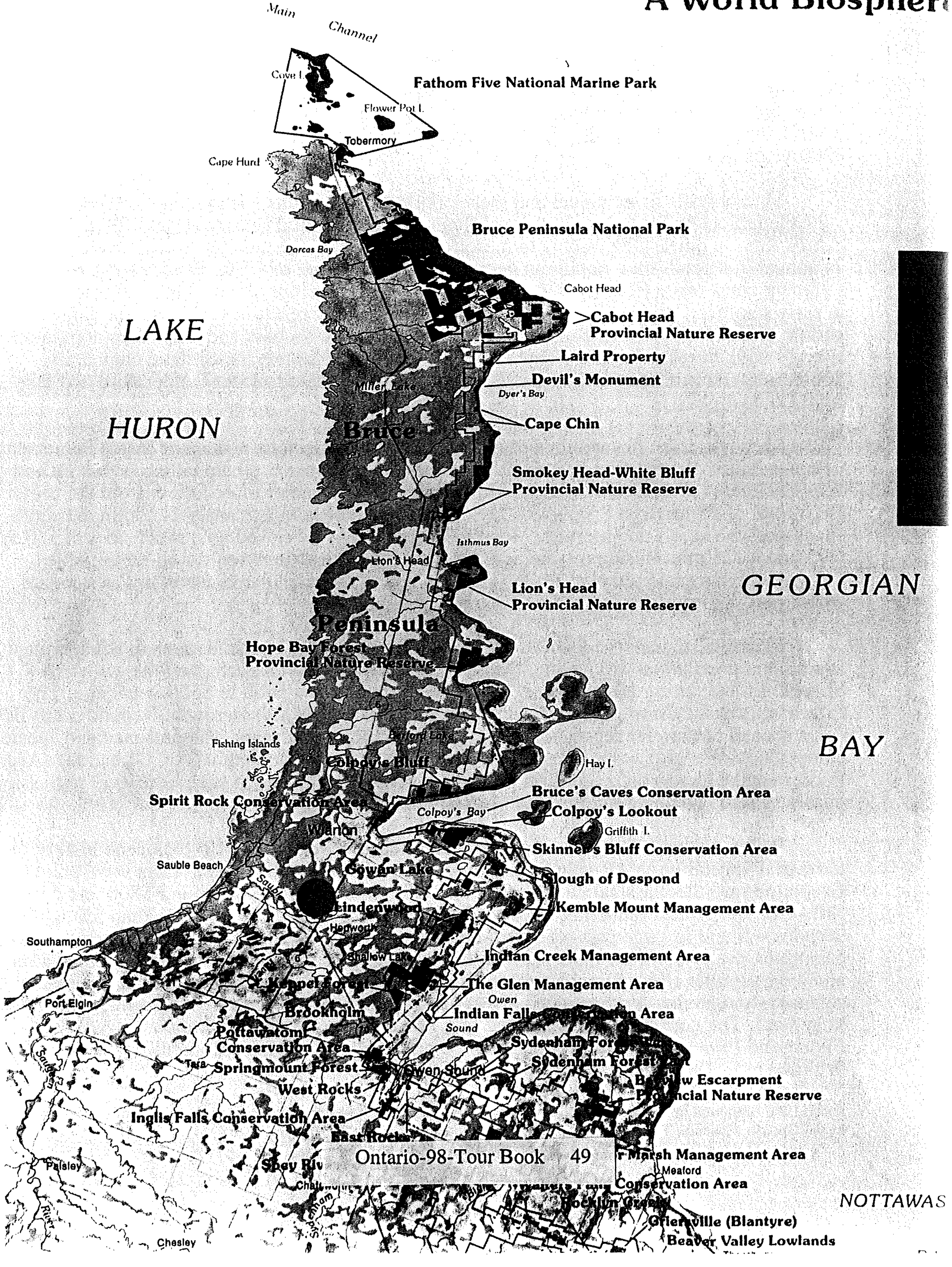
Breakfast at Lion's Head Beach Motel and Mom's Motel.

9 a.m.:	Departure for **Shepherd Lake**: Holocene lake-level fluctuations and climate change at Shepherd Lake: Reconstruction by means of aquatic plants and animals. The Mid-Holocene hemlock-decline (*Tsuga canadensis*) in northeastern North America. Its possible reasons and consequences.
Lunch	at Shepherd Lake.
2 p.m.:	Departure for Mary Lake, Open Discussion: Reasons for Early Holocene low sedimentation rates?
thereafter:	Some hours without program! Swimming, shoping, etc. at Lion's Head. Or for those interested: Discovery of possible remnants of prairie vegetation (Alvar vegetation?) in Cape Crocker Indian Reserve

Overnight in Lion's Head (Lion's Head Beach Motel and Mom's Motel), Dinner on your own at Mom's Restaurant in Lion's Head.

Niagara Escarpment

A World Biospher



Shepherd Lake

In central Europe frequent small-scale climatic fluctuations played a key role in the Holocene vegetation development and prehistoric land use (Haas, Richoz, Tinner & Wick 1998), but little is known of such fluctuations for Eastern North America. Palynological studies from Southern Ontario mainly show a long lasting mid-Holocene warm period between 7000-4000 years ago.

Macrofossils from annual and thermophile aquatic plants such as *Najas flexilis* are valuable indicators for former lake level fluctuations in Central Europe (Haas 1996). *Najas flexilis* lives in quiet, oligotrophic to mesotrophic water of high summer water temperature. As an annual it depends on a minimum germination temperature of 19°C. The presence of seeds in sediment cores taken from the center of shallow lakes therefore reflects high water temperature in early summer. Periods of low summer water temperature result in suppressed or delayed germination which reduces considerably the reproductive success and long-term population size of *Najas flexilis*. Shallow Shepherd Lake was chosen to test for climatic change in Southern Ontario relating *Najas flexilis* abundances to summer water temperature and lake level fluctuations.

Shepherd Lake lies within a drumlin field on the limestone plateau of Bruce Peninsula. Climate values are: 6 defree C annual mean and 965 mm annual precipitation. In March and July 1997 cores of gyttja were taken with a 5 cm piston sampler in a transect from the center to the littoral of 15 ha large Shepherd Lake. For the palaeoecological analysis continuous core slices were taken at 1 cm intervals. Macrofossil samples were sieved with mesh sizes of 1, 0.5, 0.25 and 0.125 mm. Residues were completely screened and analysed for all identifiable organic and inorganic remains. Pollen samples of 1 cc were prepared according to standard techniques. At least 500 pollen were counted per sample.

Macrofossil analysis: Contrary to the pollen results major fluctuations in aquatic plant and animal populations are visible. Dense *Najas flexilis* mats characterized the center of Shepherd Lake during lake-level regression approximatively 6500 to 5600 years ago. The following transgression phase prevented *Najas flexilis* and *Chara* growth. Around 5300 BP cal. a second but briefer regression phase lasted less than 100 years. The presence and species composition of zoological indicators for shallow water as Trichoptera larvae, Oribatidae (Acari), Porifera and Chironomidae confirm palaeoecological change due to such lake level regression phases. These lake level fluctuations probably reached more than 4 m.

Pollen analysis: Only very few changes occurred during the Mid-Holocene history of terrestrial vegetation. NAP-values remain unchanged below 5%, dense forests were prevalent. Exceptions are the classical hemlock decline (*Tsuga canadensis*) at around 5800 and 5300-5100 BP. The typical reduction of *Tsuga* values from 30% tree cover to less than 5% within decades – found in large parts of North Eastern America – was up to now attributed to insect calamities (Bhiry & Filion 1996). However our results from Shepherd Lake imply that warmer and drier summer climate may have been directly responsible, possibly triggering the insect calamity, and having a pronounced effect on the subsequent rapid forest composition change in general. The consequences were that lost *Tsuga* trees and stands were countered by a *Betula* and *Pinus* rise at an early stage and by a *Fagus* rise during the main *Tsuga canadensis* decline.

Funded and supported by the Swiss National Science Foundation, the Department of Botany-University of Toronto, and the Royal Ontario Museum, Toronto

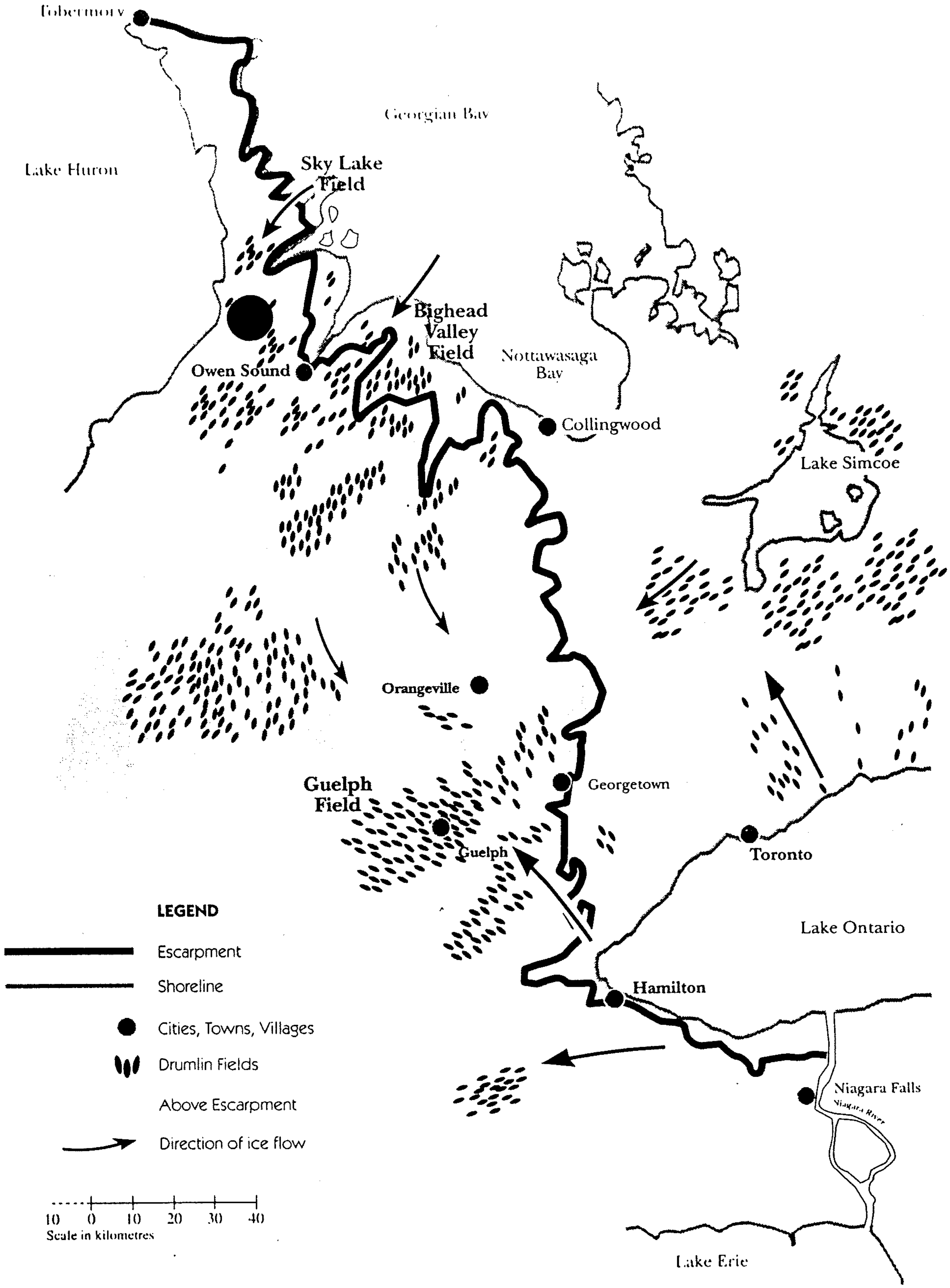
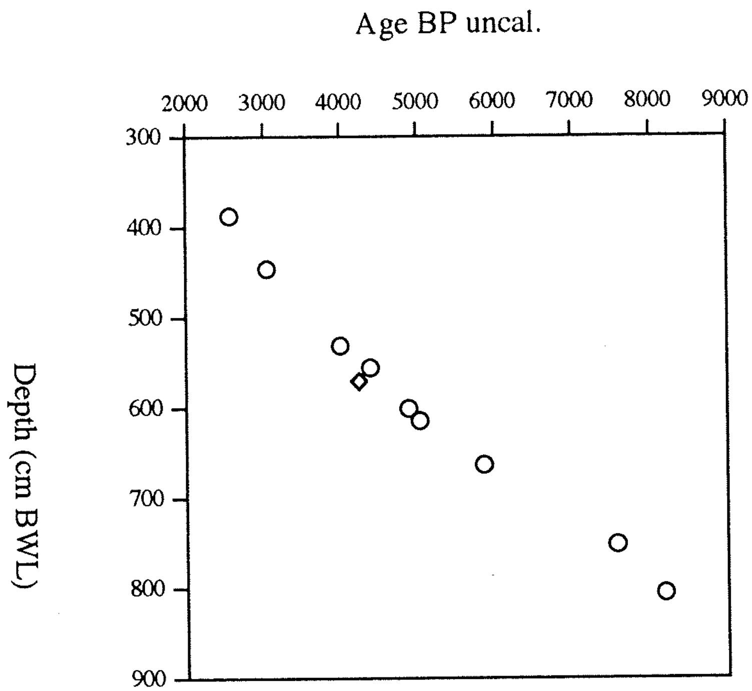
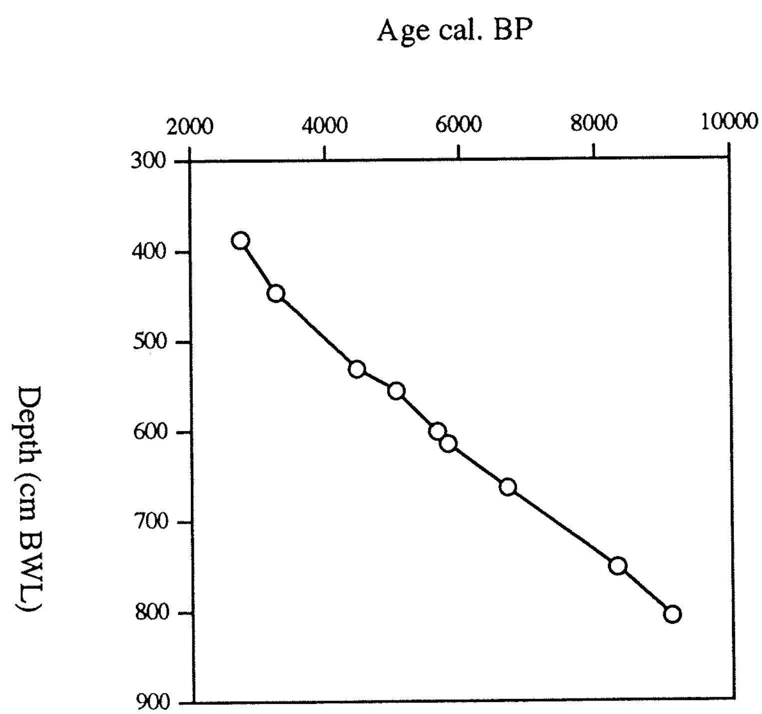


Figure 4-5

Drumlin fields in the region of the Niagara Escarpment.
(Torell 1992)

Shepherd Lake
AMS-Datings on terrestrial plant remains (performed at the University of Utrecht)

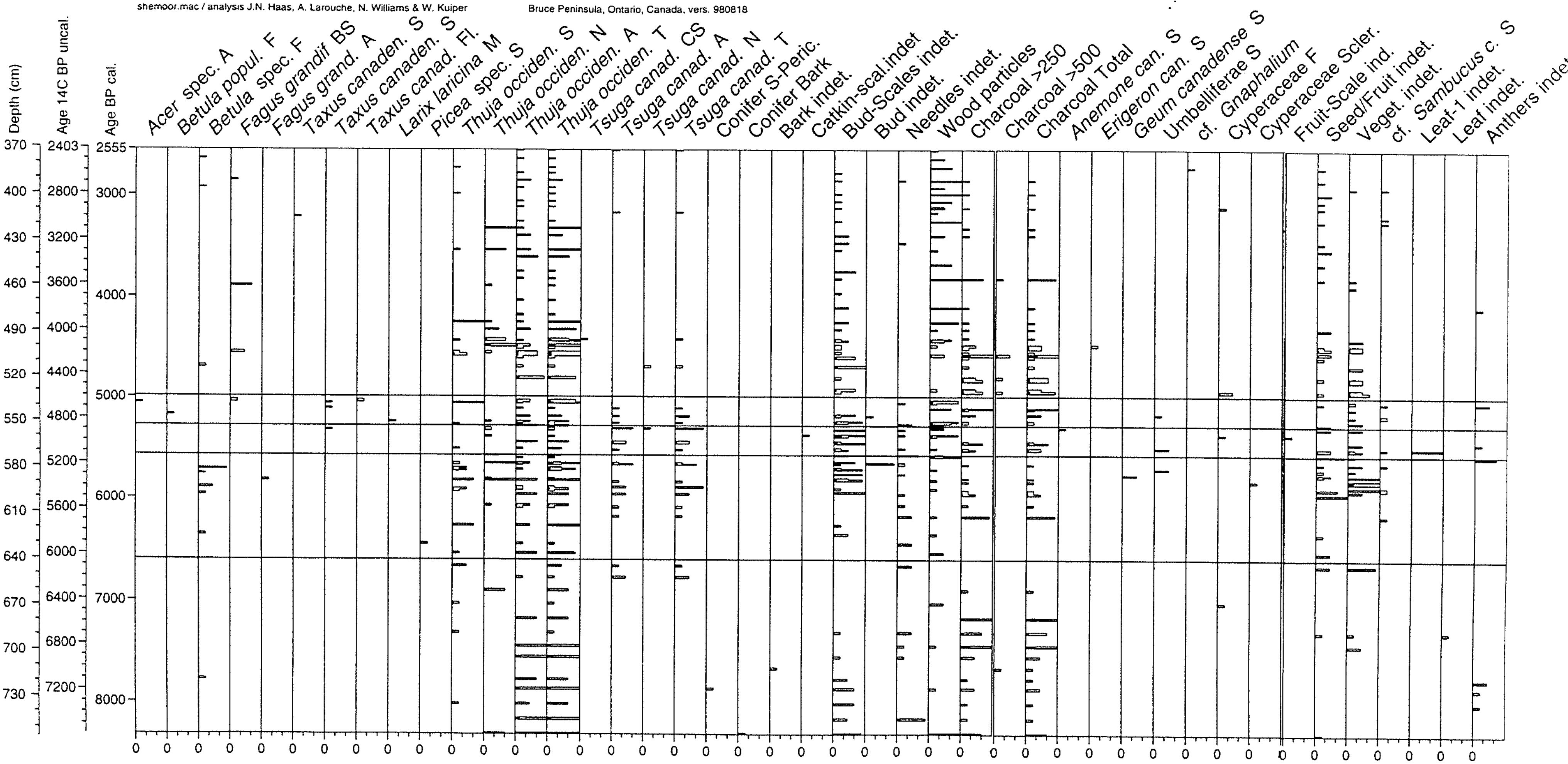




Shepherd Lake Macrofossils per 15 mL

shemoor.mac / analysis J.N. Haas, A. Larouche, N. Williams & W. Kuiper   Bruce Peninsula, Ontario, Canada, vers. 980818

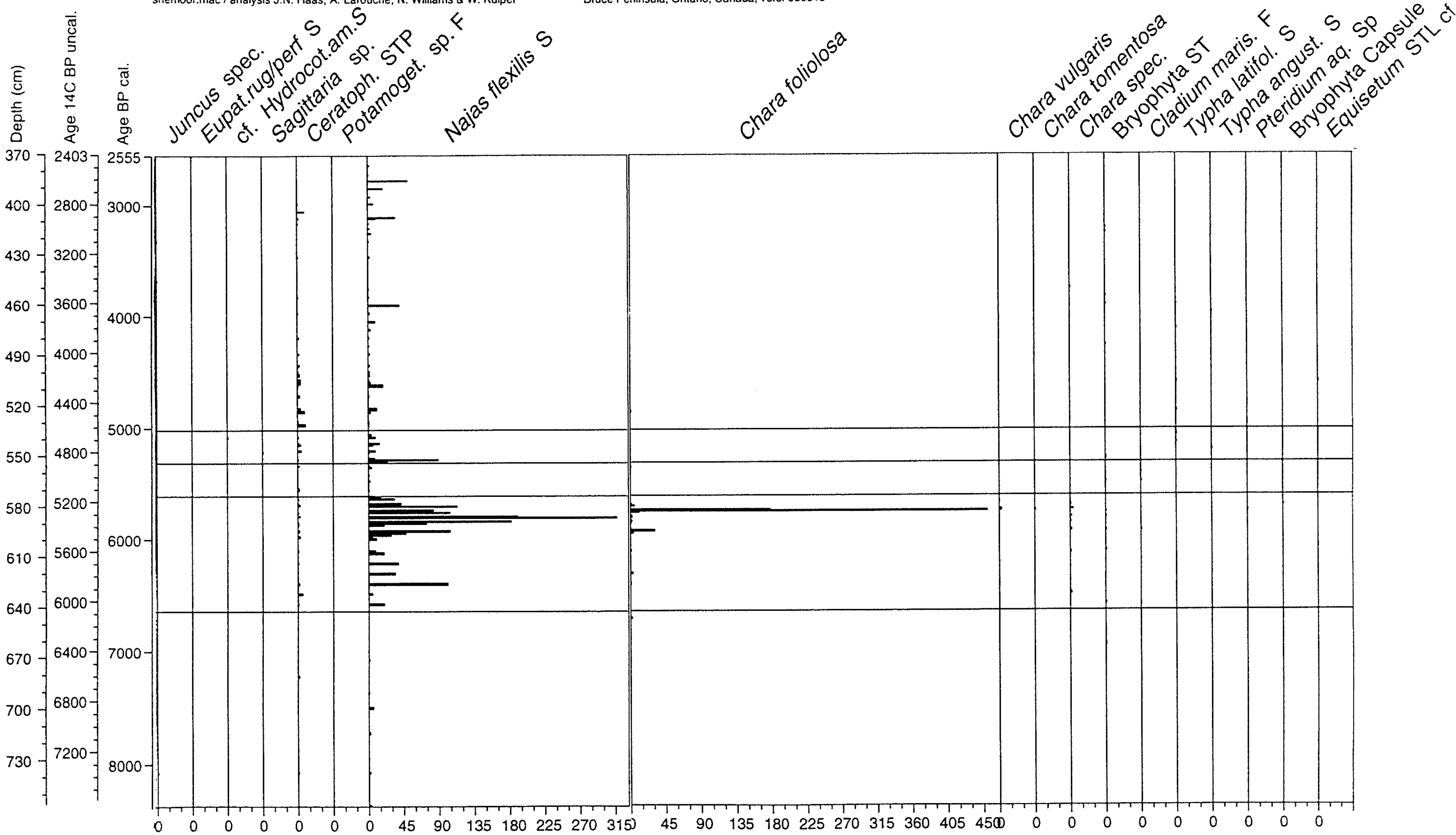
Upland Flora

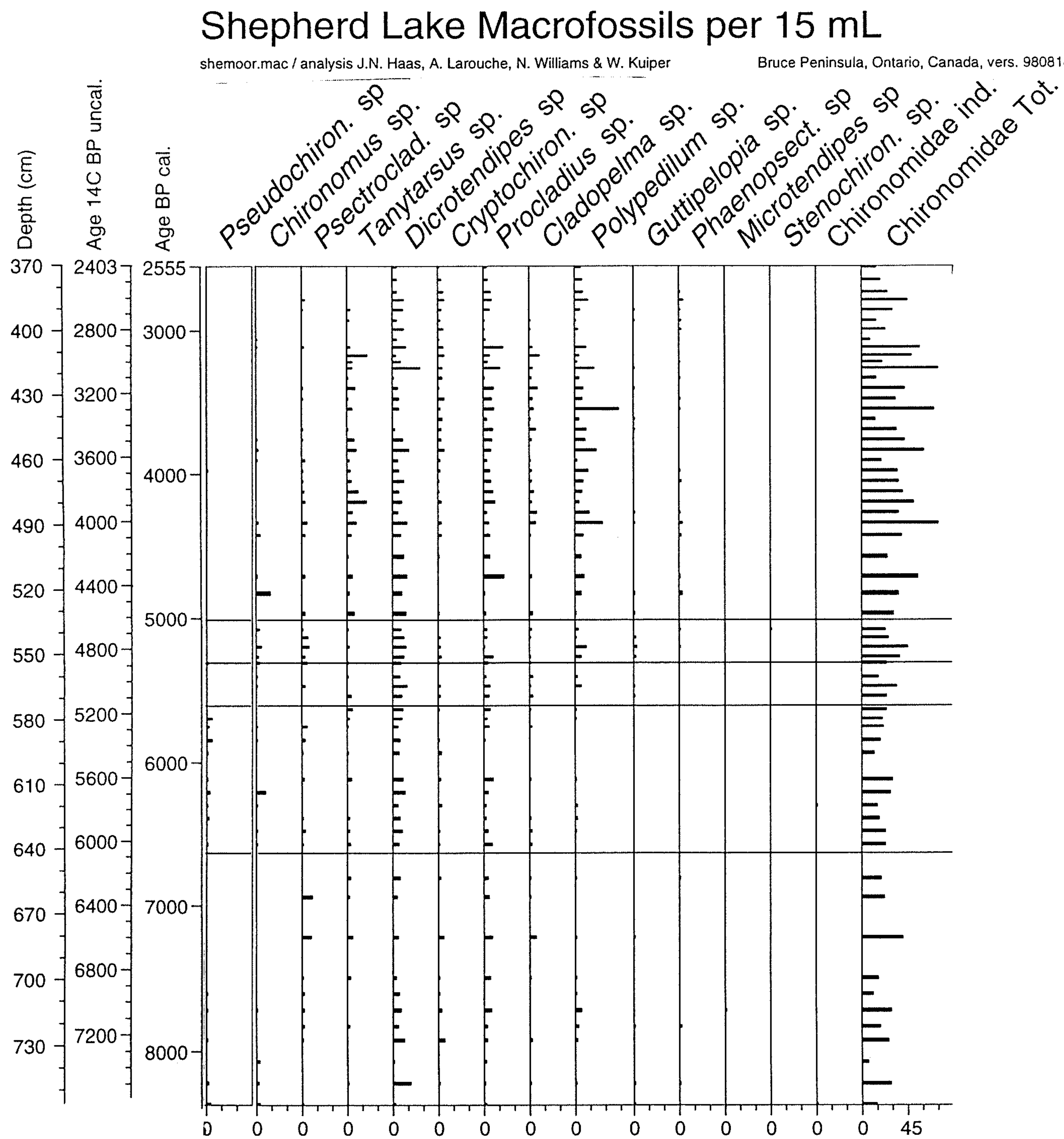


Shepherd Lake Macrofossils per 15 mL

shemoor.mac / analysis J.N. Haas, A. Larouche, N. Williams & W. Kuiper   Bruce Peninsula, Ontario, Canada, vers. 980818

Aquatic Flora

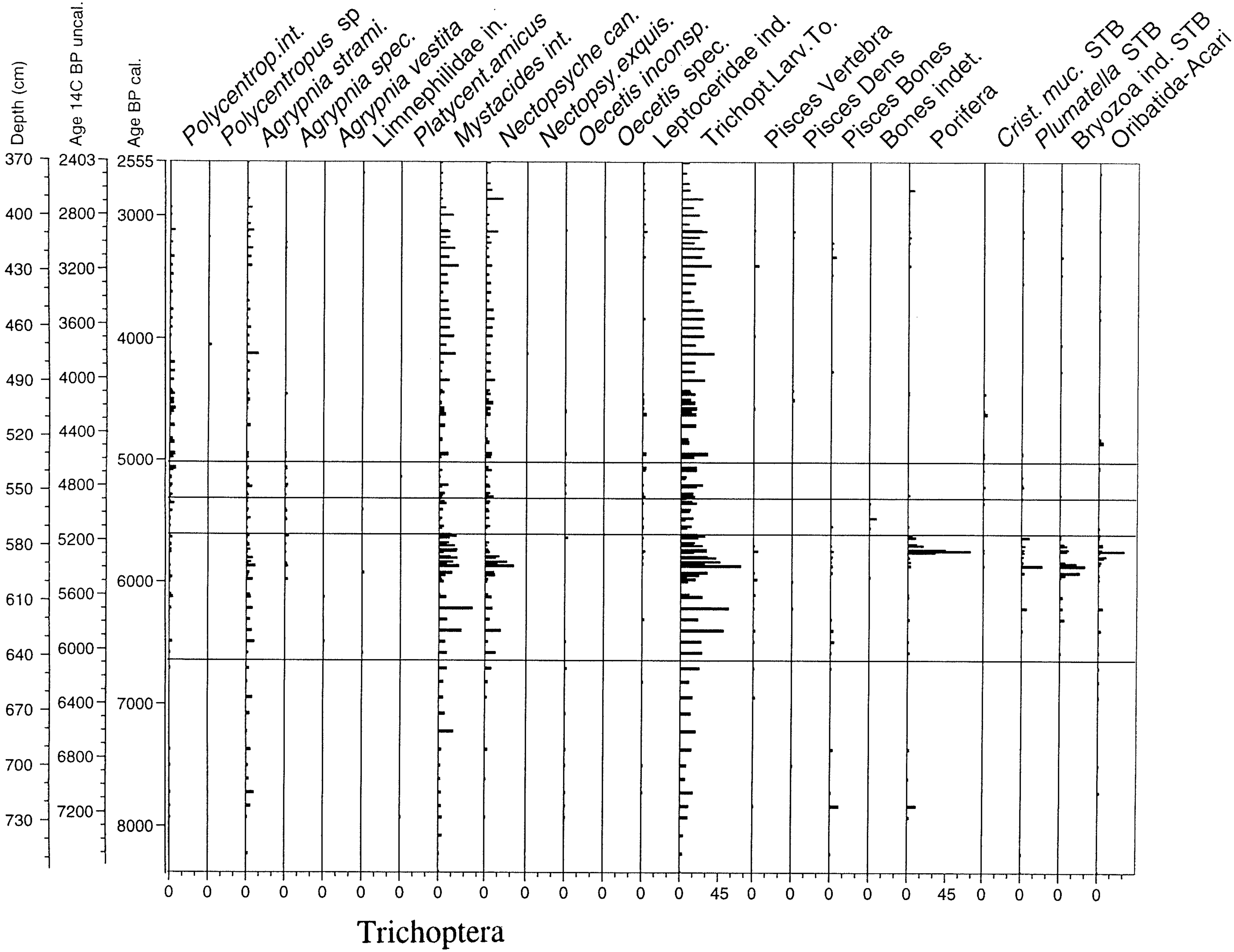




Chironomids.

Shepherd Lake Macrofossils per 15 mL

shemoor.mac / analysis J.N. Haas, A. Larouche, N. Williams & W. Kuiper   Bruce Peninsula, Ontario, Canada, vers. 980818

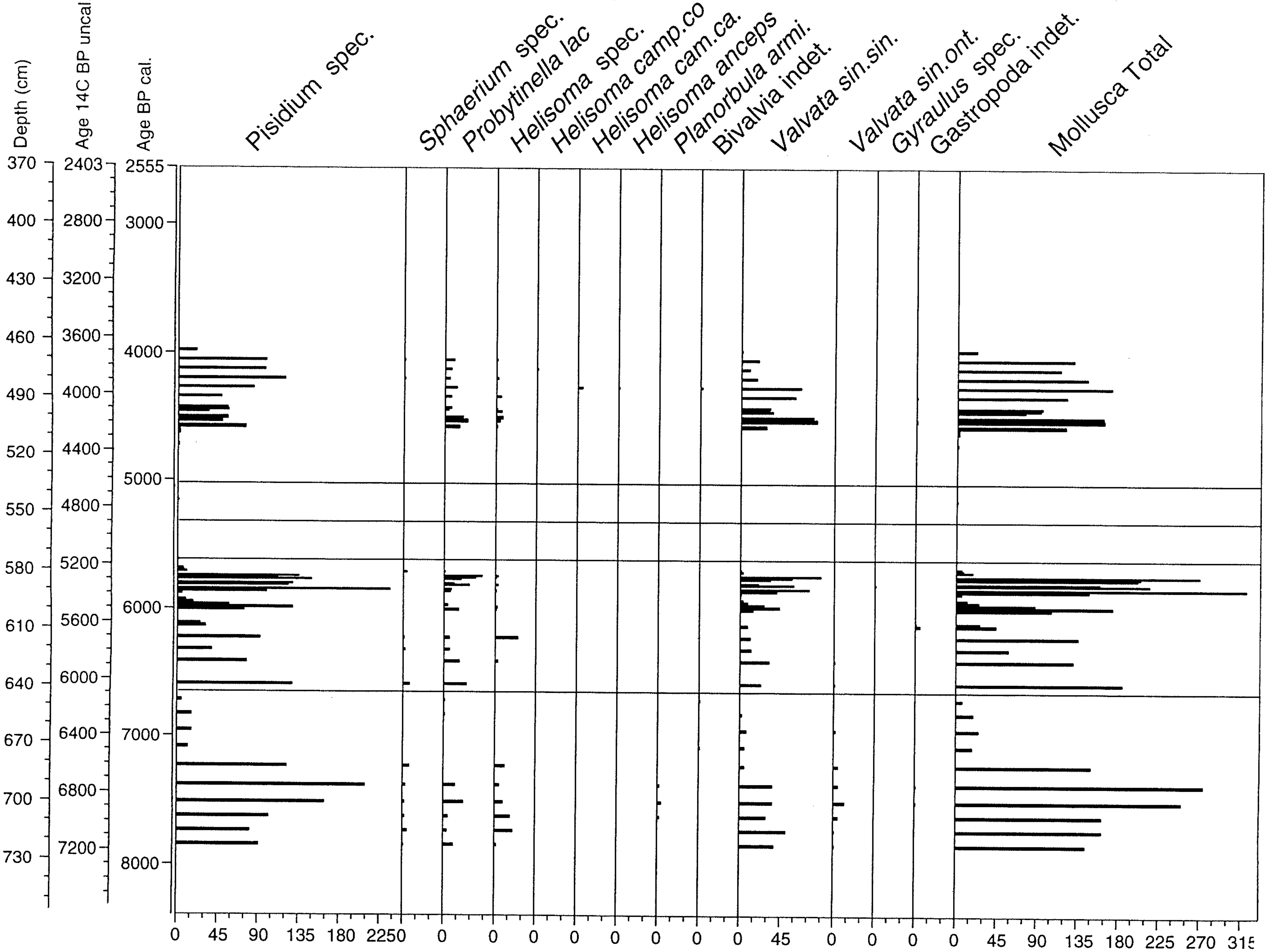


Shepherd Lake Macrofossils per 15 mL

Mollusca

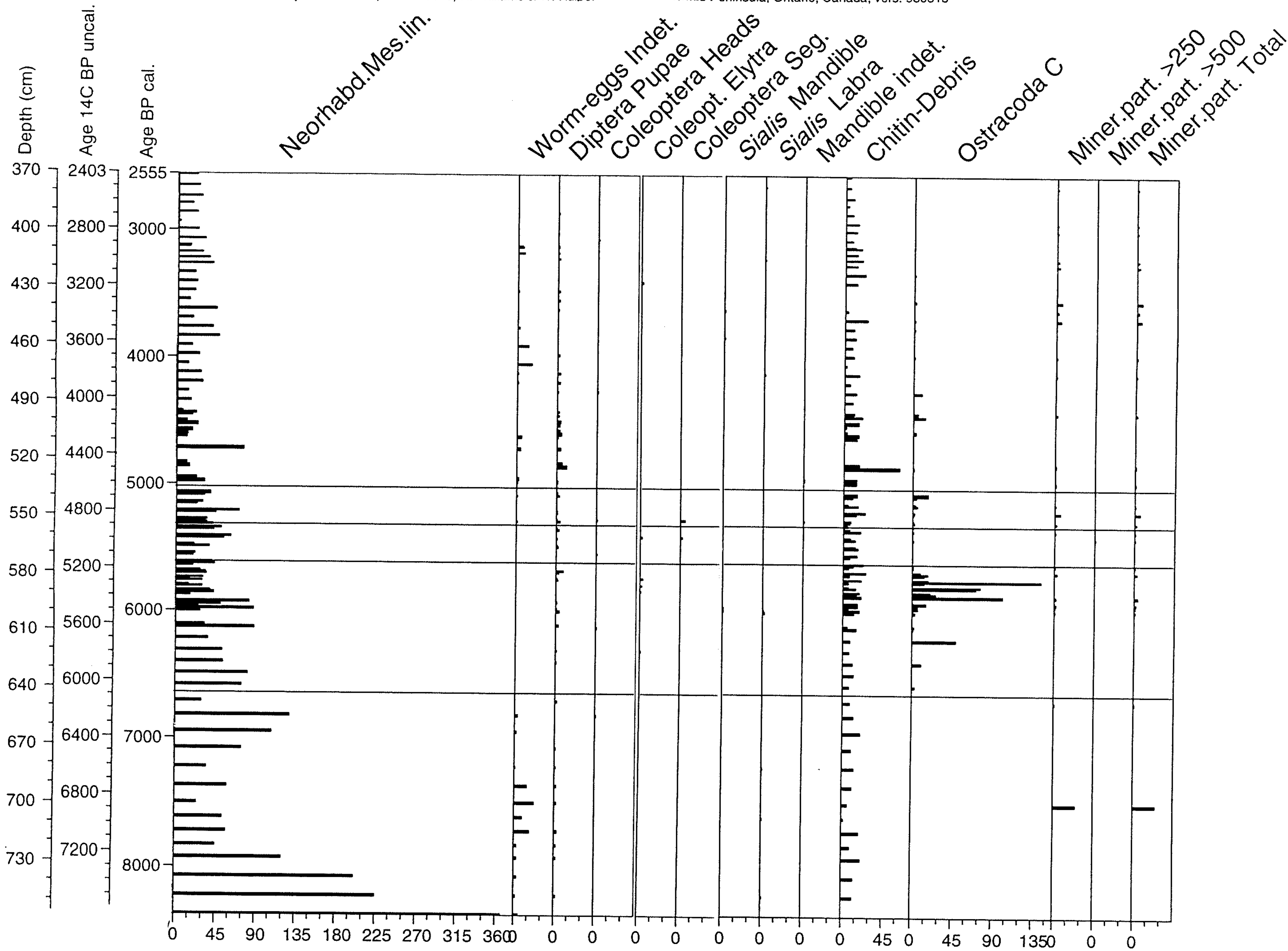
shemoor.mac / analysis J.N. Haas, A. Larouche, N. Williams & W. Kuiper

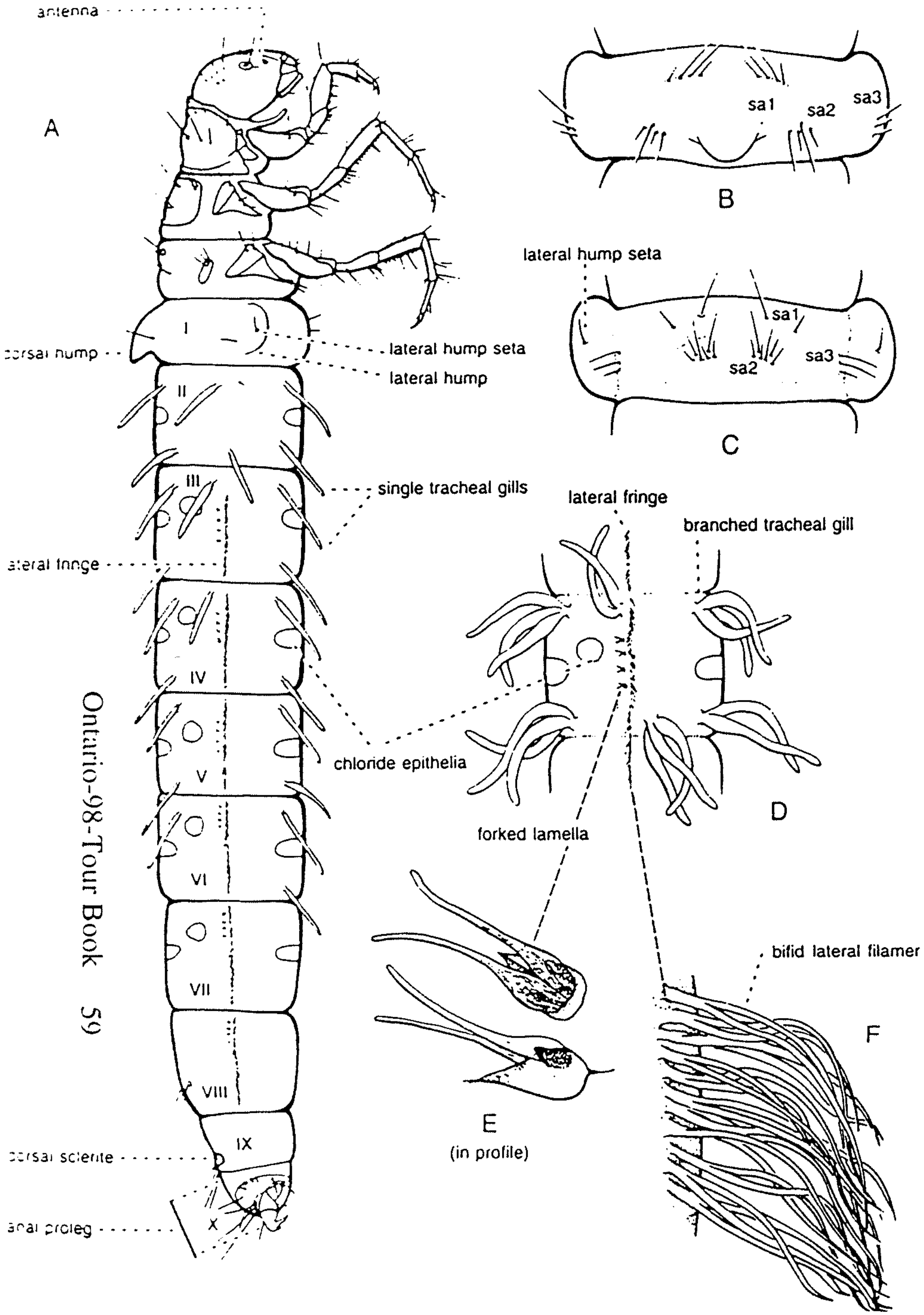
Bruce Peninsula, Ontario, Canada, vers. 980818

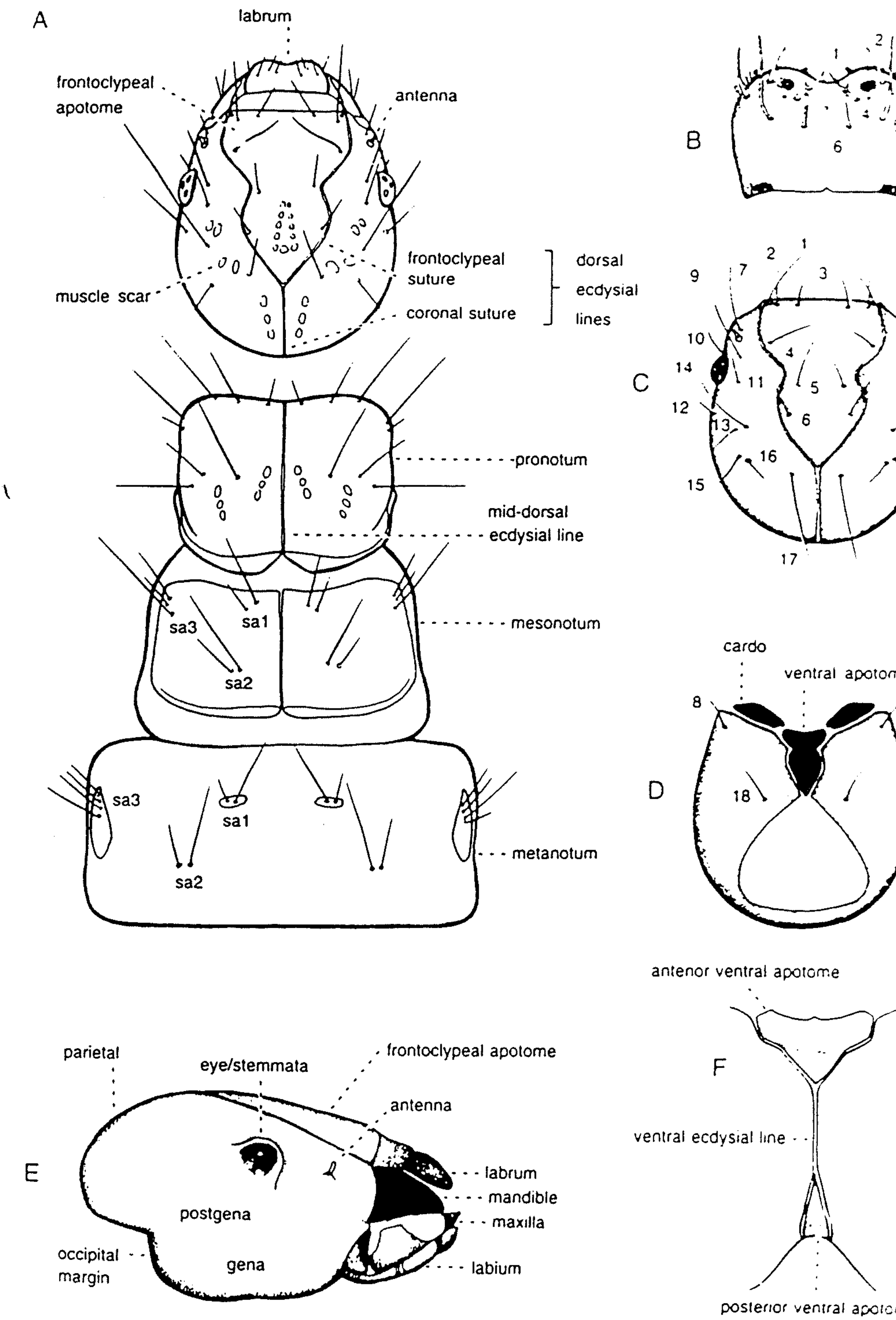


Shepherd Lake Macrofossils per 15 mL

shemoor.mac / analysis J.N. Haas, A. Larouche, N. Williams & W. Kuiper   Bruce Peninsula, Ontario, Canada, vers. 980818

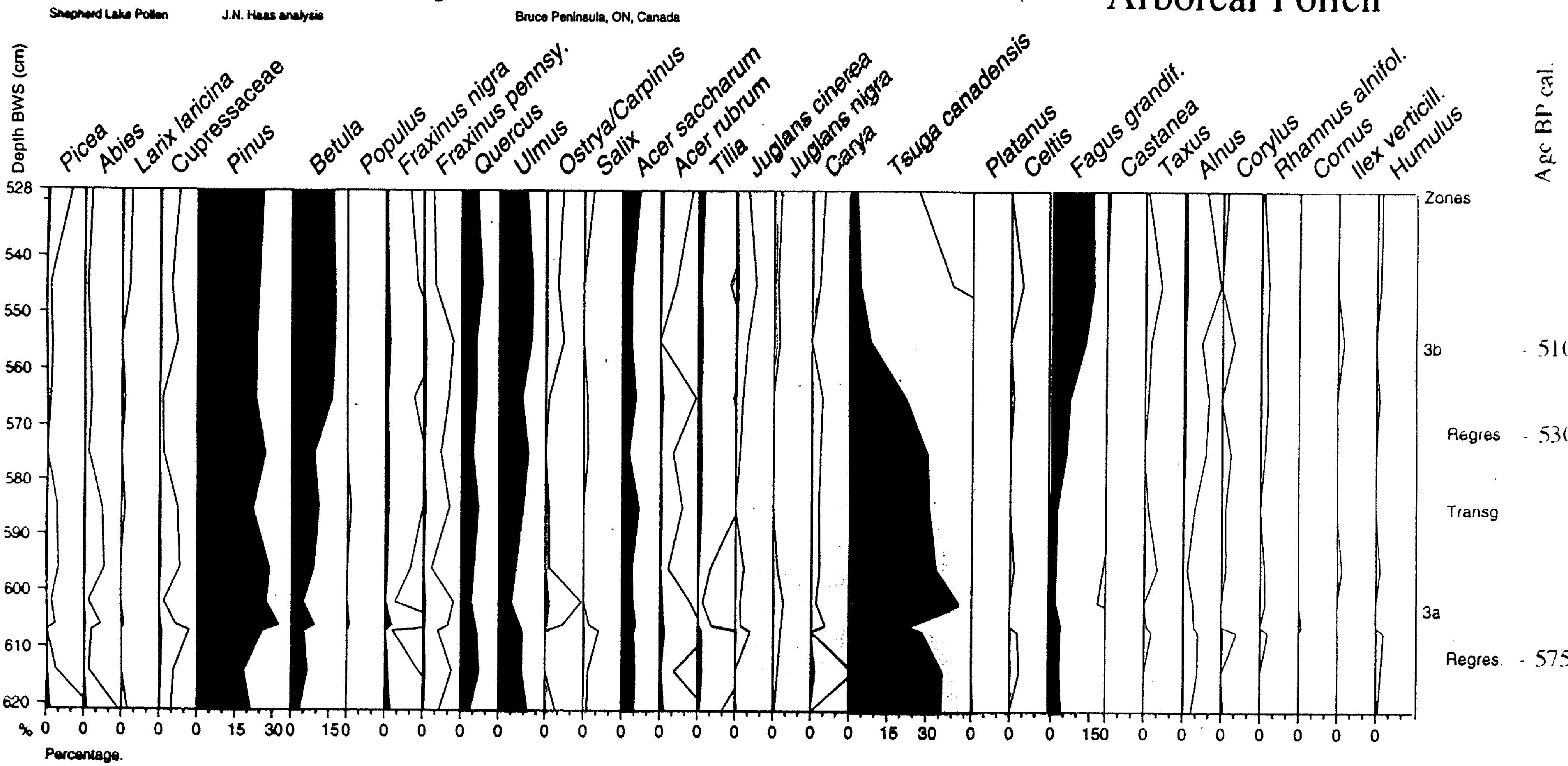



antenna
A
dorsal hump
lateral hump seta
lateral hump
single tracheal gills
lateral fringe
chloride epithelia
dorsal sclerite
anal proleg
I
II
III
IV
V
VI
VII
VIII
IX
X
sa1
sa2
sa3
B
lateral hump seta
C
lateral fringe
branched tracheal gill
D
forked lamella
E
(in profile)
bifid lateral filamer
F

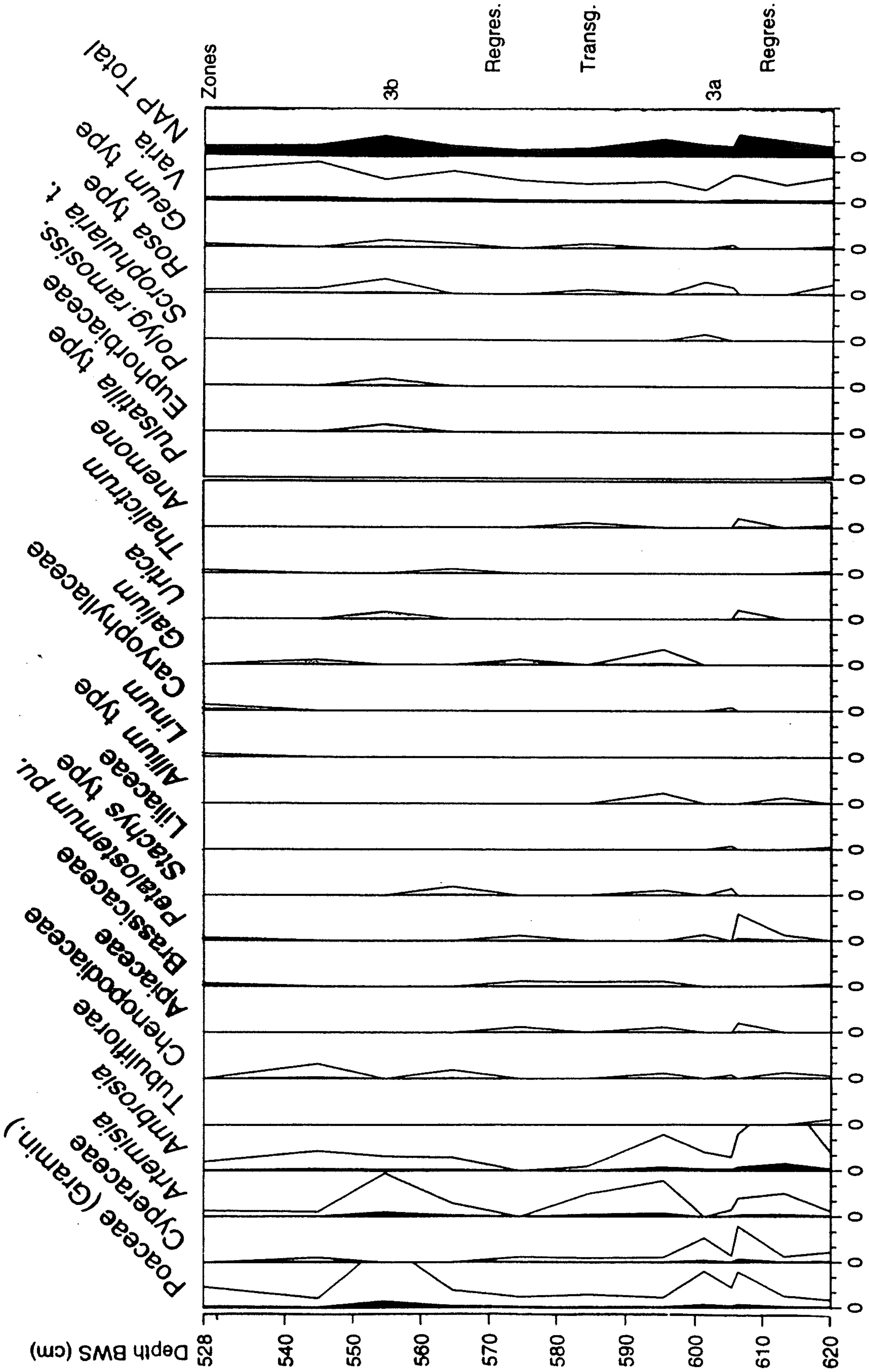

A
labrum
frontoclypeal apotome
antenna
muscle scar
frontoclypeal suture
coronal suture
dorsal ecdysial lines
pronotum
mid-dorsal ecdysial line
mesonotum
metanotum
sa1
sa2
sa3
B
C
cardo
ventral apotom
D
E
parietal
eye/stemmata
frontoclypeal apotome
antenna
labrum
mandible
maxilla
labium
postgena
gena
occipital margin
anterior ventral apotome
F
ventral ecdysial line
posterior ventral apoto

Shepherd Lake Pollen Diagram

Arboreal Pollen



Non-Arboreal Pollen



Spores, Extrafossils & Neorhabdocoela

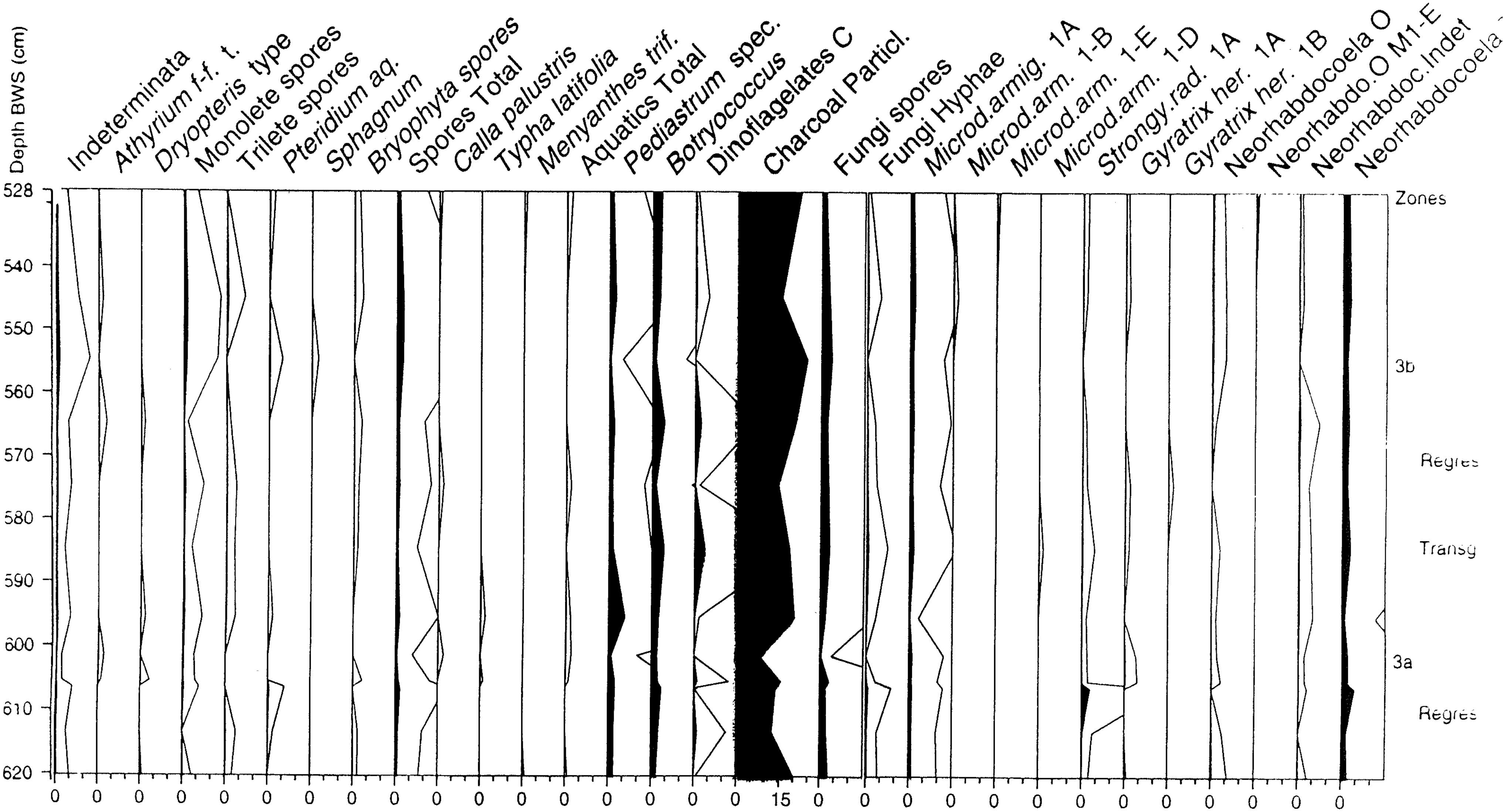
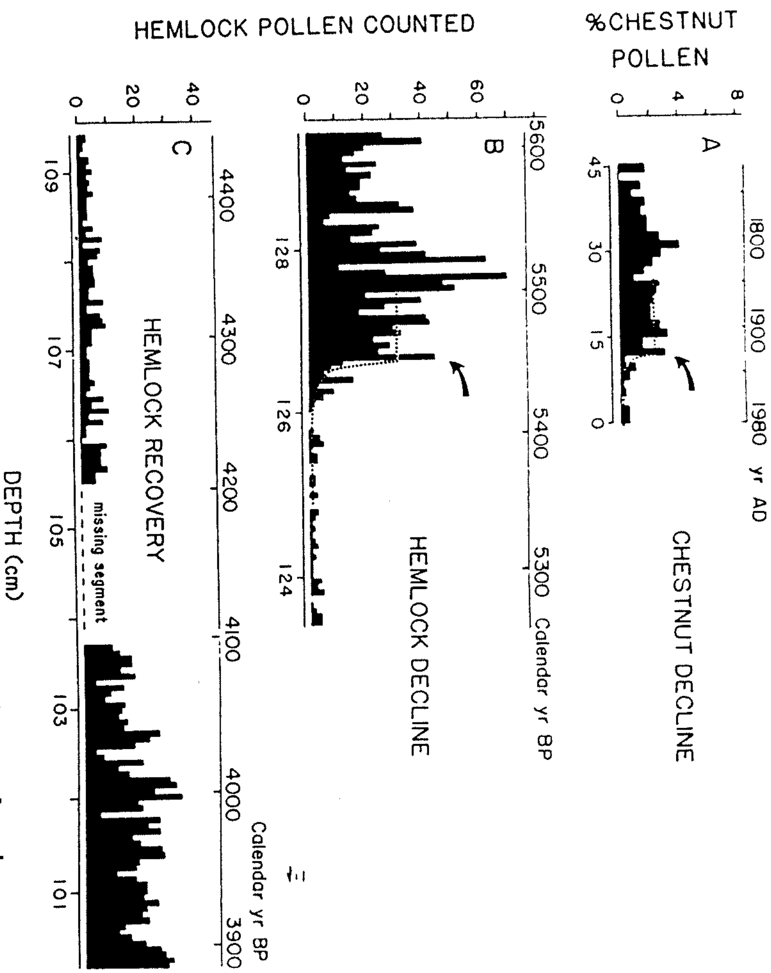


FIG. 1. (A) Chestnut pollen, as percent of total tree pollen, versus depth at Pout Pond, New Hampshire, before and after the introduction of the chestnut blight (indicated by arrow). Samples 1–2 cm thick were prepared from a frozen core using standard pollen analysis techniques. The smoothed curve (dotted line) traces a 75% decrease within 5 yr. The age scale is not linear, reflecting the change in sediment compaction with depth. (B) **Hemlock pollen grains versus depth** for the region of the hemlock decline. Hemlock pollen was counted along transects across thin sections that were cut perpendicular to the bedding plane of embedded sediment. The smoothed curve (dotted line) corresponds to a **75% decrease** within 7–8 yr. The arrow indicates the beginning of the hemlock decline at 126.66 cm depth. (C) Hemlock **pollen grains** versus depth in thin cross sections of embedded sediment from the region of hemlock recovery. The data in (B) and (C) are **counts** from one transect at each depth, but are not directly comparable, as statistically significant differences exist between lamination thicknesses in thin sections from these sampling levels. **Each count in (B) includes, on average,** 3.8 **laminations**, while each count in (C) includes, on average, 4.2 laminations. The calendar year age scales for (B) and (C) are **approximations** determined by **interpolating between radiocarbon dates calibrated in calendar years** (Klein et al. 1982). Occasional gaps occur in the count sequence of (B) and (C) due to separation of sediments during **the embedding** process or due to previous removal of sediment for pollen analysis (T. D. Allison, *personal observation*).

Allison et al. 1986



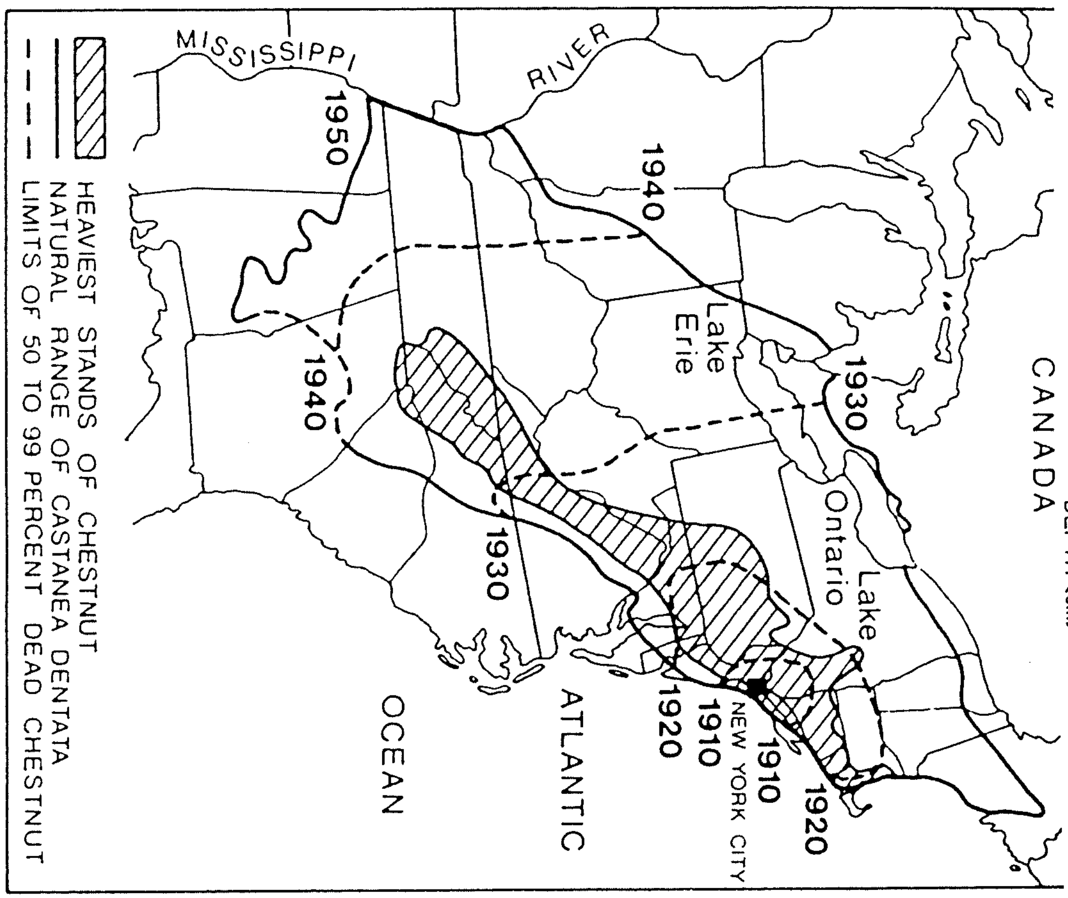


FIG. 1. Map showing the rate at which the chestnut blight spread over eastern North America. (Anderson 1974)

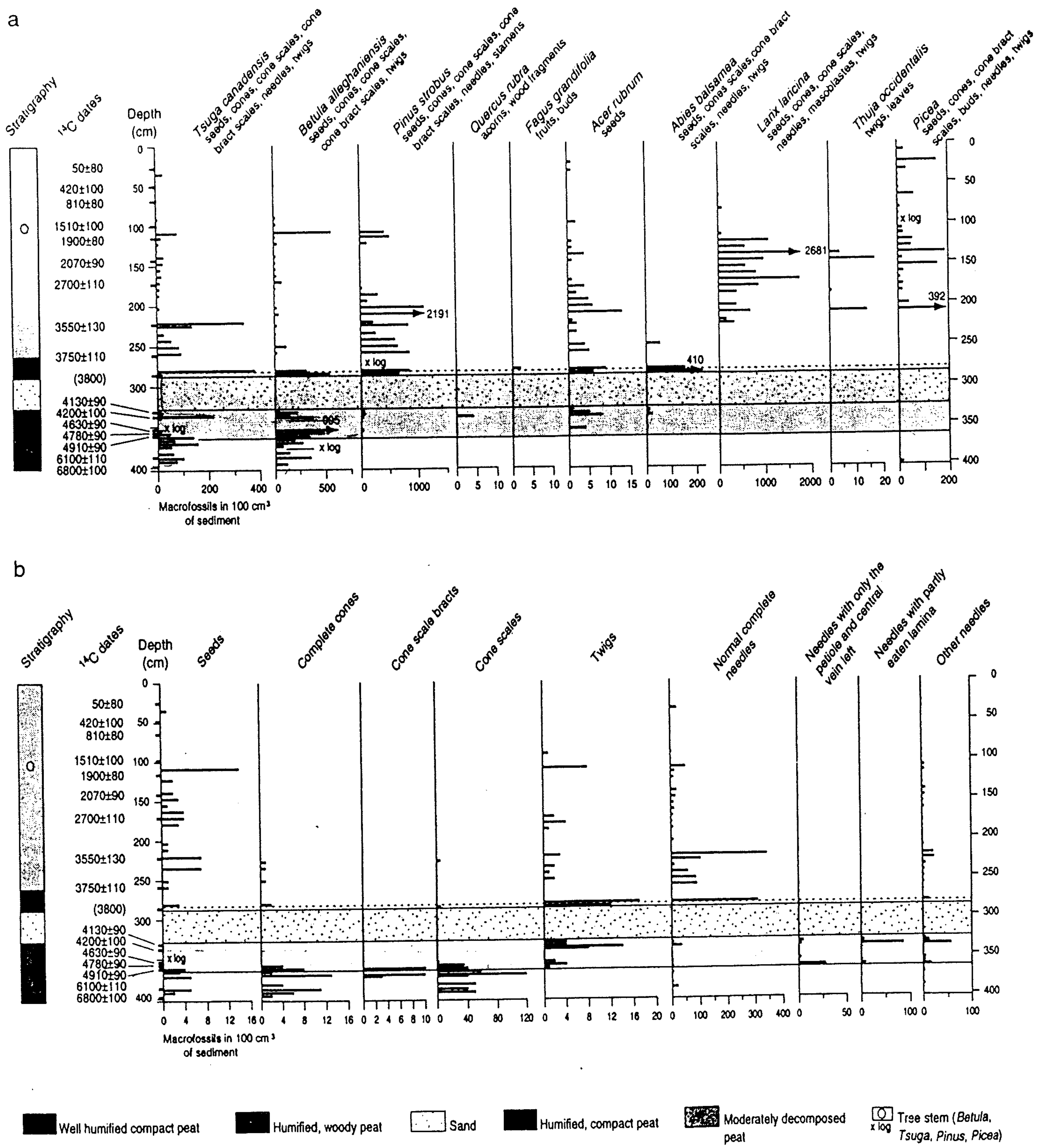


FIG. 1. (a) Abbreviated tree macrofossil diagram. The shaded area corresponds to the eastern hemlock decline as identified from plant and insect macrofossils. (b) Hemlock macrofossil diagram. Fossils from reproductive structures (female cones and seeds) are presented at left separately from other vegetative structures. Four categories of fossil needles were defined based on their morphology. The category "other needles" includes partly decomposed needles, and partly eaten and decomposed needles.

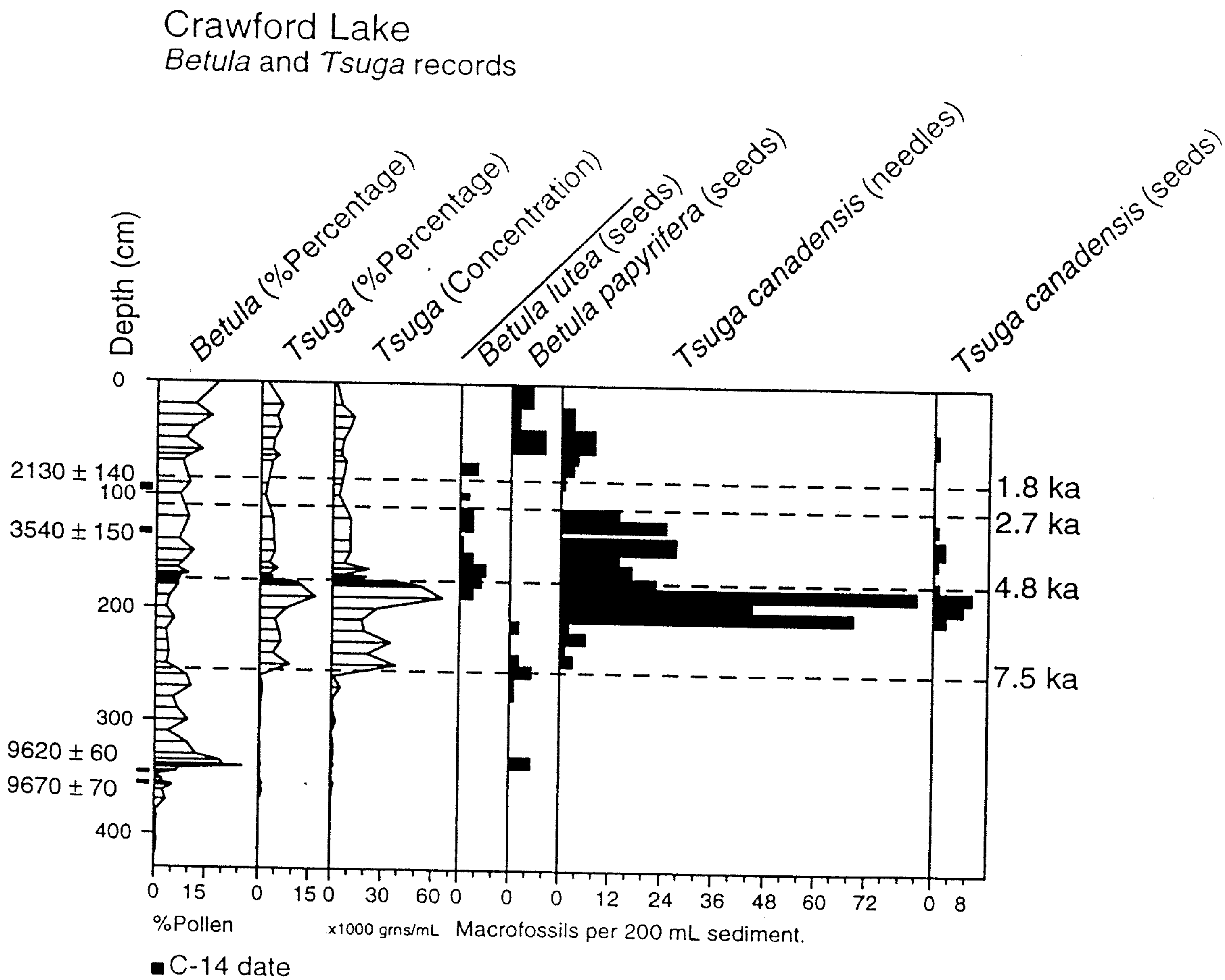


Figure 2.17. Detailed comparison of *Betula* and *Tsuga* pollen and macrofossils at Crawford Lake. Ages on the right side are based on the age model in Fig. 2.5 (ka = 1000 BP).

Yu, Z. (1997): Late Quaternary paleoecology of the southern Niagara Escarpment, Ontario, Canada: A multiple proxy investigation of vegetation and climate history. PhD Thesis, University of Toronto, 380 pp.

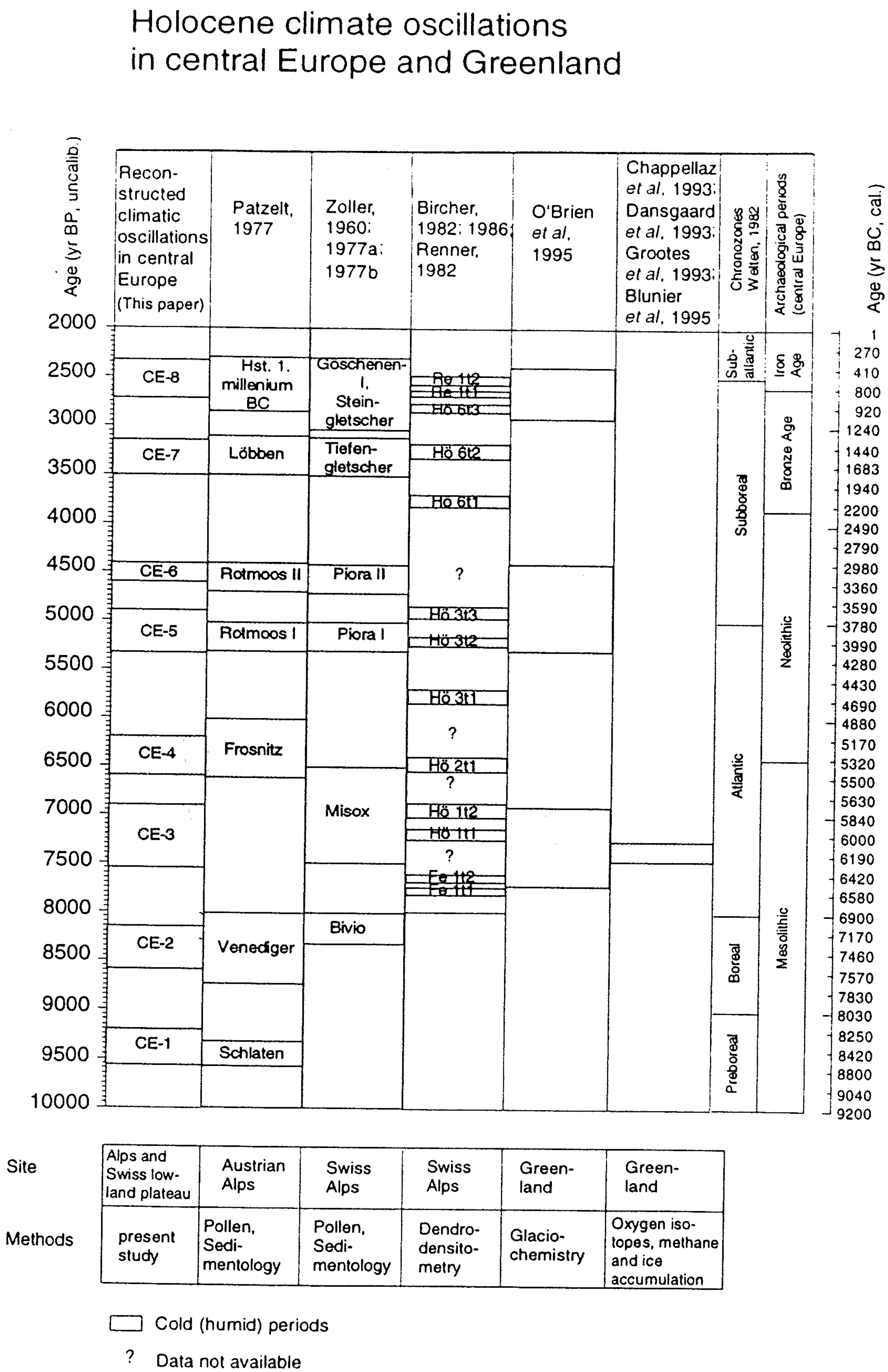


Figure 4 Comparison of reconstructed climatic oscillations with data published for central Europe (based on glacier movements, sedimentology, palynology and dendro-densitometry on subfossil wood remains) and for Greenland (based on glaciochemistry, oxygen-isotope, methane- and ice-accumulation records).

Haas et al. 1998

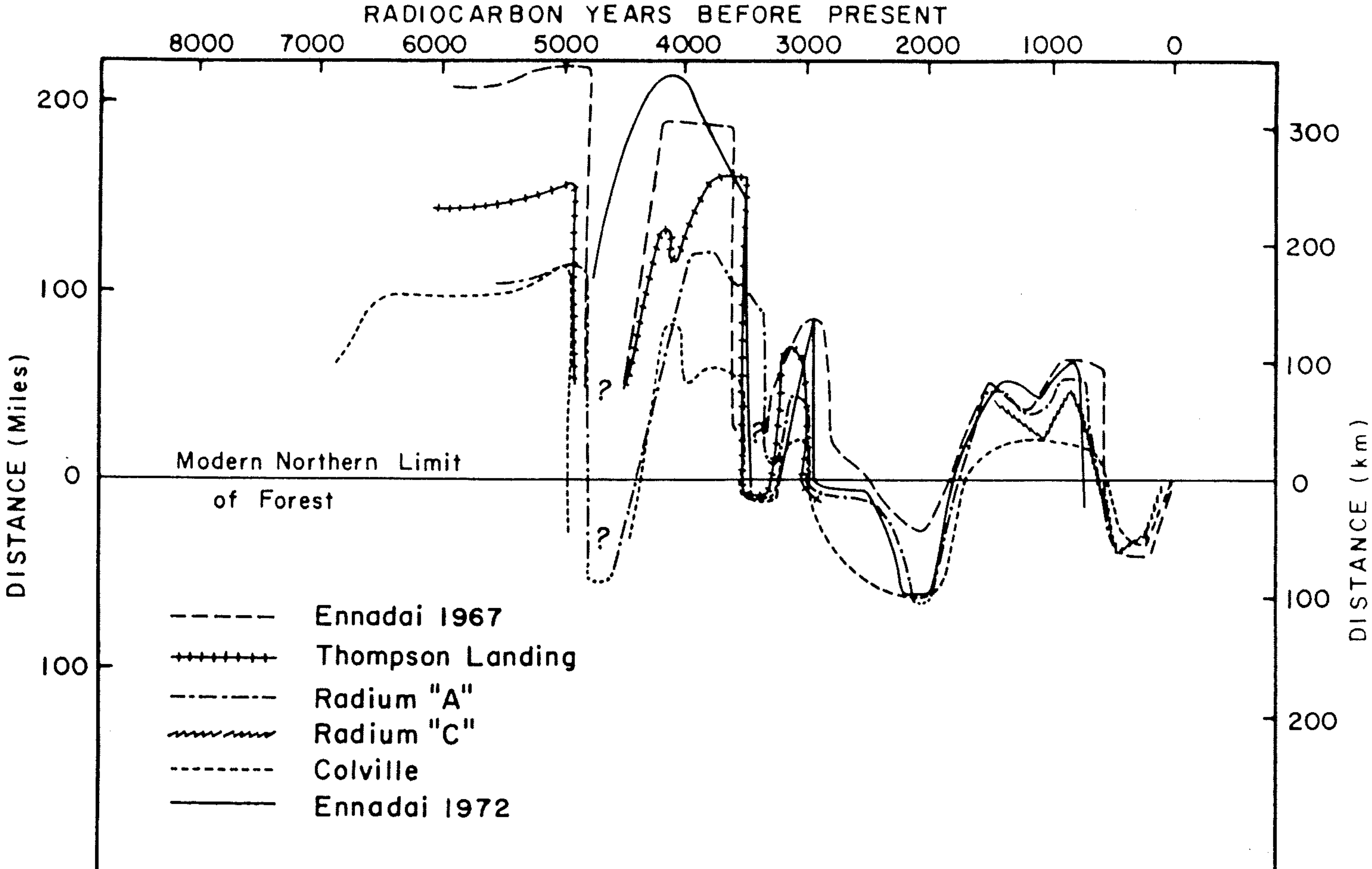


Figure 26: Tentative reconstruction of the location of the forest-tundra ecotone at several sites in northern Canada, based on palynology and macro-fossil evidence.

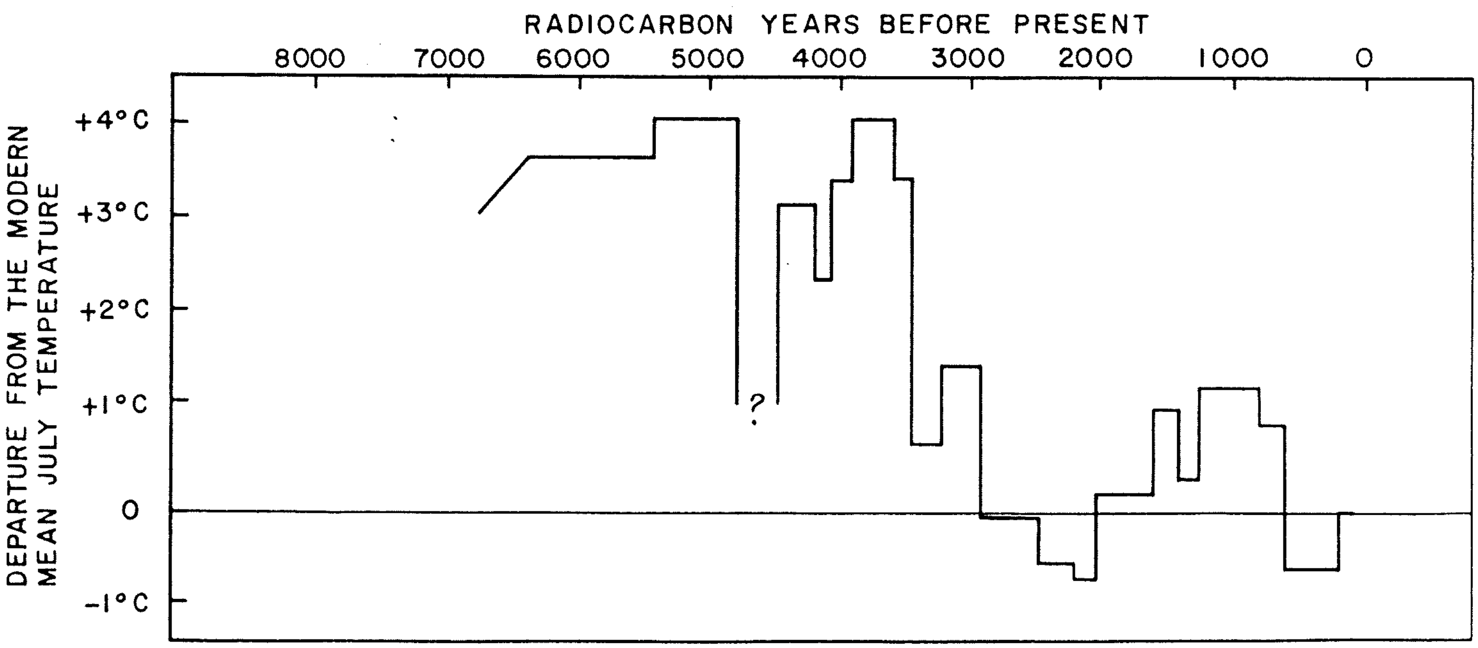


Figure 27: Tentative composite reconstruction of summer paleotemperatures at the palynological sites in Keewatin and Mackenzie, derived from Figure 26. (Nichols 1975)

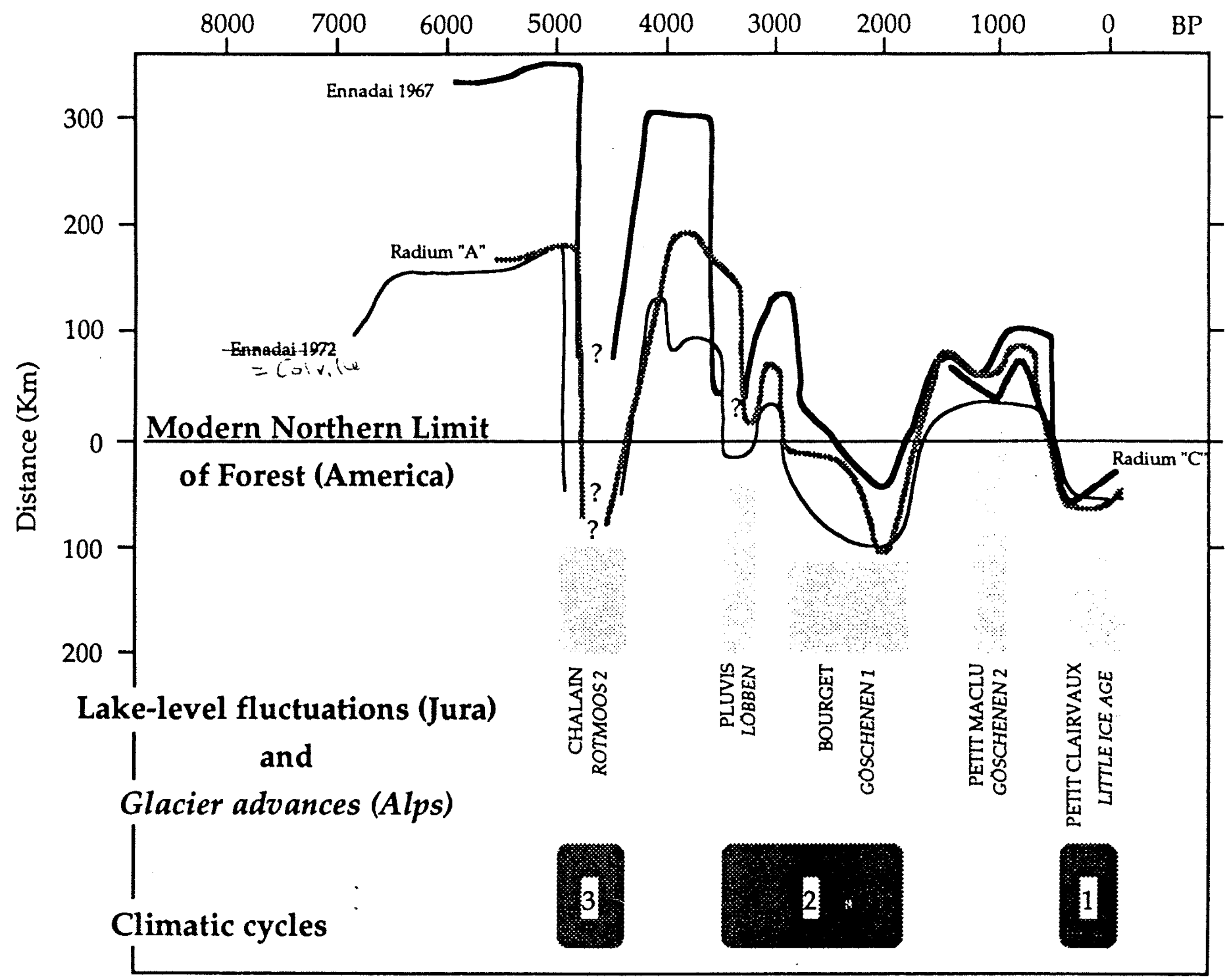
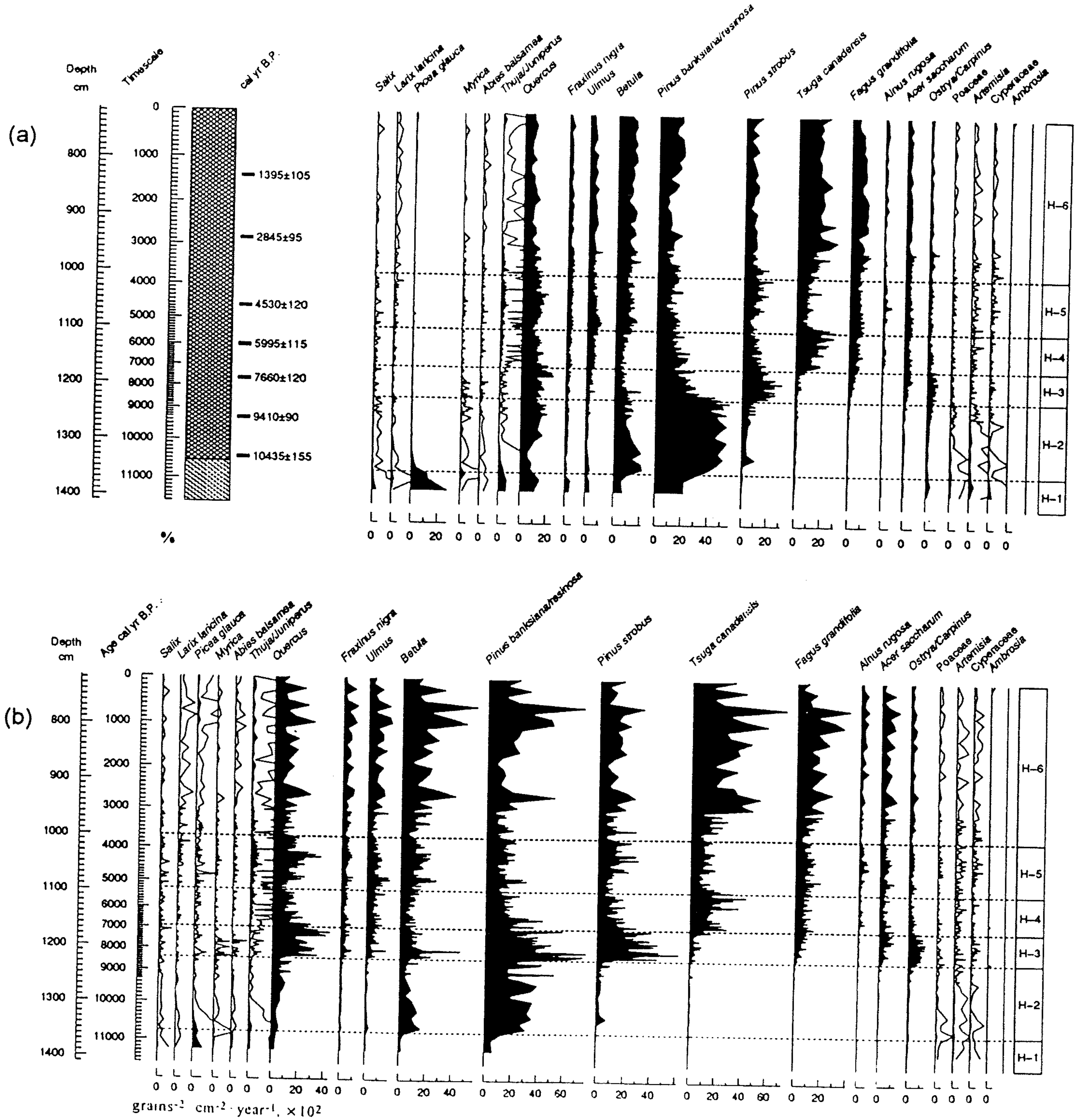


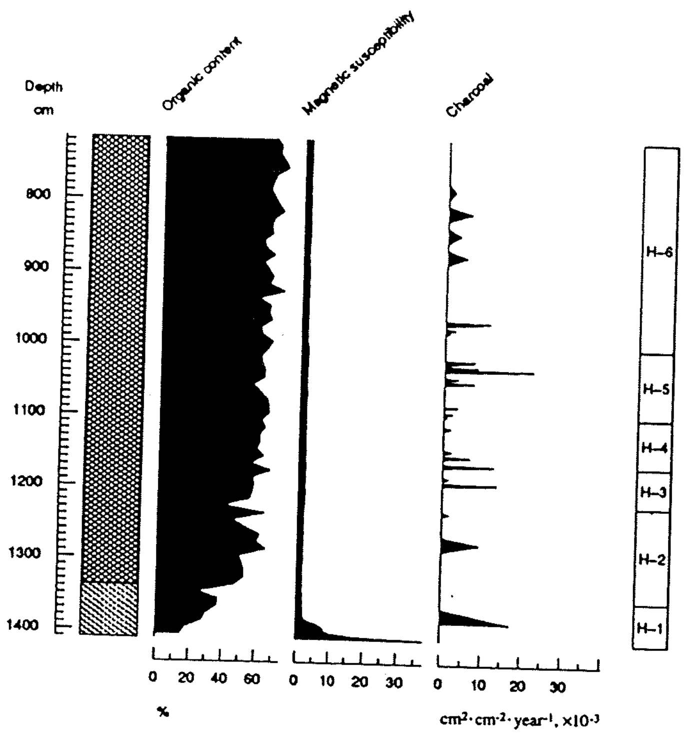
Figure 5 A tentative correlation between the northern forest limit in North America (from Lamb, 1977), lake-level fluctuations in the Jura, and glacier movements and tree-limit variations in the Alps. Note uncalibrated radiocarbon timescale

Fig. 4. (*a*) Percentages of the most common pollen and spore taxa for High Lake plotted against depth. Values for taxa present at low abundances are exaggerated by ×10. A time scale and location of the calibrated radiocarbon ages are plotted on the left next to the lithostratigraphic column (Troels-Smith 1955). (*b*) Pollen and charcoal accumulation rates for High Lake plotted against depth.



Fuller 1997

Fig. 6. Organic content (as a percentage of dry weight), magnetic susceptibility (uncalibrated units) and charcoal accumulation rates of High Lake sediments.



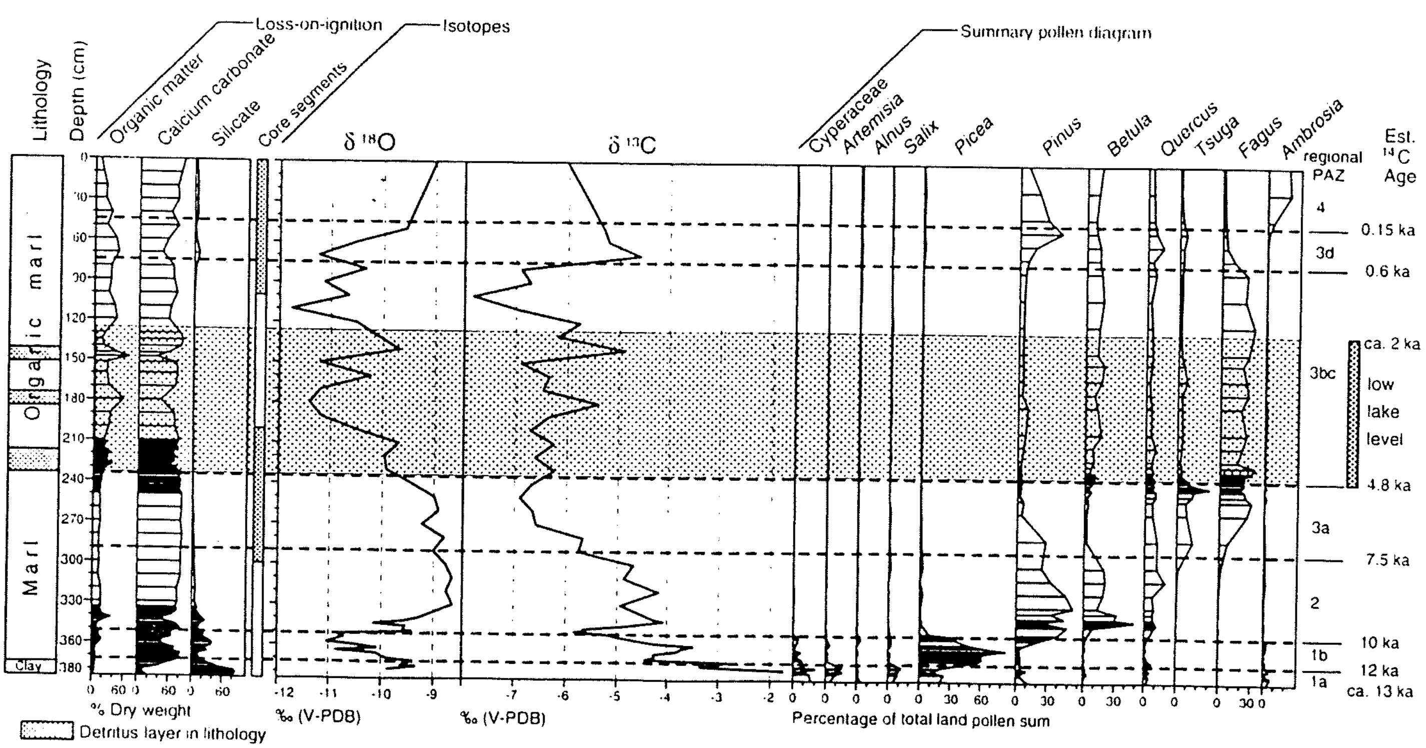


Figure 3. Lithology, isotope, and summary pollen diagrams of core SC at Crawford Lake. Chronology was based on ^{14}C dates from this site and pollen correlation with nearby dated pollen sequences. Isotopic covariance of $\delta^{18}O$ and $\delta^{13}C$ shows Spearman correlation coefficients of 0.15 for interval from 378 to 240 cm (ca. 12 to 5 ka), 0.40 for that from 230 to 130 cm (5 to 2 ka), and –0.30 for that from 120 to 0 cm (2 to 0 ka). V-PDB = Vienna Peedee belemnite.

Yu et al. 1997

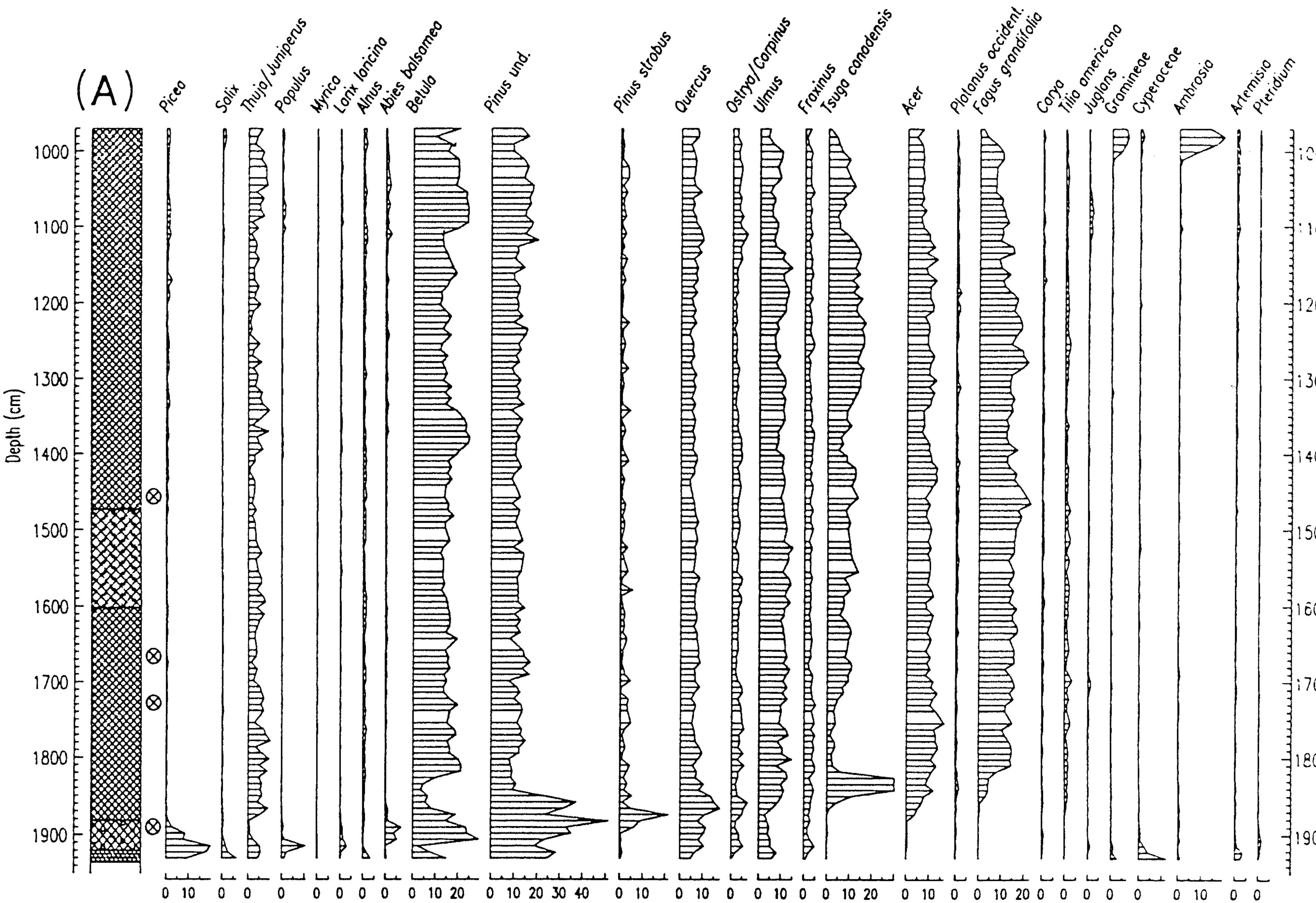
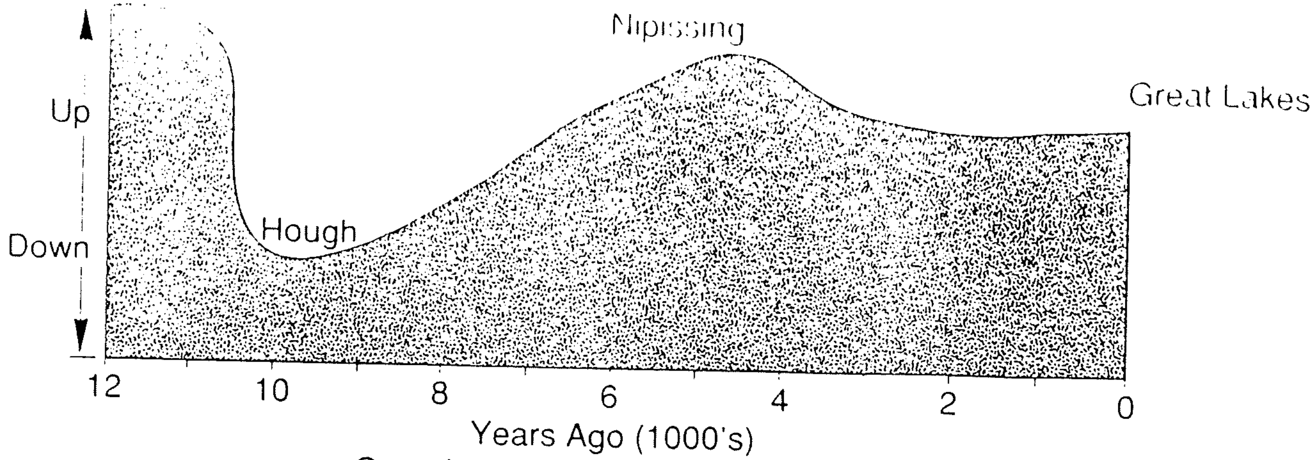


FIG. 3. Pollen percentage diagrams for two sequences of lake sediments on the Bruce Peninsula, southern Ontario, at (A) Mary Lake, Grey Co., and (B) Bartley Lake, Bruce Co. Selected taxa only are shown. The complete data set is available from the author on request. All depths are measured from the lake surface. A simplified sediment stratigraphy, using the symbols of Troels-Smith (1955) is indicated at the left of each diagram. The position of radiocarbon dates at Mary Lake is indicated by crossed circles (see Table 3 and Fig. 5).



Georgian Bay Changing Levels

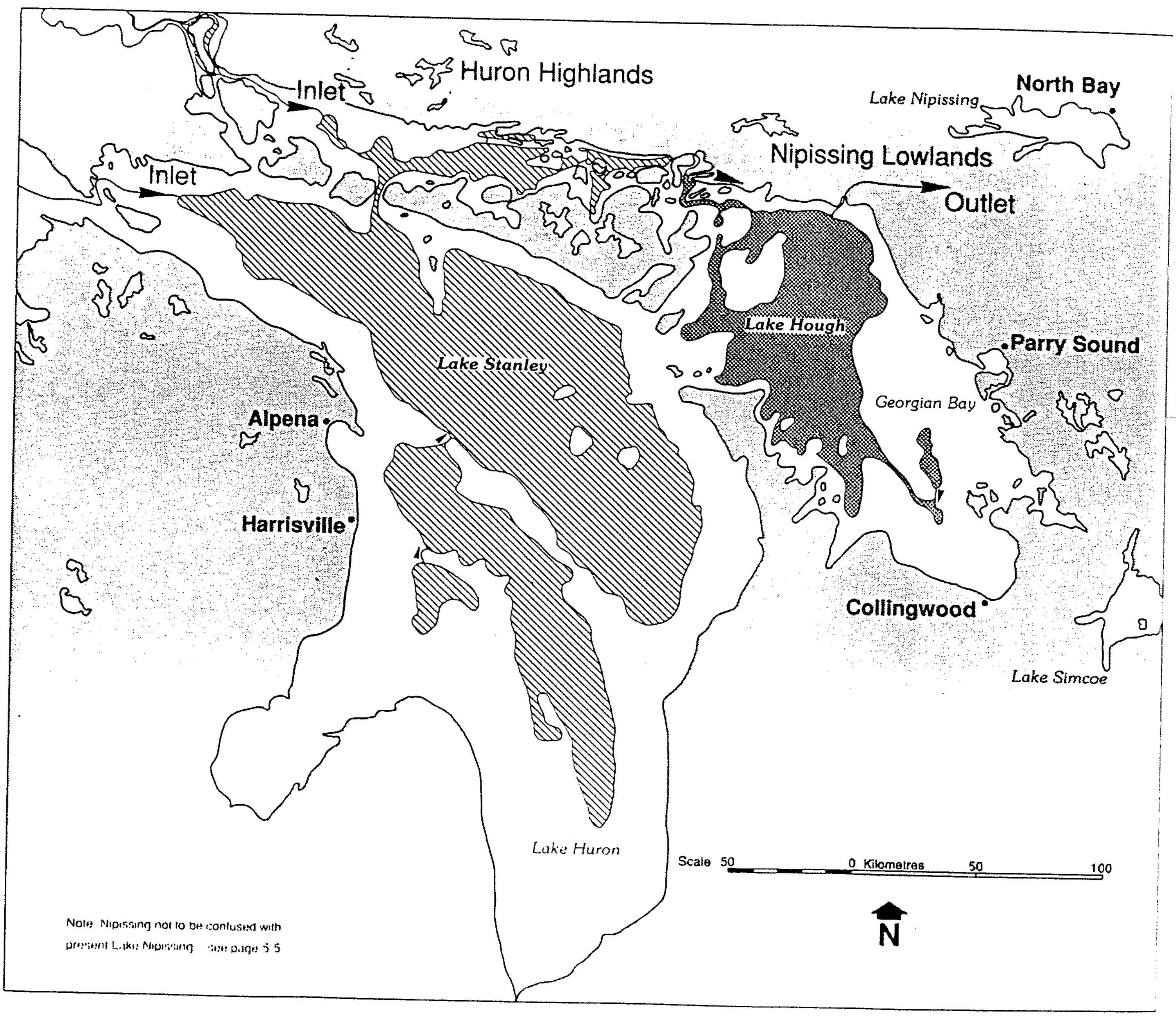
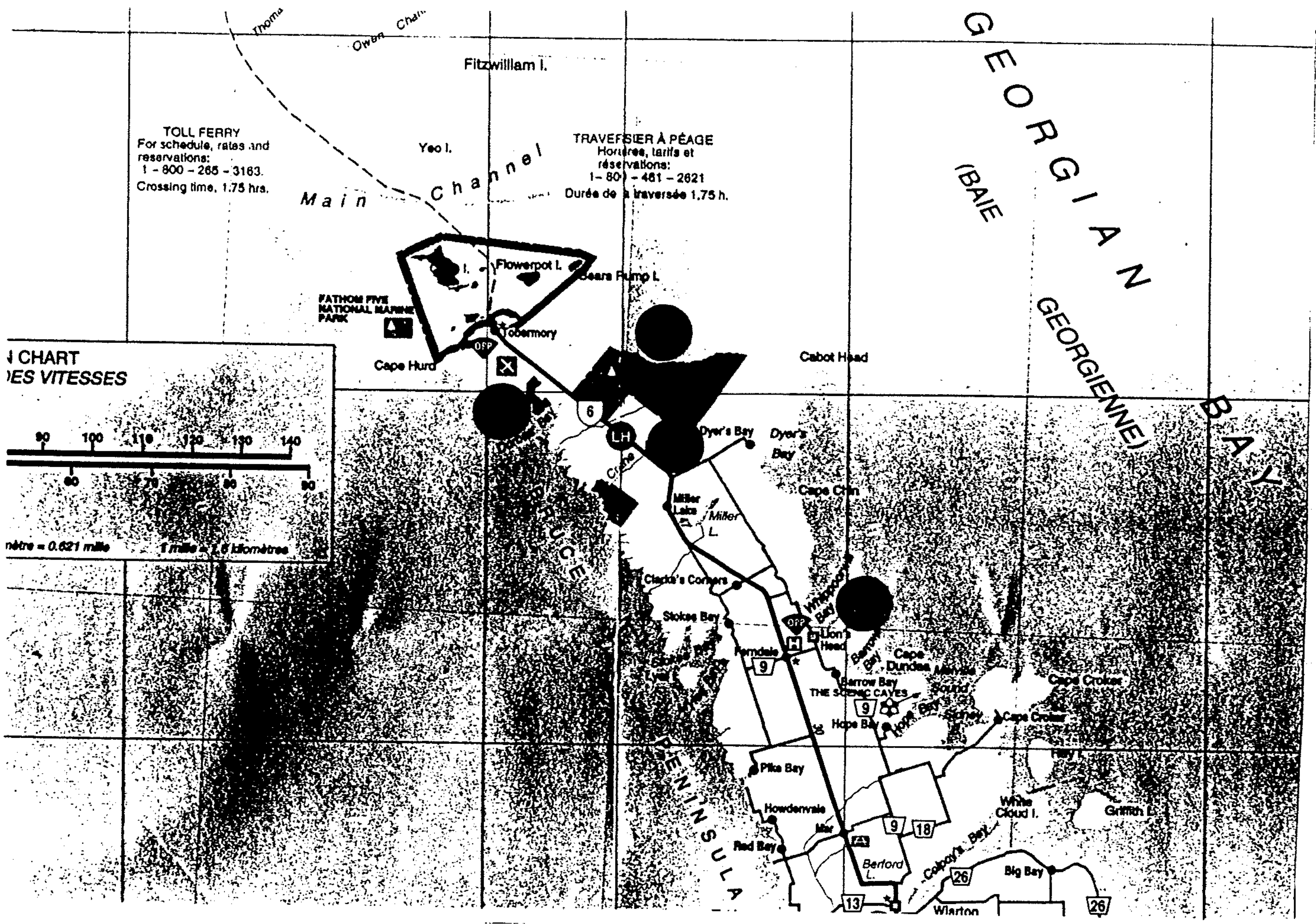


Figure 5-4 **LOW LEVELS: LAKE HURON AND GEORGIAN BAY**

August 24

Main theme:
Bruce Peninsula flora and vegetation history



Breakfast at Lion's Head Beach Motel and Mom's Motel.

9 a.m.:	Departure for **Shouldice Lake**: Holocene Vegetation History. Lake level rise and fall of Lake Huron / Georgian Bay and the Great Lakes. Alvar vegetation.
12 a.m.:	Walk through **Bruce Peninsula National Park**, Flora of the Niagara Escarpment;
Lunch	at Georgian Bay.
4 p.m.	Departure for **Dorcas Bay**: Examples of Bog Flora of the Bruce Peninsula.
Thereafter:	Dinner on your own in Tobermory
9 p.m.:	Departure from Tobermory for Lion's Head

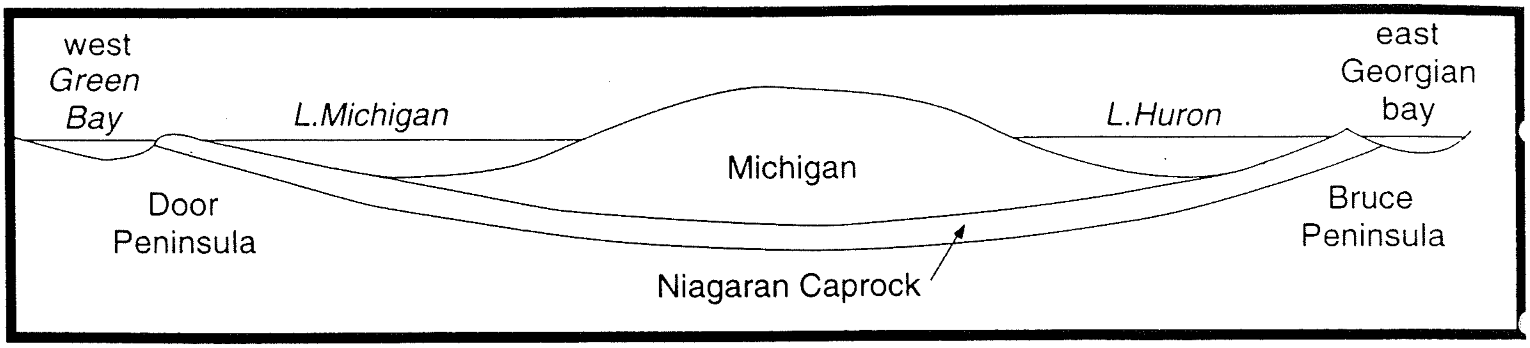
Overnight in Lion's Head (Lion's Head Beach Motel and Mom's Motel).

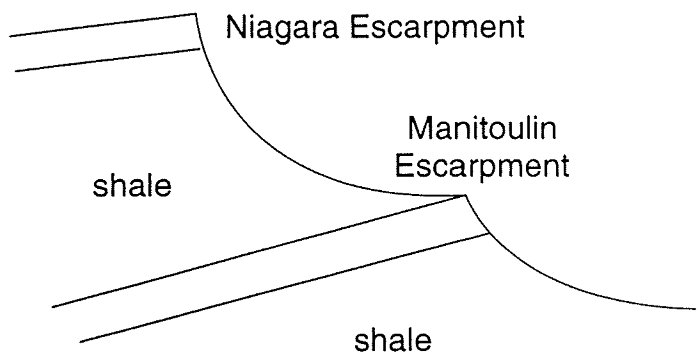
A Newsletter for the Earth Sciences

Quaternary Sciences Institute

University of Waterloo, Waterloo, Ontario, N2L 3G1 Publication QSI PFK 9

What is the Niagara Escarpment?

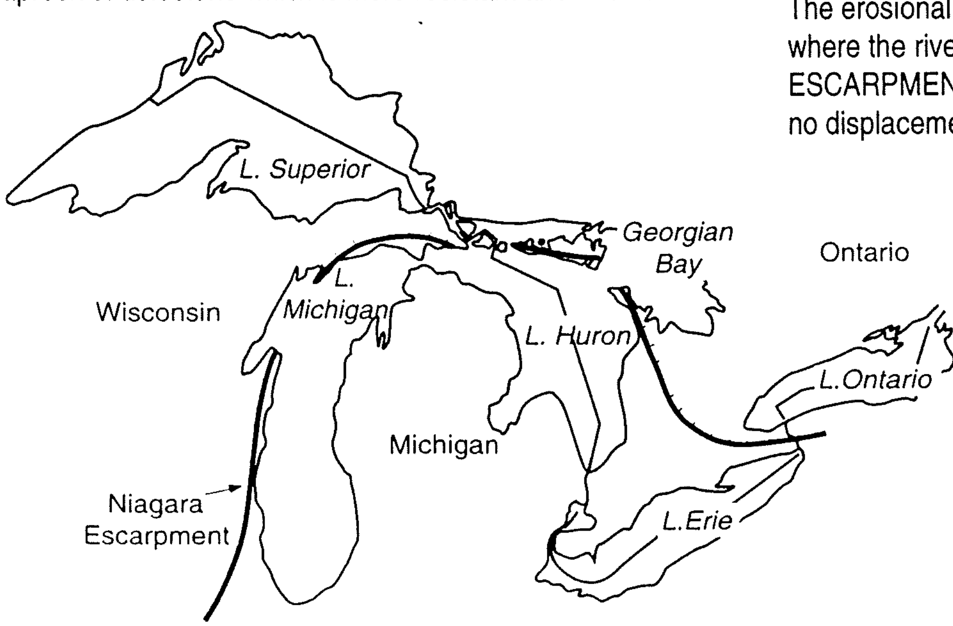




The Niagara Escarpment is the most prominent of several escarpments formed in the bedrock of southern Ontario. It is traceable from the Niagara River to northern Michigan, forming the spine of the Bruce Peninsula and Manitoulin and other islands in northern Lake Huron. It also extends into New York State and Wisconsin, roughly encircling the Michigan structural basin in the bedrock.

How was it formed?

The Escarpment formed over millions of years through the differential erosion by weather and streams of rocks of different hardnesses. The Niagara Escarpment has a caprock of dolostone which is more resistant and overlies weaker, more easily eroded shale rocks. Through time the soft rocks weather and erode away by the action of streams. The gradual removal of the soft rocks undercuts the resistant caprock, leaving it standing as a cliff - the escarpment. The erosional process is most readily seen at Niagara Falls, where the river has speeded the process.THE NIAGARA ESCARPMENT IS NOT FORMED BY FAULTING. There is no displacement of the rock layers at the Escarpment, as shown by study or rock exposures and drillholes. Additional resistant rock layers make more than one escarpment in some places. Also, in some places thick glacial deposits conceal the Niagara Escarpment, such as north of Georgetown, but it continues underground and reappears farther north.



Bruce Peninsula

The Bruce Peninsula is well known for its rich and varied flora, the diversity of habitats and for its beautiful scenery. As for August we are a bit late, but nevertheless we hope to get some impressions of the interesting flora today (even if it was a rather dry year up here this year....). The region was deglaciated around 12,000 years ago leaving most of the land inundated by the waters of glacial Lake Algonquin. As the land recovered from the weight of the ice, it began to emerge from the waters of this lake. Lake Huron and Georgian Bay originated from this process. Since then the changing land and lake levels greatly affected the area, which became a meeting point for plant and animal migrations. As a result the flora and fauna became rich and diverse. Today, besides a flora and vegetation characteristic of its location near the northern limit of the mixed forest region of the Great Lakes, this area contains plants more characteristic of the prairies, of the Atlantic shorelines, of the deciduous forests to the south and the arctic tundra to the north! Many of these grow side by side with Great Lakes endemics. A very diverse number of habitats as well as the varied topography allows a rich flora, also greatly influenced and tempered by the waters of the Great Lakes. We will visit some few of these habitats only, but we hope to introduce you in the beautiful scenery of the Bruce.

Shouldice Lake and surroundings

The alvars and open shrub forests near Shouldice Lake, especially between the Hwy 6-junction and Dyer Bay are extremely rich. The rock is dolomite, often polished by glaciers with deep fissures. Shrub community is made of *Picea glauca* (white spruce), *Populus tremuloides* (trembling aspen), *Betula papyrifera* (paper birch), *Thuja occidentalis* (cedar), *Pinus banksiana* (Jack pine), *Pinus resinosa* (red pine), and *Pinus strobus* (white pine).

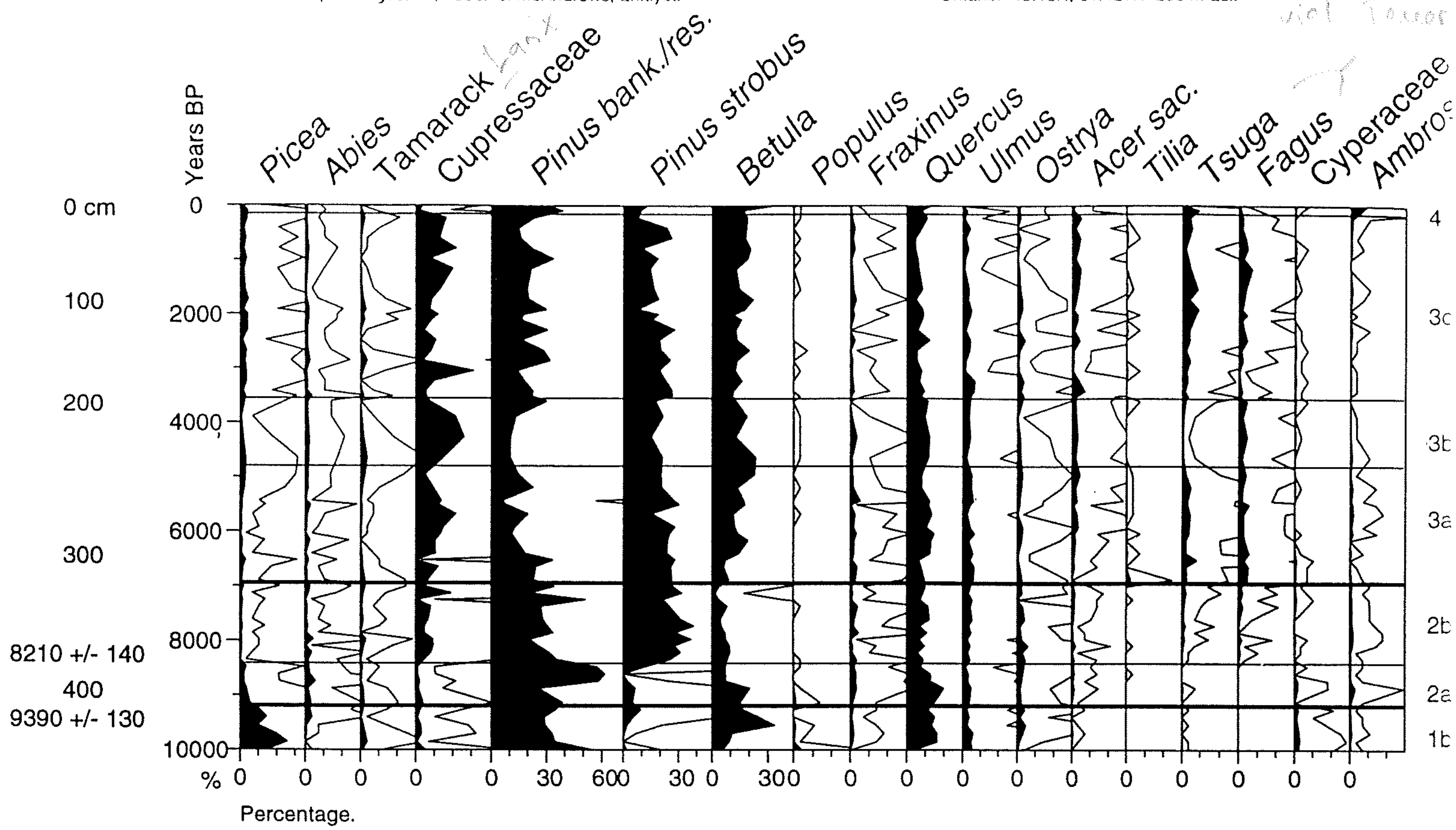
Interesting plants include:

Iris lacustris	Great Lakes endemic
Hymenoxys acaulis var. *glabra*	Great Lakes endemic

Cypripedium calceolus
Lilium philadelphicum
Calamintha arkansana
Zigadenus elegans
Polygala senega, Polygala paucifolia
Carex richardsonii, C. scirpoidea, C. eburnea, C. flava, C. buxbaumii, C. bebbii, C. crawei, C. garberi, C. capillaris
Trientalis borealis
Linnaea borealis
Pyrola rotundifolia
Senecio pauperculus
Arabis lyrata
Aquilegia candensis
Saxifraga virginiensis
Lonicera dioica
Smilacina lacustris
Arenaria serpylifolia
Viola nephrophylla
Petasites palmatus
Cornus racemosa
Castilleja coccinea
Minuartia michauxii
Campanula rotundifolia
Deschampsia caespitosa
Potentilla fruticosa
Arctostaphylos uva-ursi
Juniperus communis, J. horizontalis
Thelypteris thelypteroides
Pteridium aquilinum
Asplenium trichomanes
Oryzopsis pungens

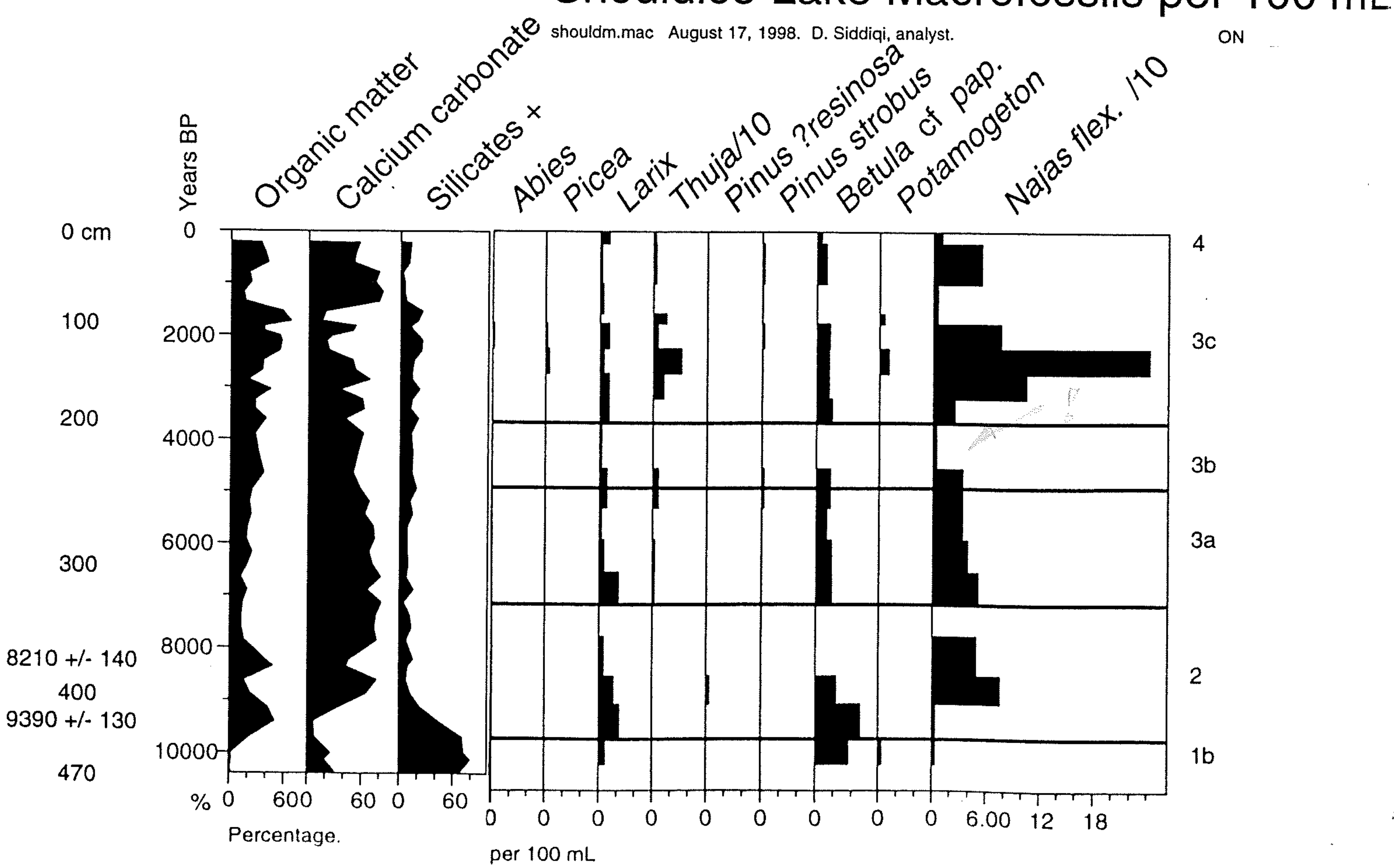
Shouldice Lake Pollen Diagram

shouldl.pol August 17, 1998. J. McAndrews, analyst. Ontario. 45.15N, 81.42W. 206 m asl.



Shouldice Lake Macrofossils per 100 mL

shouldm.mac August 17, 1998. D. Siddiqi, analyst. ON



Dorcas Bay

Be careful: There are snakes here!!!

The calcareous fens and dolomite rocky shores on the west side of the Bruce Peninsula are of particular interest. Because of the gentles slopes (the Niagara escarpment cliffs are on the eastern side of the Bruce Pensinsula!) we find extensive low shorelines, either fissured in dolomite , or as marshes and fens. Perhaps the best fen on the Bruce Peninsula known for its orchid diversity is the fen at Dorcas Bay, dominated by *Cladium mariscoides*. Even if we are a little late in the year, enjoy for example the *Sarracenia purpurea* stands!

Most interesting plants are:
(plant list partly after J.N. Haas, S. Karg and H. Zoller, summer 1996 & 1997)

Sarracenia purpurea	
Equisetum variegatum	Northern element
Solidago ohioensis	Great Lakes endemic
Iris lacustris	Great Lakes endemic
Cacalia tuberosa	Southern element
Pinguicula vulgaris	Northern element
Triglochin maritima	Maritime element
Hypericum kalmianum	Great Lakes endemic
Primula mistassinica	

Carex aquatilis, C. sterilis, C. scirpoidea, C. flava, C. buxbaumii, C. capillaris (northern element)
Cladium mariscoides
Drosera linearis, Dr. rotundifolia
Parnassia glauca
Andromeda glaucophylla
Ledum groenlandicum
Salix candida
Menyanthes trifoliata
Utricularia cornuta, U. intermedia, U. vulgaris
Platanthera psycodes, P. dilatata, P. hyperborea
Scirpus caespitosus, Sc. americanus
Deschampsia caespitosa
Lilium philadelphicum
Eriophorum viridi-carinatum
Zigadenus elegans
Castilleja coccinea
Sisyrinchium mucronatum

Dorcas Bay - Rocky shores and sandy bays

Characteristic plants are:

Potentilla fruticosa, P. anserina	
Hypericum kalmianum	Great Lakes endemic
Solidago ohioensis	Great Lakes endemic
Carex garberi	Great Lakes endemic
Primula mistassinica	
Campanula rotundifolia	
Physocarpus opulifolius	
Prunus pumila	
Arabis lyrata	
Cerastium arvense	
Pinguicula vulgaris	
Minuartia michauxii	
Salix cordata	
Erigeron philadelphicus	

Dorcas Bay - Shrub woodland and openings

Iris lacustris	Great Lakes endemic
Primula mistassinica	
Comandra umbellata	
Castilleja coccinea	
Arabis lyrata	
Cirsium hillii	Great Lakes endemic
Aquilegia canadensis	
Cypripedium calceolus, C. arietinum	
Viola nephrophylla	
Polygala paucifolia, P. senega	
Sisyrinchium mucronatum	
Corallorhiza striata	

Massasauga Rattlesnake

Canada

THE EASTERN MASSASAUGA RATTLESNAKE... A threatened species

The Eastern Massasauga rattlesnake, once found throughout Southern Ontario, is now reduced to a few scattered populations. Disappearing habitat and a much maligned reputation have contributed to the dwindling numbers.

The Massasauga's designation as a threatened species on the Canadian Endangered Species list indicates the need for public and government support. At one time national and provincial parks were the only haven for these animals but now the species is protected by law everywhere in Ontario.

WHAT TO LOOK FOR

The Massasauga is the only venomous snake in Eastern Canada. Look for a blunt tail normally ending in a rattle. All other Ontario snakes have pointed tails. Its heavy body and triangular head are tan-coloured with dark brown blotches. An adult is approximately 50-70 cm long. When disturbed, the snake vibrates its rattle, producing an insect-like buzz (the non-poisonous milk snake will vibrate its tail in dry leaves when disturbed). A new segment is added to the rattle each time the snake sheds its skin, which can be several times a year.

SNAKES ARE CARNIVORES

With the help of heat-sensitive pits on the face, the Massasauga is well adapted for catching its prey - small warm-bodied animals such as mice, chipmunks and small birds. When the snake strikes, venom is injected through two hollow fangs. Often within minutes the venom has caused sufficient internal damage to render the prey helpless. The snake can then eat with little risk of injury to itself.

RATTLESNAKE ENCOUNTERS

Massasaugas show a strong preference for marshes and coniferous forests, tending to avoid open areas, open water and mixed forests. As you approach a rattlesnake you won't neccessarily get a warning buzz. Parks Canada research determined that snakes failed to respond to human disturbance 60% of the time. As a precaution while hiking:

- Wear long pants and boots;
- Always look where you are putting your feet and hands;
- Do not attempt to capture or confine this or any other species – snakes may strike in self-defence.
- Keep your pet on a leash at all times. Dogs are inquisitive; rattlesnakes don't appreciate it and may bite in self-defence.

If you do hear a buzzing sound, locate the snake visually and move carefully around it. Allow the snake to escape. These snakes are not aggressive and will not chase you. Make note of the time and location of the encounter and report it to park staff. Be sure of your identification. This species is often confused with milk and water snakes.

IF SOMEONE IS BITTEN:

- keep the person calm
- cleanse the wound
- wrap the affected area with a firm bandage
- seek medical attention
- notify park staff

NEVER apply a tourniquet, cut the bite area, perform suction or apply ice. Do not let the patient walk.

Records show only two people in Canada have died from a Massasauga bite – neither received proper treatment.

WE HAVE SO MUCH TO LEARN

Since relatively little is known about these animals, the Warden Service at Bruce Peninsula National Park has developed a long-term research program. In past studies radio transmitters were implanted into several snakes. Today part of the program includes marking specimens with computer tags to help with population and growth rate studies. These tags are also used to deter illegal possession of animals. The results of these studies have identified the snake's preferred habitat, enabling the park to manage the population and provide for public safety.

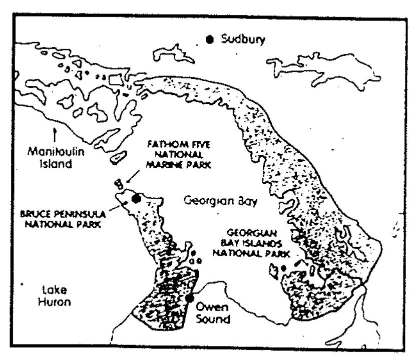
WHY CARE

The fact that rattlesnakes are declining should disturb us – these animals are an integral part of Ontario's ecosystem. When we step away from the myths and unnecessary fears we see that they are fascinating creatures.

Public education and an awareness of endangered species and spaces has given much support to the Eastern Massasauga. Hopefully, with continued effort, species such as this will be respected and not feared.

Rattlesnakes in Ontario

Although rattlesnakes formerly had a more extensive range, they are now chiefly confined to the green portions of the map and some islands in Georgian Bay.



Near Bruce Peninsula National Park, the following medical clinics have antivenin:

Tobermory Medical Clinic
Tobermory (519) 596-2305

Bruce Peninsula and District Memorial Hospital
369 Mary Street, Wiarton (519) 534-1260

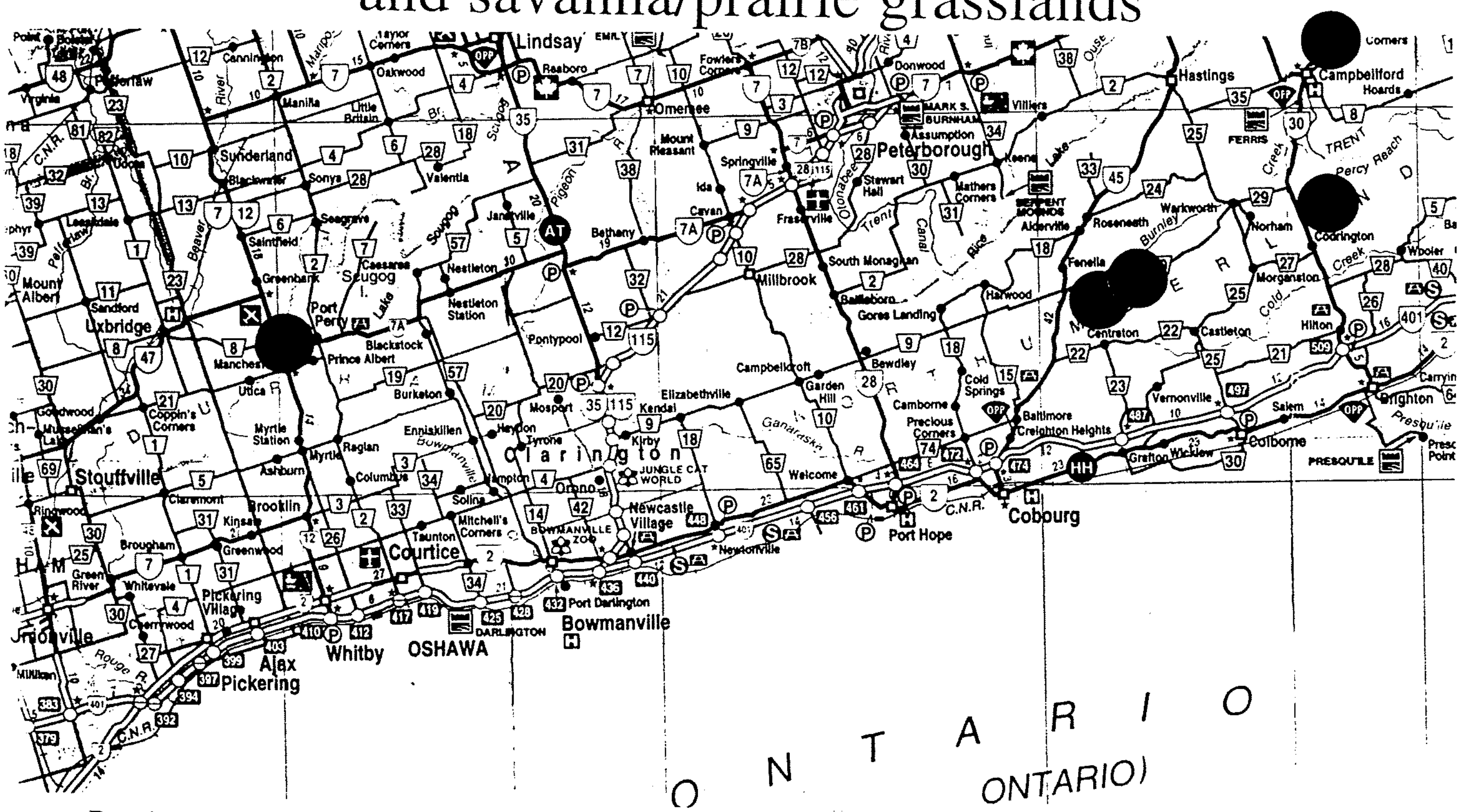
Red Cross Hospital
Lion's Head (519) 793-3424

August 25

Main themes:

Wild rice stands and wild rice gathering

Remants of old-growth forests and savanna/prairie grasslands



Breakfast at Lion's Head Beach Motel and Mom's Motel.

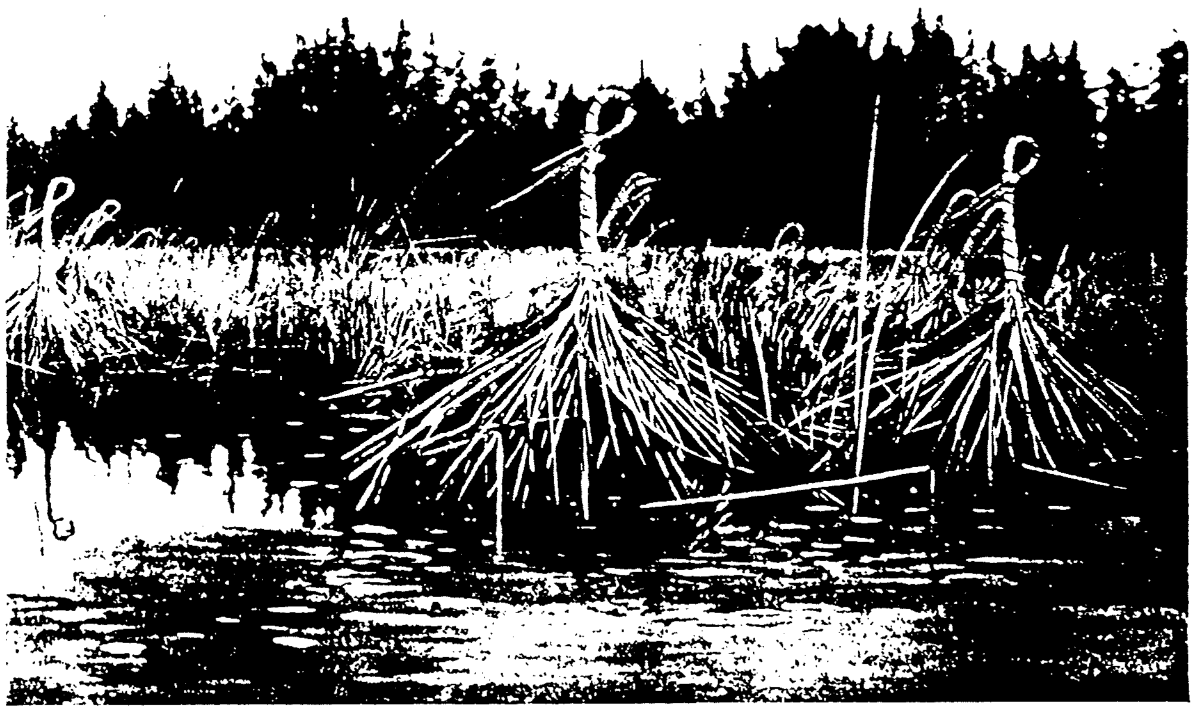
8 a.m.:	Departure for a relatively long travel day with common short-stops of interest.
Lunch	at Port Perry on your own.
ca. 2 p.m.	Short photo-stop of the Wild Rice stands at **Lake Scugog**.
ca. 3 p.m.	Visit and one-hour walk through the fantastic **Peter's Woods Provincial Nature Reserve**: old growth mesic forest (possibly up to 400 yrs. old).
ca. 5 p.m.	Visit to black oak savanna/prairie grassland remnants in **Red Cloud Cemetery**

Overnight in Codrington at Dunpollen (sorry, no Telephone) and at the Swiss managed (Familie Emmenegger!) Campbellford River Inn in Campbellford (Tel. -705-6531771). Dinner-Barbecue at Dunpollen.

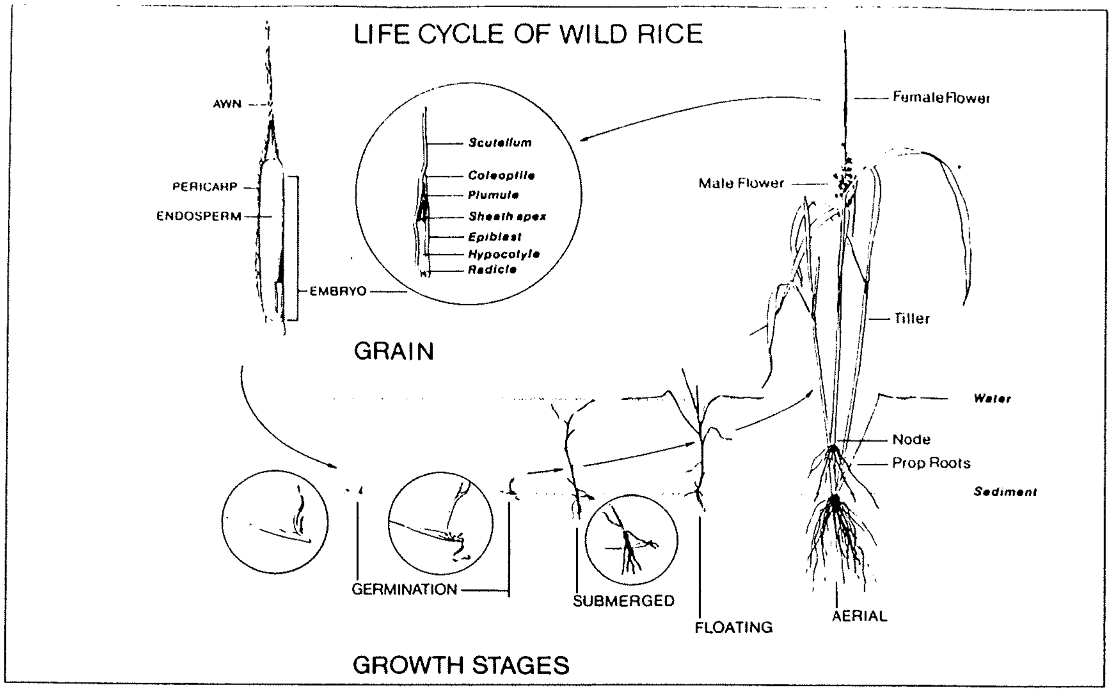
Lake Scugog

Wild Rice stands south of Highway 7

Wild Rice (*Zizania palustris* & *Z. aquatica*). This annual plant is now in full flower and will mature over the next two weeks. Pollen analysis of a core from the site indicates that the rice stand appeared during the historic zone 4 and was preceeded by a subzone 3d *Typha* marsh. The succession was probably caused by altered hydrology: the damming of the lake outlet to raise the lake's water level and the construction of the causeway which protected the site from waves.



Wild rice was first described by Gronovius of Holland, in 1743. A member of the grass family, wild rice has been a staple in the diet of North American Native peoples, particularly those of the Great Lakes Basin. Long prized by gourmets for its distinctive flavor and texture, varieties of wild rice are being grown commercially in increasing quantities.



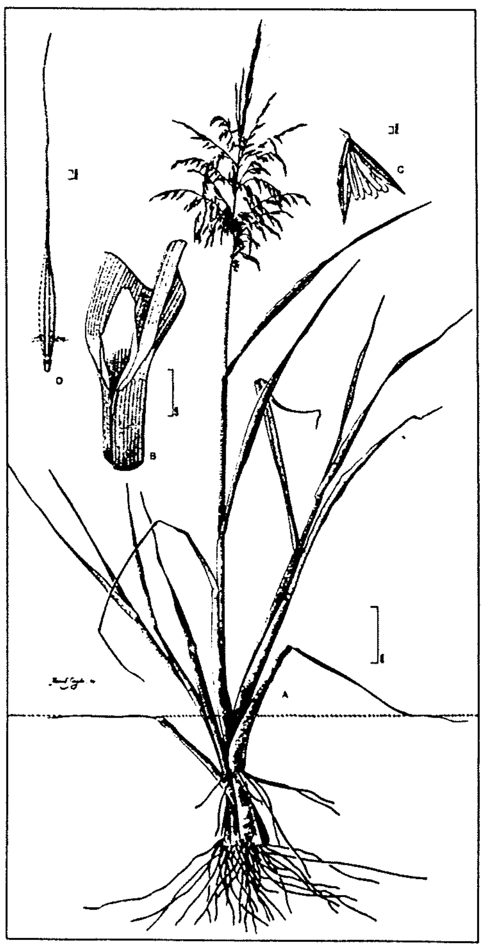


Fig. 7. *Zizania aquatica. (A)* Flowering plant, approximately 2 m high. *(B)* Junction between leaf sheath and blade showing ligule. Scale bar = 1 cm. *(C)* Pendulous male spikelet at anthesis showing six anthers. *(D)* Erect female spikelet with long awn. Scale bar = 1mm.

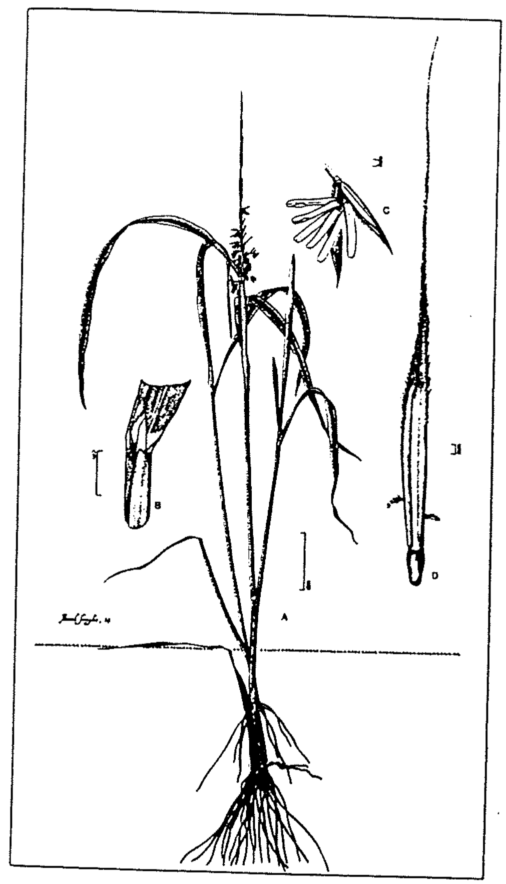


Fig. 8. *Zizania palustris. (A)* A flowering plant approximately 1.5 m high. *(B)* The junction between leaf sheath and blade showing ligule. Scale bar = 1 cm. *(C)* Pendulous male spikelet at anthesis, showing six anthers. Scale bar = 1 mm. *(D)* Erect female spikelet with long awn. Scale bar = 1 mm.

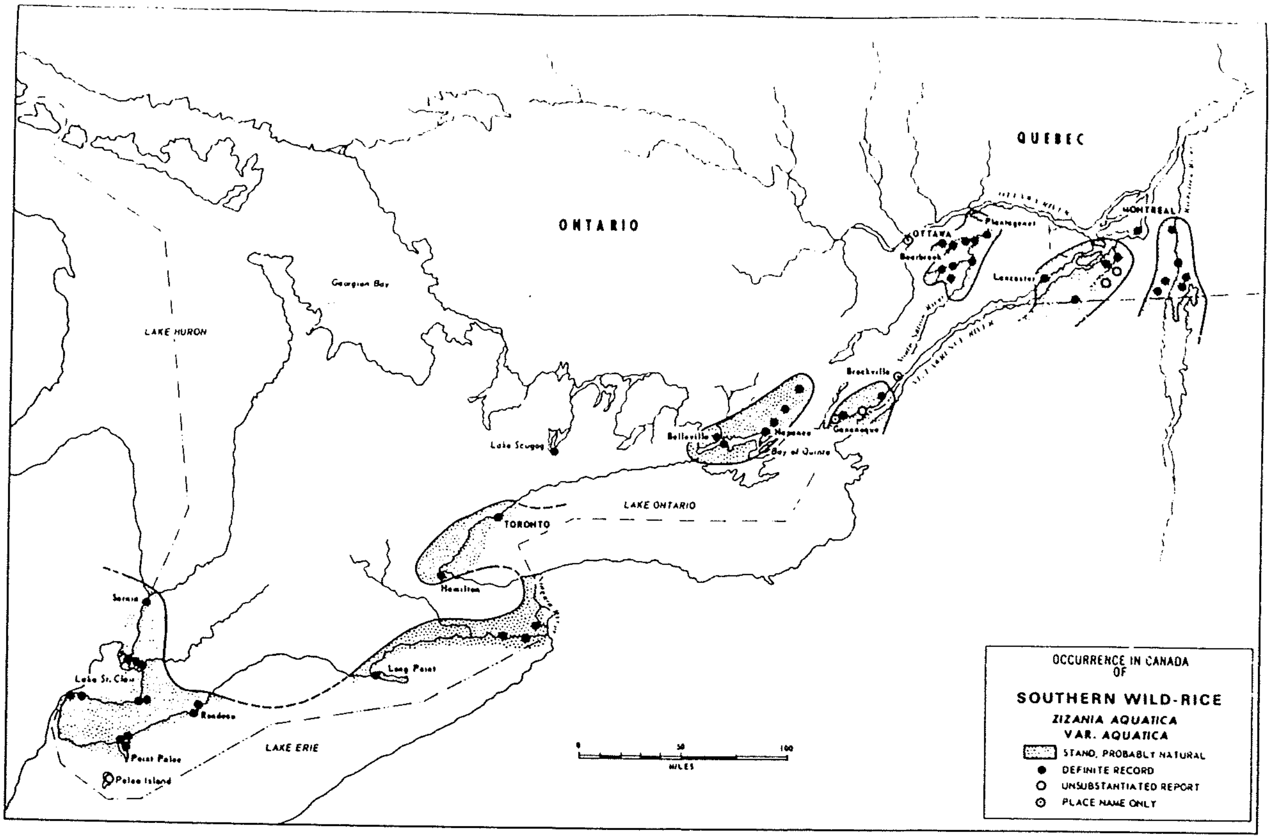


Fig. 9. Map of the distribution of *Z. aquatica.*

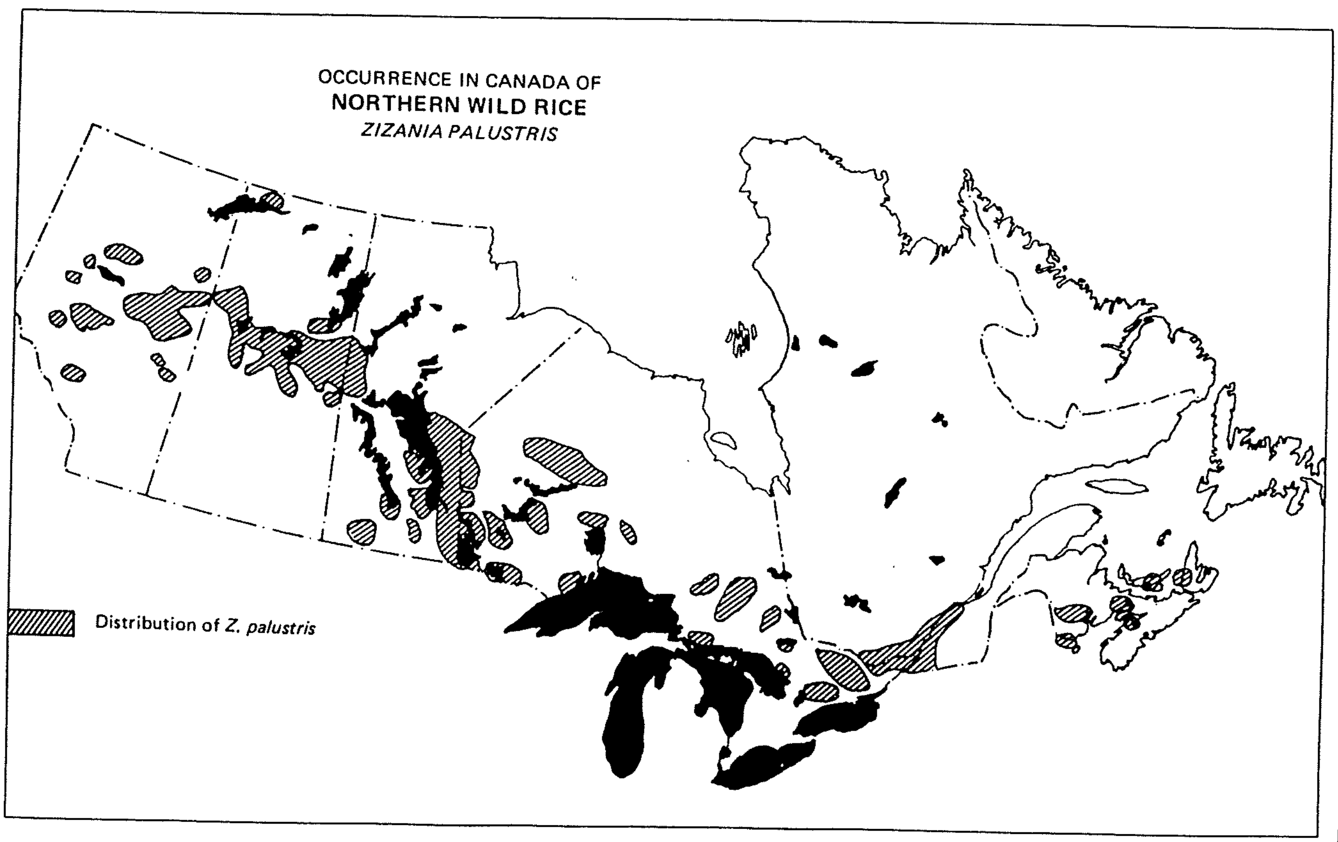


Fig. 11. Map of the distribution of *Z. palustris.*

Traditional 2-stick method of harvesting rice.

1. A Mississagua squaw parching wild rice by stirring over a slow fire. Near Harwood, Rice Lake, Ontario.

2. "Dancing" wild rice to separate the grain from the hulls. Near Harwood.

3. Winnowing wild rice. Near Harwood, Rice Lake, Ontario.

—*Adapted from photographic postcards.*

Fig. 34. Traditional methods of preparing wild rice for food.

Peter's Woods Provincial Nature Reserve

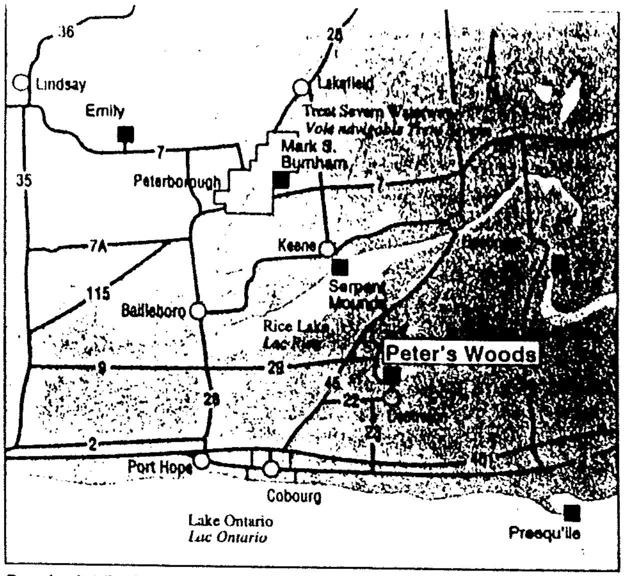
This Nature Reserve is one of the best remaining old growth mesic hardwood forest stands that is typical of the forest of Southern Ontario before being cleared by european farmers 150 years ago. Therefore the trees and and understory of Peter's Woods is a relic of such forests of late prehistoric time represented by pollen zone 3d (see Zoller and Haas 1995). Trees are perhaps as much as 400 years old; the main species are *Acer saccharum, Pinus strobus, Quercus rubra, Quercus alba, Betula alleghaniensis* and *Fagus grandifolia*. What is the explanation for the absence of *Pinus* and *Quercus* reproduction?. Observe the relatively rare, old and decaying *Pinus strobus* trees and stumps. Note the microtopography of pits and mounds from trees blowing over. Why is *Tsuga canadensis* locally succeeding *Acer* and *Fagus*?*

1 Foto: Tsuga, Acer, Fagus dominant

* Vernässte Böden: Quellen im Wald!

Abbildung 2. Urwald mit bis zu 300 Jahre alten Bäumen (*Acer saccharum, Quercus rubra, Q. alba, Betula alleghaniensis* und *Fagus grandifolia)* in Peter's Woods, Provincial Nature Reserve (Ontario, Canada, 1994, phot. J.N. Haas).


Peter's Woods
Provincial Nature
Reserve
Legend:
Park boundary
intermittent stream
trail
vault privy
sensitive area
fence
bridge
P



Provincial Parks/*Parcs provinciaux* : ■

An Environmental Sanctuary

Experience the natural beauty of an original maple beech forest that once covered much of southern Ontario. Peter's Woods Provincial Nature Reserve is one of only a few natural woodlots remaining. The reserve is allowed to follow the natural processes of growth, decay and regeneration. Share this ecological history by examining the wide variety of trees and plants protected for scientific research, environmental education and natural science appreciation. Peter's Woods Provincial Park exists to maintain and perpetuate the natural features and communities that enrich our natural world.

A Protected Haven

In the early 18th century, pine and oak from this area was used for ships' masts and square timber. One hundred years later, much of the land in southeastern Ontario had been cleared by settlers for agriculture, and by the early 1900s the mature hardwood forests had virtually disappeared.

To preserve a part of the original hardwood forest, the Willow Beach Field Naturalists, a private conservation group, and the Ontario Ministry of Natural Resources set aside 55 hectares of land as a provincial nature reserve. The reserve is named after Mr. A.B. "Peter" Schultz, a leading member of the Willow Beach group.

The park protects a variety of environments including an upland woodlot, a cedar swamp, an open field and a grassed

Peter's Woods Provincial Park

Parc provincial Peter's Woods

Ontario

Provisional List of the Vascular Plants of Peter's Woods Provincial Nature Reserve

D A. Sutherland, Natural Heritage Information Centre, Peterborough, Ontario May 28, 1995

LYCOPODIACEAE	**CLUBMOSS FAMILY**
Lycopodium digitatum	Ground Cedar
Lycopodium lucidulum	Shining Clubmoss
EQUISETACEAE	**HORSETAIL FAMILY**
Equisetum arvense	Field Horsetail
Equisetum hyemale	Common Scouring-rush
Equisetum scirpoides	Dwarf Scouring-rush
OPHIOGLOSSACEAE	**GRAPEFERN FAMILY**
Botrychium multifidum	Leathery Grapefern
Botrychium obliquum	Oblique Grapefern
Botrychium virginianum	Virginia Grapefern or Rattlesnake Fern
OSMUNDACEAE	**FLOWERING FERN FAMILY**
Osmunda claytoniana	Interrupted Fern
DENNSTAEDTIACEAE	**FERN FAMILY**
Pteridium aquilinum	Bracken
DRYOPTERIDACEAE	**WOOD FERN FAMILY**
Athyrium filix-femina	Lady Fern
Athyrium thelypterioides	Silvery Glade Fern
Cystopteris bulbifera	Bulblet Fern
Cystopteris tenuis	Fragile Fern
Dryopteris carthusiana	Spinulose Wood-fern
Dryopteris intermedia	Glandular Wood-fern
Dryopteris X triploidea	Hybrid Wood-fern
Gymnocarpium dryopteris	Oak Fern
Matteuccia struthiopteris	Ostrich Fern
Onoclea sensibilis	Sensitive Fern
Polystichum acrostichoides	Christmas Fern
PTERIDACEAE	**FERN FAMILY**
Adiantum pedatum	Maidenhair Fern
THELYPTERIDACEAE	**FERN FAMILY**
Thelypteris noveboracensis	New York Fern
Thelypteris palustris	Marsh Fern
PINACEAE	**PINE FAMILY**
Pinus strobus	Eastern White Pine
Pinus sylvestris	Scots Pine
Tsuga canadensis	Eastern Hemlock
CUPRESSACEAE	**CEDAR FAMILY**
Thuja occidentalis	Eastern White Cedar
POACEAE	**GRASS FAMILY**
Brachyelytrum erectum	Bearded Shorthusk
Bromus inermis	Smooth Brome Grass
Dactylis glomerata	Orchard Grass
Danthonia spicata	Poverty Oat Grass
Elymus repens	Quack Grass
Glyceria striata	Fowl Manna Grass
Hystrix patula	Bottlebrush Grass
Milium effusum	Wood Millet
Oryzopsis asperifolia	Rough-leaved Mountain-rice
Panicum linearifolium	Linear-leaved Panic Grass
Phleum pratense	Timothy
Poa annua	Annual Blue Grass
Poa compressa	Canada Blue Grass
Poa pratensis	Kentucky Blue Grass
Schizachne purpurascens	False Melic Grass
CYPERACEAE	**SEDGE FAMILY**
Carex arctata	Sedge
Carex blanda	Sedge
Carex communis	Sedge
Carex crinita	Sedge
Carex deweyana	Sedge
Carex disperma	Sedge
Carex eburnea	Sedge
Carex gracillima	Sedge
Carex leptalea	Sedge
Carex leptonervia	Sedge
Carex peckii	Sedge
Carex pedunculata	Sedge
Carex pensylvanica	Sedge
Carex plantaginifolia	Sedge
Carex platyphylla	Sedge
Carex radiata	Sedge
Carex rosea	Sedge
Carex rugosperma	Sedge
Carex scabrata	Sedge
ARACEAE	**ARUM FAMILY**
Arisaema triphyllum	Jack-in-the-Pulpit
LEMNACEAE	**DUCKWEED FAMILY**
Lemna minor	Lesser Duckweed
JUNCACEAE	**RUSH FAMILY**
Juncus dudleyi	Dudley's Rush
Juncus tenuis	Path Rush
Luzula acuminata	Wood-rush
LILIACEAE	**LILY FAMILY**
Erythronium americanum	Yellow Trout-lily
Maianthemum canadense	Canada Mayflower
Maianthemum racemosum	False Solomon's-seal
Medeola virginiana	Indian Cucumber-root
Polygonatum pubescens	Solomon's-seal
Smilax herbacea	Carrion-flower
Streptopus roseus	Rose Twisted-stalk
Trillium erectum	Red Trillium
Trillium grandiflorum	White Trillium
Uvularia grandiflora	Large-flowered Bellwort

ORCHIDACEAE	ORCHID FAMILY
Galearis spectabilis	Showy Orchis

SALICAEAE	WILLOW FAMILY
Populus balsamifera	Balsam Poplar
Populus grandidentata	Large-toothed Aspen
Populus tremuloides	Trembling Aspen

JUGLANDACEAE	WALNUT FAMILY
Carya cordiformis	Bitternut Hickory

BETULACEAE	BIRCH FAMILY
Betula alleghaniensis	Yellow Birch
Betula papyrifera	White Birch
Carpinus caroliniana	Blue Beech
Corylus cornuta	Beaked Hazel
Ostrya virginiana	Hop-hornbeam

FAGACEAE	BEECH FAMILY
Fagus grandifolia	American Beech
Quercus alba	White Oak
Quercus rubra	Red Oak

ULMACEAE	ELM FAMILY
Ulmus americana	White Elm

URTICACEAE	NETTLE FAMILY
Laportea canadensis	Canada Wood Nettle

ARISTOLOCHIACEAE	BIRTHWORT FAMILY
Asarum canadense	Wild Ginger

POLYGONACEAE	BUCKWHEAT FAMILY
Rumex acetosella	Sheep-sorrel

CHENOPODIACEAE	GOOSEFOOT FAMILY
Chenopodium album	Goosefoot

PORTULACEAE	PURSLANE FAMILY
Claytonia caroliniana	Carolina Spring Beauty
Claytonia virginica	Virginia Spring Beauty

CARYOPHYLLACEAE	PINK FAMILY
Arenaria serpyllifolia	Thyme-leaved Sandwort
Cerastium fontanum	Common Chickweed
Cerastium semidecandrum	Mouse-ear Chickweed

RANUNCULACEAE	BUTTERCUP FAMILY
Actaea pachypoda	White Baneberry
Actaea rubra	Red Baneberry
Anemone canadensis	Canada Anemone
Anemone cylindrica	Thimbleweed
Anemone virginiana	Thimbleweed
Aquilegia canadensis	Wild Columbine
Hepatica acutiloba	Sharp-lobed Hepatica
Hepatica americana	Round-lobed Hepatica
Ranunculus acris	Tall Buttercup
Ranunculus abortivus	Kidney-leaved Buttercup
Ranunculus recurvatus	Hooked Buttercup
Thalictrum dioicum	Early Meadowrue

BERBERIDACEAE	BARBERRY FAMILY
Caulophyllum thalictroides	Blue Cohosh
Podophyllum peltatum	May-Apple

MENISPERMACEAE	MOONSEED FAMILY
Menispermum canadense	Canada Moonseed

FUMARIACEAE	FUMITORY FAMILY
Dicentra cucullaria	Dutchman's-breeches

CRUCIFERAE	MUSTARD FAMILY
Capsella bursa-pastoris	Shepherd's Purse
Erysimum cheiranthoides	Wormseed Mustard
Dentaria diphylla	Toothwort

SAXIFRAGACEAE	SAXIFRAGE FAMILY
Chrysosplenium americanum	Golden Saxifrage
Mitella diphylla	Mitrewort
Mitella nuda	Naked Mitrewort
Tiarella cordifolia	Foamflower

GROSSULARIACEAE	GOOSEBERRY FAMILY
Ribes cynosbati	Prickly Gooseberry
Ribes triste	Swamp Currant

ROSACEAE	ROSE FAMILY
Fragaria virginiana	Wild Strawberry
Geum aleppicum	Yellow Avens
Geum canadense	White Avens
Prunus pensylvanica	Pin Cherry
Prunus serotina	Black Cherry
Prunus virginiana	Choke Cherry
Potentilla norvegica	Cinquefoil
Potentilla recta	Rough Cinquefoil
Potentilla simplex	Field Cinquefoil
Rubus idaeus var. melanolasius	Red Raspberry
Rubus pubescens	Dwarf Raspberry

LEGUMINOSAE	PEA FAMILY
Amphicarpaea bracteata	Hog-peanut
Medicago lupulina	Black Medic
Trifolium pratense	Red Clover

GERANIACEAE	GERANIUM FAMILY
Geranium robertianum	Herb-Robert

POLYGALACEAE	MILKWORT FAMILY
Polygala paucifolia	Fringed Polygala

ANACARDIACEAE	CASHEW FAMILY
Rhus radicans ssp. rydbergii	Poison-ivy
Rhus typhina	Staghorn Sumac

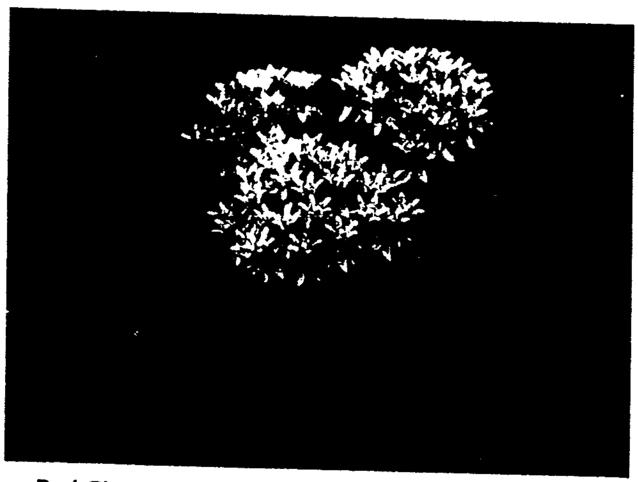
ACERACEAE	MAPLE FAMILY
Acer rubrum	Red Maple
Acer saccharum	Sugar Maple
Acer spicatum	Mountain Maple

BALSAMINACEAE	**BALSAM FAMILY**
Impatiens capensis	Spotted Touch-me-not
RHAMNACEAE	**BUCKTHORN FAMILY**
Rhamnus cathartica	Common Buckthorn
TILIACEAE	**LINDEN FAMILY**
Tilia americana	American Basswood
GUTTIFERAE	**ST. JOHN'S-WORT FAMILY**
Hypericum perforatum	Common St. John's-wort
VIOLACEAE	**VIOLET FAMILY**
Viola blanda	Small White Violet
Viola conspersa	Dog Violet
Viola cucullata	Marsh Blue Violet
Viola fimbriatula	Northern Downy Violet
Viola macloskeyi ssp. *pallens*	Smooth White Violet
Viola pubescens	Downy Yellow Violet
Viola sororia	Common Blue Violet
THYMELAEACEAE	**MEZEREUM FAMILY**
Dirca palustris	Leatherwood
ONAGRACEAE	**EVENING-PRIMROSE FAMILY**
Circaea alpina	Dwarf Enchanter's-nightshade
Circaea lutetiana var. *canadensis*	Enchanter's-nightshade
ARALIACEAE	**GINSENG FAMILY**
Aralia nudicaulis	Sarsaparilla
Panax trifolius	Dwarf Ginseng
UMBELLIFERAE	**CARROT FAMILY**
Osmorhiza claytonii	Sweet-cicely
CORNACEAE	**DOGWOOD FAMILY**
Cornus alternifolia	Alternate-leaved Dogwood
MONOTROPACEAE	**MONOTROPE FAMILY**
Monotropa uniflora	Indian Pipe
PYROLACEAE	**WINTERGREEN FAMILY**
Pyrola elliptica	Shinleaf
PRIMULACEAE	**PIMPERNEL FAMILY**
Trientalis borealis	Starflower
OLEACEAE	**OLIVE FAMILY**
Fraxinus americana	White Ash
APOCYNACEAE	**DOGBANE FAMILY**
Apocynum androsaemifolium	Spreading Dogbane
ASCLEPIADACEAE	**MILKWEED FAMILY**
Asclepias syriaca	Common Milkweed
HYDROPHYLLACEAE	**WATERLEAF FAMILY**
Hydrophyllum virginianum	Virginia Waterleaf
BORAGINACEAE	**BORAGE FAMILY**
Myosotis laxa	Smaller Forget-me-not
LABIATAE	**MINT FAMILY**
Leonurus cardiaca	Motherwort
Satureja vulgaris	Wild Basil
SOLANACEAE	**NIGHTSHADE FAMILY**
Solanum dulcamara	Bittersweet Nightshade
SCROPHULARIACEAE	**SNAPDRAGON FAMILY**
Verbascum thapsus	Common Mullein
Veronica americana	American Brooklime
Veronica arvensis	Field Speedwell
Veronica serpyllifolia	Creeping Speedwell
OROBANCHACEAE	**BROOMRAPE FAMILY**
Epifagus virginiana	Beechdrops
PHRYMACEAE	**LOPSEED FAMILY**
Phryma leptostachya	Lopseed
PLANTAGINACEAE	**PLANTAIN FAMILY**
Plantago rugelii	Rugel's Plantain
RUBIACEAE	**BEDSTRAW FAMILY**
Galium circaezans	Wild Licorice
Galium lanceolatum	Wild Licorice
Galium trifidum	Marsh Bedstraw
Galium triflorum	Fragrant Bedstraw
Mitchella repens	Partridge-berry
CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**
Diervilla lonicera	Northern Bush Honeysuckle
Lonicera canadensis	Canada Honeysuckle
Sambucus racemosa ssp. *pubens*	Red Elderberry
Viburnum acerifolium	Maple-leaved Viburnum
CAMPANULACEAE	**BELLFLOWER FAMILY**
Campanula rotundifolia	Harebell
COMPOSITAE	**ASTER FAMILY**
Achillea millefolium	Yarrow
Aster cordifolius	Heart-leaved Aster
Aster macrophyllus	Large-leaved Aster
Erigeron philadelphicus	Philadelphia Fleabane
Hieracium caespitosum	King Devil
Solidago altissima	Late Goldenrod
Solidago caesia	Bluestem Goldenrod
Solidago flexicaulis	Zig-zag Goldenrod
Solidago nemoralis	Gray Goldenrod
Taraxacum officinale	Common Dandelion
Taraxacum palustre	Marsh Dandelion

Red Cloud Cemetery

Black oak (*Quercus palustris*) savanna/prairie grassland remnants are rare in Ontario because of their value as agricultural soil. Red Cloud Cemetery is probably the best remaining example of dry prairie. In April of each year part of the Cemetery is burned to suppress shrubs such as *Rhus typhena* (Anacardiaceae) *and Populus tremuloides*. Grass dominants include *Andropogon gerardi, Agropyron trachycaulum, Schizachrium scoparium* and *Sorghastrum nutans*. Forbs include Blazing star (*Liatris cylindrica*, Asteraceae), Prairie buttercup *(Ranunculus rhomboideus)*, New Jersey tea (*Ceanothus americanus*, Rhamnaceae) and butterfly weed (*Asclepias tuberosa*), all together endangered species in Southern Ontario.

Pioneer Cemetery Saves Virgin Prairie



Red Cloud Cemetery, near Castleton, has preserved butterflyweed and other prairie species rare to Ontario.

Some places are special. Robert and Sarah Walker recognized this when they buried their infant daughter, Amarilla, in June 1858 amid the prairie flowers at Red Cloud, Ontario. Near Castleton in Cramahe Township, the site lies on the south edge of the Rice Lake Plains.

By 1880 Red Cloud was a thriving community with farms, mills and a school. Amarilla's burial place became a one-hectare cemetery, and thus a small piece of prairie grassland was protected from the plow. The headstones tell the story of this isolated pioneer community. By the 1930s most families had left Red Cloud as the soil was blown to dust and its fertility lost. Still, the Castleton Cemetery Board continued to care for the graves of families long gone. In the late 1960s, encouraged by a government reforestation program, the board planted hundreds of red pine. Slowly the trees grew and began to shade the prairie flora.

In the early 1990s, botanists Paul Catling and Vivian Brownell discovered the Red Cloud prairie in their studies of the Rice Lake Plains, recognizing prairie species rare to Ontario such as blazing star, prairie buttercup, New Jersey tea and butterflyweed. They shared their findings with the Lower Trent Region Conservation Authority (LTRCA), which sought the views of other experts such as Wasyl Bakowsky of the Natural Heritage Information Centre in Peterborough. He believes this pioneer cemetery contains the best example of dry prairie soil in Ontario. In many U.S. states, he notes, prairies were so thoroughly destroyed by settlement that their original composition was pieced together by studying the only remaining examples, which occur in cemeteries and along railway rights-of-way. Larry Lamb and Ron Sumner of the University of Waterloo surveyed the plants and recommended felling the pines to reduce shading and discourage poison ivy.

At first, Cramahe Township Council and the cemetery board were hesitant about managing Red Cloud as a heritage site, but with advice and technical support from LTRCA and funding from the Shell Environment Fund they have taken on the project. On a cold weekend in March 1996, volunteers started to cut down the pines. Six hundred trees and many weekends later, the prairie is open to the sun again. Volunteers have set up a monitoring program and plan to install a path to allow visitation without damage. Ed Heuvel, formerly LTRCA's stewardship coordinator and now a key volunteer, expects that the prairie vegetation will have come back fully in about five years. Robert and Sarah Walker would no doubt be pleased.

—Louise Livingstone

Plants of Red Cloud Cemetery, Northumberland County

Contributions by W. Bakowsky, P. Catling, V. Catling, J. Haas, S. Karg and J. McAndrews.

A "+" indicates alien species.

Trees

Acer negundo	Manitoba maple
Betula papyrifera	White birch
Crataegus sp.	Hawthorn
Fraxinus americana	White ash
Juniperus virginiana	Red cedar
Malus sp. (planted)	Apple+
Picea sp. (planted)	Spruce+
Pinus resinosa (planted)	Red pine
Pinus strobus	White pine
Pinus sylvestris (planted)	Scots pine+
Populus tremuloides	Trembling aspen
Prunus serotina	Black cherry
Quercus velutina	White oak
Thuja occidentalis	White cedar

Shrubs and vines

Amelanchier sanguinea	Saskatoon-berry
Arctostaphylos uva-ursi	Bearberry
Ceanothus americanus	New Jersey tea
Prunus susquehanae	Sand cherry
Prunus virginiana	Choke cherry
Rhus typhina	Staghorn sumach
Rosa blanda	Smooth rose
Salix humilis	Prairie willow
Rhus radicans	Poison-ivy
Rhus typhina	Staghorn sumach
Syringa vulgaris (planted)	Lilac+
Vitis riparia	Riverbank grape

Herbs, grass-like

Agropyrum trachycaulum	Slender rye-grass
Anderpogon gerardii	Big bluestem
Bromus inermis	Smooth brome+
Carex siccata	Hay sedge
Carex pensylvanica	Pensylvania sedge
Carex richardonii	Richardson's sedge
Danthonia spicata	Poverty grass
Panicum perlongum	Panic grass
Poa compressa	Canada bluegrass
Poa pratensis	Kentucky bluegrass+
Schizachrium scoparium	Little bluestem
Sorghaastrum nutans	Indian grass
Sisyrinchium sp.	Blue-eyed grass

Fern

Pteridium aquilinum	Bracken fern

Herbs, broad-leaved

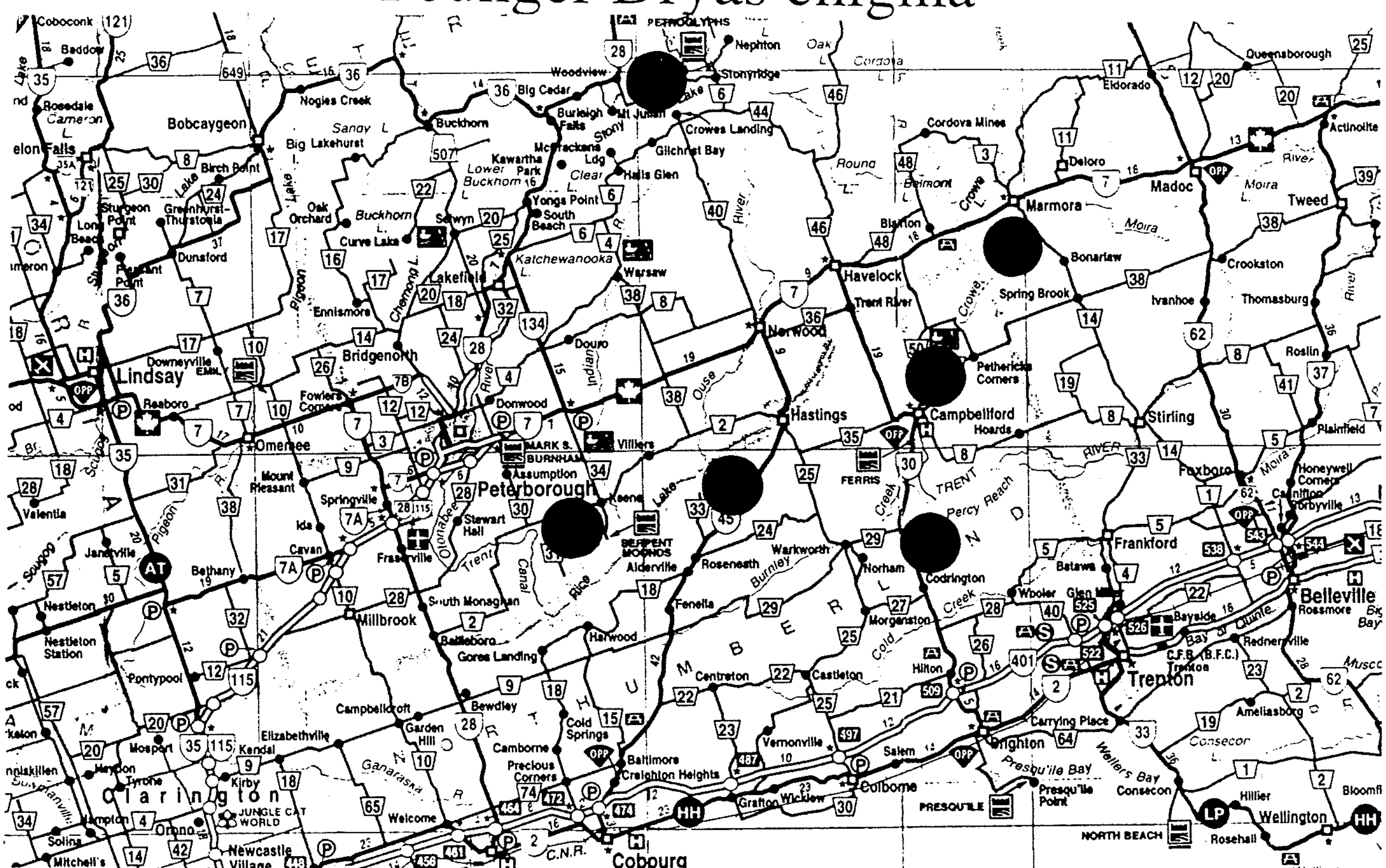
Anemone cylindrica	Long thimbleweed
Asparagus officinalis	Asparagus+
Aster laevis	Smooth aster
Aster ericoides	Heath aster
Aster oolentangiensis	Sky-blue aster
Apocynum androsaemifolium	Spreading dogbane
Antennaria neglecta	Pussytoes
Ascepias tuberosa	Butterfly weed
Calystegia spithamea	Upright bindweed
Conyza canadensis	Horseweed+
Chrysanthemum leucanthemum	Oxeye daisy
Epipactus helleborine	Helleborine+
Euphorbia cyparissias	Spurge+
Fragaria virginiana	Wild strawberry
Hypericum perforatum	Common St. John's wort+
Iris sp. (planted)	Iris+
Lechea intermedia	Pinweed
Liatris cylindracea	Cylindrical blazing-star
Lilium philadelphicum	Wood lily
Linum sulcatum	Yellow flax
Medicago lupulina	Black medick+
Monarda fistulosa	Wild bergamot
Monotropa hypopythys	Pinedrops
Oxalis stricta	Wood sorrel
Phlox pilosa	Downy phlox
Potentilla recta	Rough-fruited cinquefoil+
Ranunculus rhomboideus	Prairie buttercup
Saxifraga virginiensis	Early Saxifrage
Solidago juncea	Early goldenrod
Taraxacum officinale	Dandelion+
Tragopogon pratensis	Goat's-beard+
Trifolium pratense	Red clover+
Verbascum thapsus	Common mullein+
Viola sagitatta	Arrow-leaved violet

74 species

August 26:

Main themes:

Precambrian Canadian Shield, Prehistoric wild rice gathering, Late-Glacial deglaciation succession and Younger Dryas enigma



5.30 a.m.! Wild-turckey-watching for those interested early risers on this beautiful summer morning!

7.30 a.m. Breakfast at Dunpollen and at the Campbellford River Inn.

8.30 a.m. Departure for **Marmoranton Iron Mine**: Shrub community on dry limestone. Short visit of a deciduous tree swamp with *Acer saccharinum, Fraxinus nigra* and fern communities. Short stop at famous contact zone between Precambrian Canadian Shield (1'000'000 yrs old) and Palaeozoic sediments (500'000 yrs old).

Lunch at **McGinnis Lake** (a wonderful Chara-Lake!). Discussion of the McGinnis pollen profile for the last 3000 years.

1.30 p.m. Visit of **Petroglyphs in Petroglyph Provincial Park**: Petroglyphs and their age?

3 p.m. **Rice Lake**: Serpent Mounds: Holocene lake levels of Rice Lake. Prehistoric Wild Rice (*Zizania*)-gathering.

5 p.m. **Webb's Lake**: Late Glacial vegetation history and wetland forest succession.

Overnight at Dunpollen and at the Campbellford River Inn in Campbellford. Dinner-Barbecue at Dunpollen.

Marmoranton Iron Mine

1. Shrub and tree community on dry limestone

Species list (Haas & McAndrews, June 1998)

--> Collection of specimen is possible at this locality!

Prunus virginiana
Juniperus communis
Amelanchier laevis
Crataegus sp.
Symphoricarpus albus
Cornus rotundifolia
Viburnum spec.
Rhus radicans (!)
Rhus cf. *aromatica*
Rhus typhina
Ceonothus americanus (Rhamnaceae)
Asclepias syriaca
Quercus alba
Quercus rubra
Ostrya virginiana
Betula papyrifera
Acer saccharum
Fraxinus americana
Tilia americana
Pinus strobus

2. Marmora-wet-forest:

Acer saccharinum
Acer rubrum
Ulmus americana
Fraxinus nigra
Tilia americana
Thuja occidentalis
Onoclea sensibilis
Equisetum scirpoides

3. Short stop on the Canadian Shield for getting an impression on Flora and vegetation types

McGinnis Lake

This lake is one of the nicest spots for having a lunch and viewing its brilliant jade colour, but it also represents an interesting marl and *Chara* lake, and please be aware: You are in Black Bear country! The lake is steep-sided, wind-protected, and hence meromictic. The deep water of the lake is coloured light purplish from anaerobic purple bacteria. The lake (near the prehistoric petroglyphs) is of palaeoecological interest. The pollen diagram of the upper 120 cm shows that the rate of marl sedimentation is obviously extremely low. The pollen diagram mainly represents regional pollen input for roughly the last 3000 years. Note the zonation.

Associated mixed forest trees which grow on shallow soils (and possibly influenced by former forest fires) include:

Tilia americana	Basswood
Populus tremuloides	Trembling Aspen
Acer saccharum	Sugar Maple
Acer rubrum	Red Maple
Thuja occidentalis	Eastern White Cedar
Pinus resinosa	Red Pine
P. strobus	White Pine
Quercus alba	White Oak
Q. rubra	Red Oak
Tsuga canadensis	Hemlock
Ostrya virginiana	Ironwood

On the thinly covered rocks and associated with the Petroglyphs we find a characteristic herb and grass community. Shallow soil plus hot and dry weather have created conditions for repeated fires. This has had an influence on the main plant species composition.

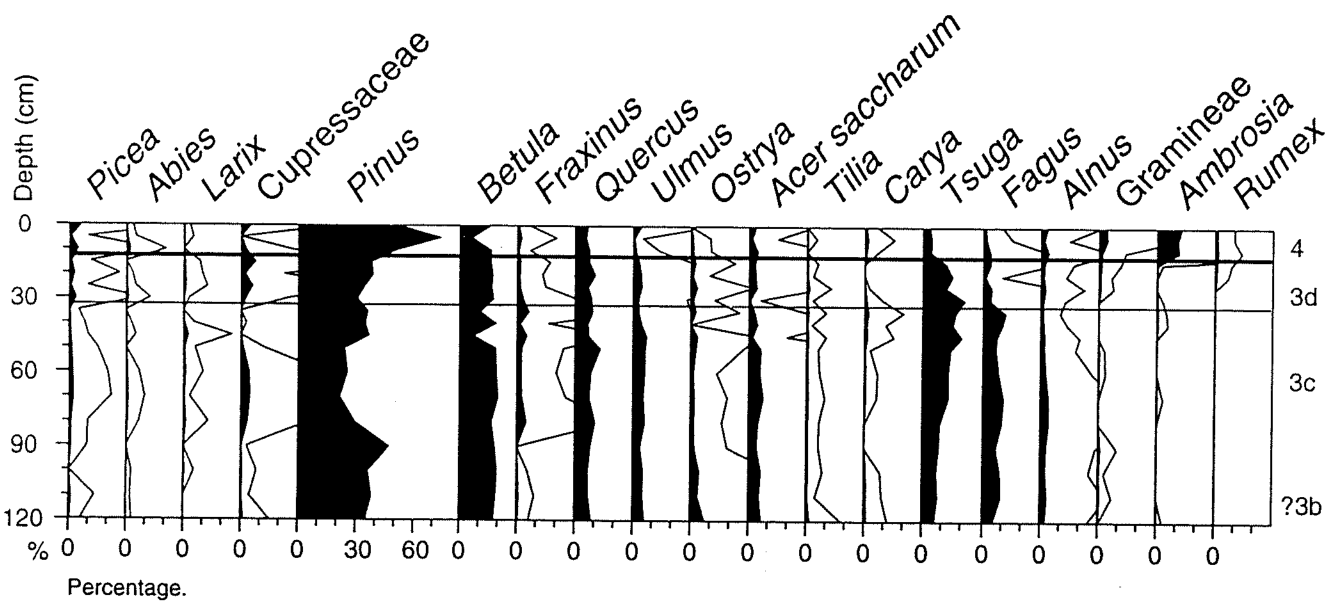
Phleum pratense	Timothy Grass	Corydalis sempervirens	Pale Corydalis
Oryzopsis asperifolium	Winter Grass	Aster macrophyllum	Aster
Panicum spp.	several species	Fragaria americana	Wild strawberry
Trifolium repens	Clover	Campanula rotundifolia	Bellflower
Trifolium hybridum	Aliske clover	Saxifraga virginiensis	Saxifrage
Rumex acetosella	Sheep sorel	Hypericum ellipticum	St. John's wort
Asclepias syriaca	Common milkweed	Cladonia raniferina	Reindeer Moss
Achillea millefolium	Yarrow	Pteridium aquilinum	Bracken
Verbascum thapsus	Mullein	Rhus radicans	Poison Ivy (!)

Late succession trees and shrubs include: :

Betula papyrifera	White Birch	Prunus pensylvanicum	Pincherry
Diervilla lonicera	Bush Honeysuckle	Acer rubrum	Red Maple
Amelanchier sp.	Juneberry	Populus tremuloides	Trembling Aspen
Corylus cornuta	Hazel	Shepherdia canadensis	Soapberry
Pinus strobus	White Pine	Vaccinium angustifolium	Blueberry
Picea glauca	White Spruce	Rhus typhina	Stag-horn sumac

McGinnis Lake (marl sediment)

mcginnis.pol July 27, 1998 R.J. Adams and J. McAndrews, analysts. ON Also ONTSUR 81. Tree sum.



McGinnis Lake

Gruppenfoto mit See (Karbonatschelf)

McGinnis Lake is a protected, glacial lake located in the southwestern corner of the park. Because of its many unusual and unique traits, it is often the focus of many visitors questions. It is 15 - 16 metres deep (approximately 45 feet), and its basin consists of limestone and gneiss.

Unlike normal lakes, where turnover of the top and bottom waters occur biannually, McGinnis Lake never experiences this turnover. This rare condition is termed as ***meromictic.*** The water in meromictic lakes is stratified into three different layers, each layer having a distinct chemical composition created by sharp temperature changes in the water column. The deepest layer of water in these lakes never mixes with the above two layers. Meromictic lakes generally occur in areas with steep-sided drainage basins, protecting the lake from wind-generated mixing.

Beyond the 12 metre level in McGinnis Lake, the water contains no oxygen. Due to this condition, the sediments are left virtually undisturbed by any organisms, as many are incapable of surviving in an oxygen-free environment. The accumulated sediments found at the bottom of McGinnis Lake date back to 10,000 years ago when the Wisconsin glacier began to retreat northwards at the end of the last Ice Age. Within these sediments are many organic compounds such as pollen and algae which are of great scientific value, as they can determine past environmental events which occurred around McGinnis Lake (e.g. forest fires, deforestation).

In the summer months, McGinnis Lake takes on another unique trait, its brilliant jade colour. ***Calcium carbonate*** ($CaCO_3$) , a byproduct of algae, is capable of cleansing a lake of coloured, dissolved substances, such as a freshwater lake's characteristic brown hue. This cleansing allows blue and green coloured wavelengths of light to penetrate into the deepest waters, reflecting a jade tone. As the temperature increases in the months of July and August, so does the amount of algae, as it thrives in warmer temperatures. An increase in algae thus increases the amount of dissolved calcium carbonate in the water, in turn increasing the water's clarity, therefore casting a more brilliant shade of green.

Due to the great increase in algae during the summer months, an overabundance of calcium carbonate can be produced, therefore some of it is precipitated out of the water onto the lake bed. This results in the production of ***marl*** - a whitish-gray, clay-like substance deposited along the shoreline of the lake. Marl is a mixture of trapped algae cells, insects, crustaceans, snail and clam shells, and other organic materials. Many benches of marl occur along the shoreline of McGinnis Lake, reaching over ten metres deep in some areas.

Park Information

In addition, a few sedimentological studies have recently been done at McGinnis Lake, one of them is a Msc. Thesis done at the University of Waterloo, ON:

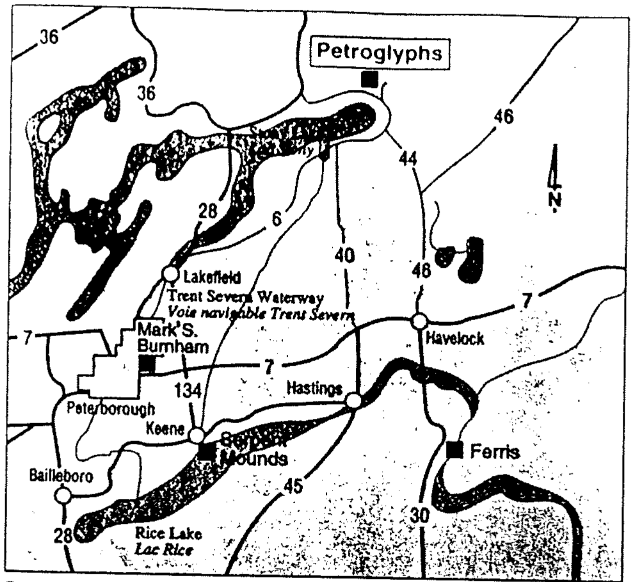
T.H. Hagan (1997): "Characterization of carbonate sediments from McGinnis Lake and Julian Lake, southern Ontario". Msc Thesis Univ. of Waterloo (student of Dr. Mario Coniglio)

ABSTRACT
Lacustrine carbonates (marl) in Julian Lake and McGinnis Lake, southern Ontario, form prograding benches along lake margins in both lakes, and also accumulate as large shoals in the centre of Julian Lake. Marl benches and shoals develop flat platforms and steeply inclined slopes (18-22∞ and 20-29∞ for Julian Lake and McGinnis Lake, respectively). A succession of plant communities extends from the shore, across the benches and shoals, and into deeper water. Basinward, these communities are terrestrial, emergent macrophytes, submergent macrophytes, charophytes, filamentous algae and bacteria, and anoxic tolerant communities (McGinnis Lake only). Benches and shoals are composed of a series of sediment facies that closely reflect the plant communities. A series of cores were extracted from each lake to establish the characteristics of these facies. From shoreline to basin, these facies are peat, carbonate mud, charophyte micrite, algal micrite, and cyanophyte-diatom micrite (McGinnis Lake only). With exception of the peat facies, carbonate content decreases and organic content increases from shoreline to basin. Loss-on-ignition and stable carbon and oxygen isotope analyses were carried out on a 19 cm core from Julian Lake and a 34 cm core from McGinnis Lake. Although the chronology of each core was not established, relative changes in composition and stable isotopes were noted which reflected changes in palaeoproductivity, palaeohydrology, and palaeoclimate of the lakes. d18O values of the organic-rich lower unit (14 to 19 cm) in the McGinnis Lake core remain relatively constant whereas the d18O values of the carbonate-rich upper unit vary by 3.1 o/oo. Carbonate content of the lower unit is 32 to 74% and organic content is 14 to 42% compared to the carbonate content of 71 to 80% and organic content of 10 to 17% of theupper unit. Both the loss-on-ignition and stable carbon and oxygen isotope analyses of sediment from McGinnis Lake are interpreted to record the transition from a wetter period in the past to a drier period in the present. Peaks in the organic and non-combustible matter and the slight enrichment in the d13C values at 16 and 26 cm sediment depth are interpreted to represent increased lake productivity. Although Julian Lake records similar trends in carbonate and organic content, the stable oxygen and carbon isotope signatures are overprinted by strong atmospheric signals. In addition to analyses conducted on bulk sediment samples, mollusc shells were microscopically analyzed. Numerous circular, 30 to 270 mm-diameter bore-holes in several species of gastropod and bivalve shells from Julian Lake are similar in appearance to the ichnotaxa Oichnus simplex, Oichnus paraboloides and Tremichnus isp. These ichnotaxa are well described from marine systems but are rarely reported from freshwater environments. The numerous bore-holes and their random placement in individual shells from Julian Lake indicate that the borers were non-predatory. The purpose of boring may have been to scavenge either the organic material contained within the shell microstructure or the shell carbonate to be used as a source of carbonate. Plant roots or rhizoids, algae, bacteria, and to a lesser extent gastropods are the most probable bioeroders. The identity of the trace maker, however, is uncertain. Similar holes have been previously described in lacustrine settings and interpreted as dissolution pits. As with marine systems, the recognition of freshwater borers indicates that bioeroders may be active contributors to carbonate sedimentation in lacustrine settings, and they also diminish the preservation potential of shells in the sedimentary record. Furthermore, as with their marine counterparts, freshwater borings create potential pathways in shells through which diagenetic porewaters can enter and dissolve or recrystallize shell carbonate.

Additional literature:

Hagan, T.H., Coniglio, M., and Edwards, T.W.D., in press. Bioerosion of mollusk shells from a marl lake, southern Ontario. Ichnos.

Al-Aasm, I.S., Coniglio, M. and Hagan, T.H., 1998.Chemistry and stable isotopic fractionations in marl lakes: an example from McGinnis Lake, southern Ontario. 15th International Sedimentological Congress, Abstracts, April 12-17, 1998, Alicante, Spain, p. 123-124.



Provincial Parks/*Parcs provinciaux* : ■

THE CARVERS

The rock carvings here were most likely done by Algonkian speaking natives approximately 600 to 1100 years ago. The Algonkian linguistic group refers to related native tribes who speak similar languages. Four examples are the Ojibway, Algonquin, Pottawatomi, and Cree. These tribes, and others, traditionally inhabited much of the Canadian Shield region of Ontario. They were nomadic peoples who subsisted primarily by hunting, gathering and fishing. One important aspect of survival was each person's relationship to the spirit world. The petroglyphs may be a visual portrayal of such a relationship. The complexity and sophistication of these carvings suggest that this site may have been visited by shamans (spiritual leaders or advisors).

THIS SITE

These petroglyphs were carved in a white crystalline marble which was worn down by weathering. Many native people believe manitous live or dwell at unusual geological formations like this large outcropping of rock. Perhaps the natural crevices are openings to the inner world and the intermittent underground streams, in the vicinity of this rock, are thought to be the voices of these manitous. The petroglyphs themselves do not tell an overall story, but rather reflect the culture and the individuality of those who carved here over a period of time. Such a prolonged use certainly attests to the spiritual nature of this location. It is important to realize that the site and immediate area are sacred and special to many people.

INTERPRETING THE CARVINGS

The precise meaning of these carvings is gone with the people who made them. At the present time there are different interpretations regarding the meanings of these carvings. Therefore, interpretations at the park are based on information gathered from natives, including elders, and others.

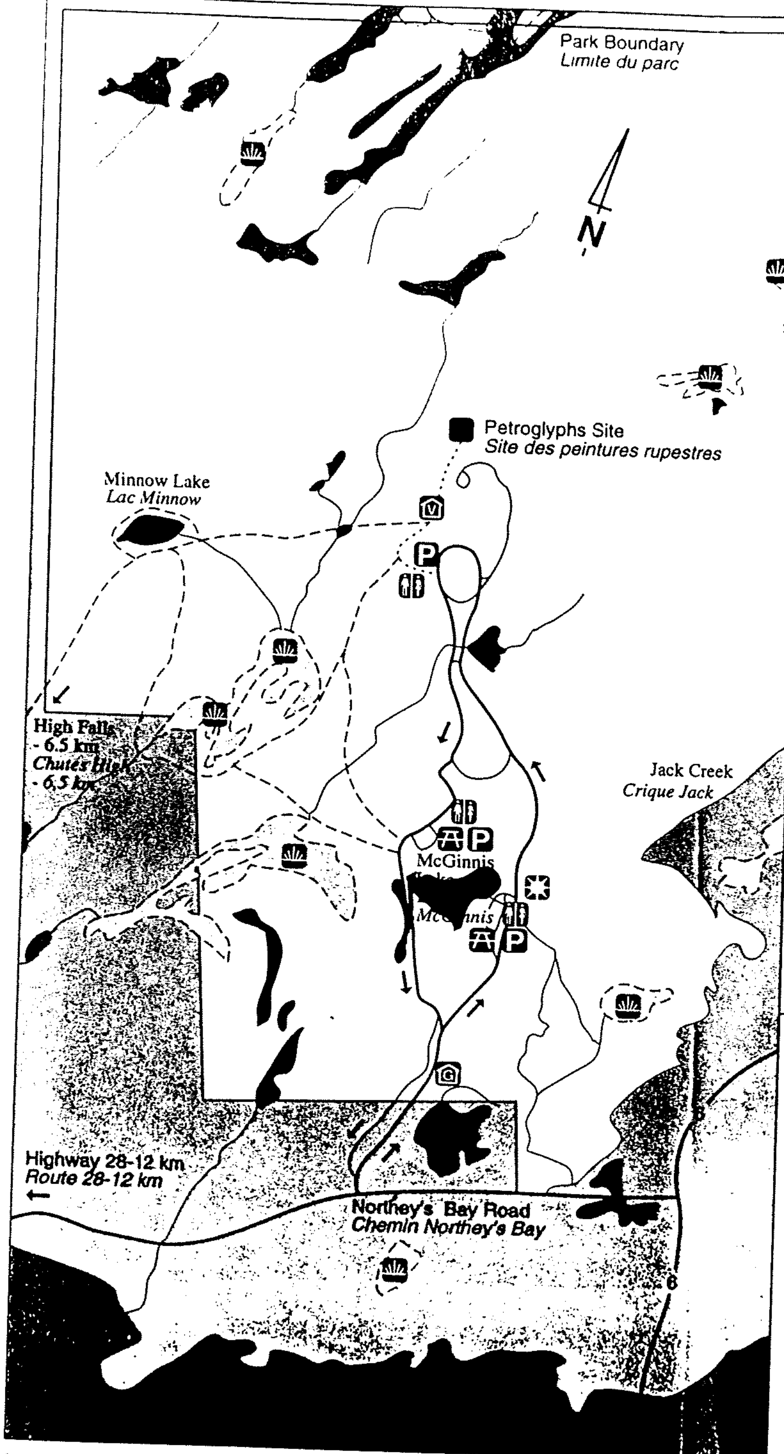
Petroglyphs Provincial Park

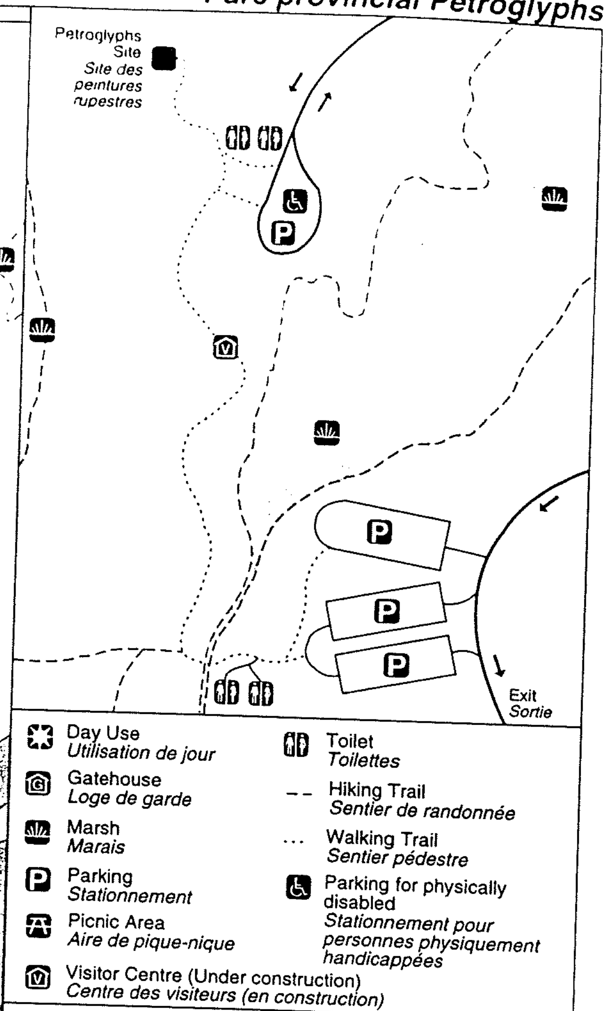
Parc provincial Petroglyphs

Ontario

Petroglyphs Provincial Park

Parc provincial Petroglyphs





SELF-SERVE ENTRANCE OFFICE: During low-use periods, we do not find it practical to staff the gatehouse. If you arrive when there is no one at the gatehouse please:

- pay the appropriate fee as directed by the sign, and
- proceed to the main parking lot (a distance of 4 km) where you will be greeted and welcomed.

PICNIC AREAS: The road system is a one-way loop system, to and from the petroglyphs site. If you are interested in picnicking, you have a choice between using the east picnic area on the way to the site, or the west picnic area after visiting the site.

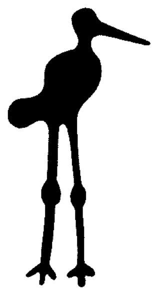
BUREAU D'ENTRÉE (LIBRE-SERVICE) : Pendant les périodes peu achalandées, nous ne croyons pas qu'il soit utile d'avoir du personnel dans la loge de garde. S'il n'y a personne dan la loge de garde lors de votre arrivée, veuillez :

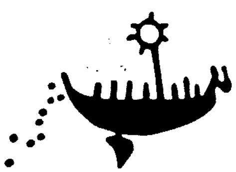
- payer le montant indiqué sur l'affiche; et
- vous rendre au stationnement principal (à une distance de 4 km) où vous serez accueilli.

AIRES DE PIQUE-NIQUE : Le réseau routier est constitué d'une boucle a sens unique pour se rendre et pour revenir du site des peintures rupestres. Si vous voulez pique-niquer, vous avez le choix entre une aire de pique-nique située à l'est, en direction du site des peintures rupestres, ou a l'ouest, au retour de votre visite.

There are 13 turtle carvings in the park. It is an important animal for many native people as it is a symbol of patience, longevity, and fertility. The small circular images around some turtles may be its eggs. In narratives of re-creation, the turtle offered its back as a place for a new world to be built (see front panel).

This five foot long bird may be a heron or a crane. Some evidence reveals that it is more likely a crane as cranes appear to be more important to some natives. It is important to some shamans as they believe it has a peculiar influence. For some people it is a clan symbol and members of this clan traditionally are the speakers at meetings.





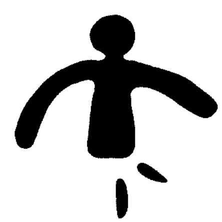
The boats or canoes at this site do not look like birch-bark canoes the natives in this region used. Some anthropologists believe they are boats which could take the shaman or spirits to different world levels. The lines in the boats are said to represent the beings or shamans in that particular vessel.

At this site are many triangular shaped objects. Some people believe they may portray shamanistic spirits as a triangular shape was often used by native people to depict a body. Notice the differences in the tops of these glyphs.

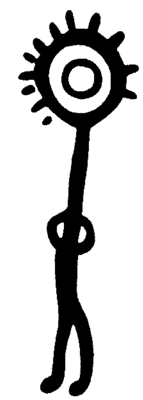
Many snake images can be found at this place. For native people they are thought to be guardians of underground springs, symbols of renewal and regeneration, and can be allies for some shamans. Snakes are also creatures who live in the underworld. Look closely and you will see that some snakes are carved as if they are coming out of a crack in the rock.

A unique glyph here is a carving of what is thought to be a shaman. The shaman is holding an object in one hand and it may be a rattle which he or she may use in ceremonies. A cone shaped object over the shaman's head may be a headdress or hat.

The thunderbird is the protector of people and is an imaginary bird. Some individuals think that when they hear thunder outside it is the thunderbird flapping its wings, when they see lightening it is the bird flashing its eyes. This bird is a common image to many natives in Canada and the United States.



In some native legends there is mention of a spirit called Nanabush. This is believed to be a carving of Nanabush in its rabbit form. Nanabush has the ability to transform itself into anything it wants to be; however, it has to accept the limitations of that particular form. Nanabush also likes to play tricks on people and animals and is the spirit who taught some people how to hunt and fish.



This large figure is thought to be a carving of Gitchi Manitou or the Great Spirit. This is the creator of the world according to some natives. The sun is said to be its home and it does not have a constant form or shape.

OTHER ROCK ART SITES

The tradition of rock art is a distinguishing feature of native culture. In addition to the Peterborough Petroglyphs, there are more than 300 other rock art sites documented in the Shield region, the majority of which are rock paintings (pictographs). Some of the pictograph sites that are accessible in Ontario are: Mazinaw Lake, Bon Echo Provincial Park; Agawa Bay, Lake Superior Provincial Park, Quetico Provincial Park.

Holocene water levels at Rice Lake, Ontario, Canada: sediment, pollen and plant-macrofossil evidence

Zicheng Yu† and John H. McAndrews†°

(†Department of Botany, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6, Canada and Department of Botany, University of Toronto, Toronto, Ontario M5S 1A1, Canada; °Department of Geology, University of Toronto, Toronto, Ontario M5S 1A1, Canada)

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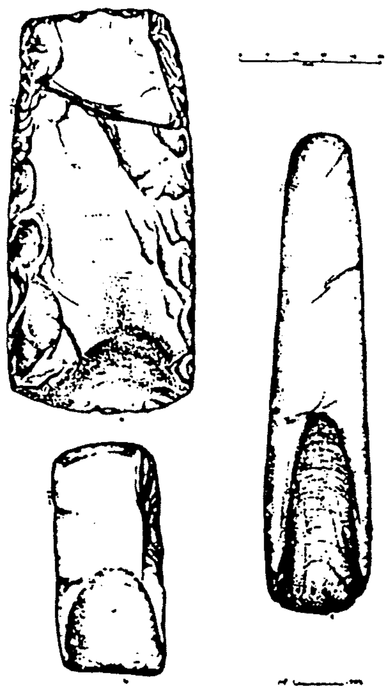
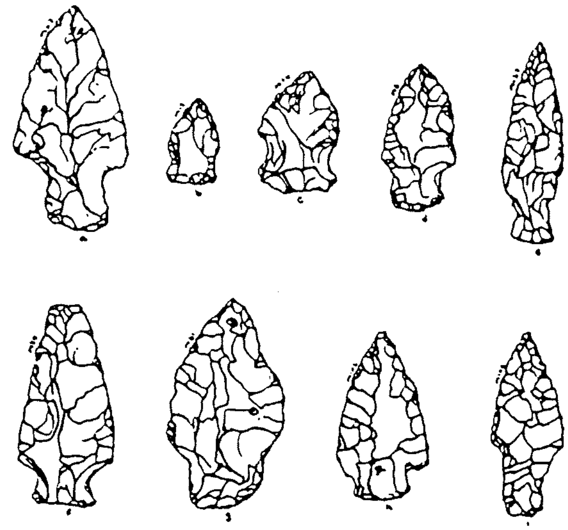
The Holocene 4,2 (1994) pp. 141–152

A HOLOCENE RESEARCH PAPER

Abstract: Four cores taken along a transect from the western basin and four cores from the middle basin of Rice Lake, Ontario, provide evidence for shoreline transgression during the early Holocene, for low water levels during the mid-Holocene, and for abrupt rise of the lake levels due to dam building in AD 1838. The transition from detritus mud to the overlying marl, spanning from ca. 10000 to 8600 BP, indicates flooding of a wetland by a lake; this flooding is supported by plant-macrofossil succession from *Larix*, *Scirpus*, and *Carex* to *Najas flexilis*. The transgression was due to isostatic tilt after deglaciation, which raised the eastern outlet sill of the lake and caused the lake water to rise and flood westward. A sediment hiatus between the marl and the overlying gyttja (between 6000 and 4000–3000 BP) across the lake basin, supported by the bracketing radiocarbon dates and missing regional pollen zones, indicates low water level caused by a dry/warm climate. Regional palaeoclimatic estimates from pollen-climate transfer functions indicate that the mid-Holocene mean July temperatures were about 1°C higher and annual precipitations about 10% less than before or after. Subsequent rise of the lake level after the hiatus was a combination of cooling climate and continued isostatic tilt.

THE McINTYRE SITE: ARCHAEOLOGY, SUBSISTENCE AND ENVIRONMENT





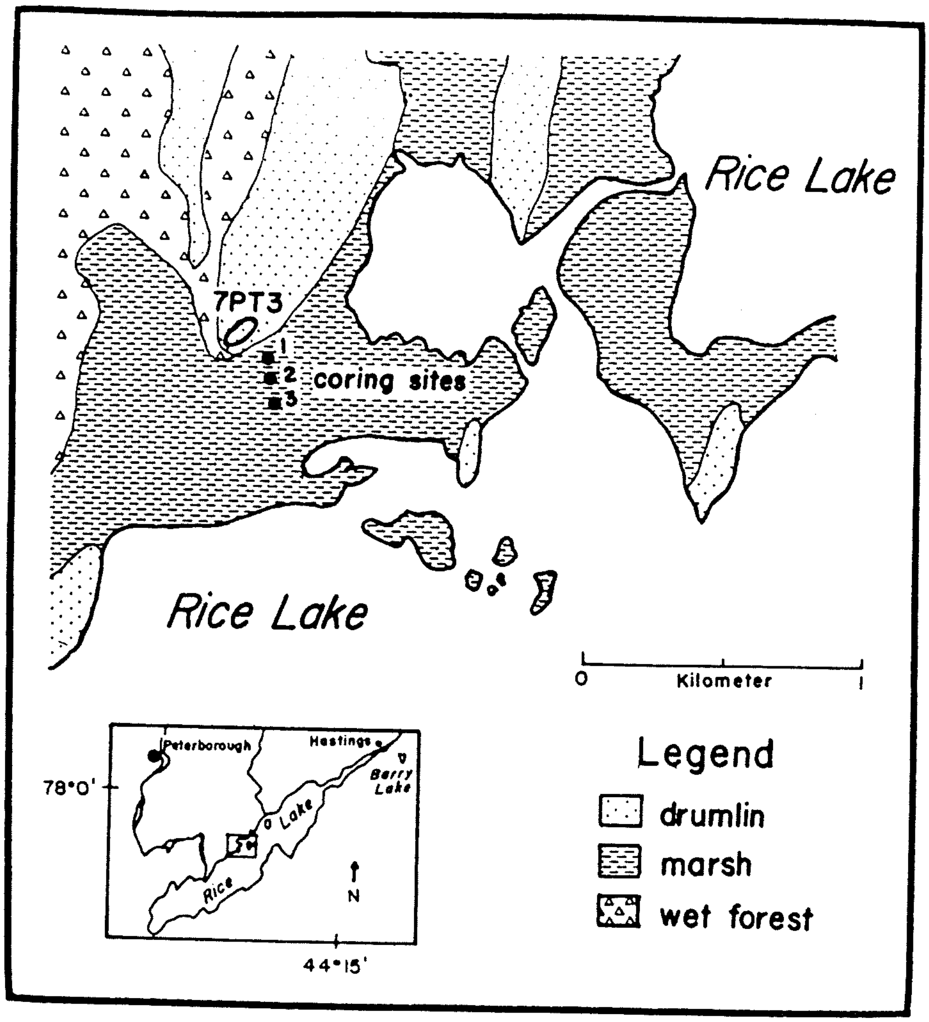


Fig. 1. Location of Rice Lake and McIntyre site. The lake core site is near East Sugar Island, about 4 km northeast of the marsh area.

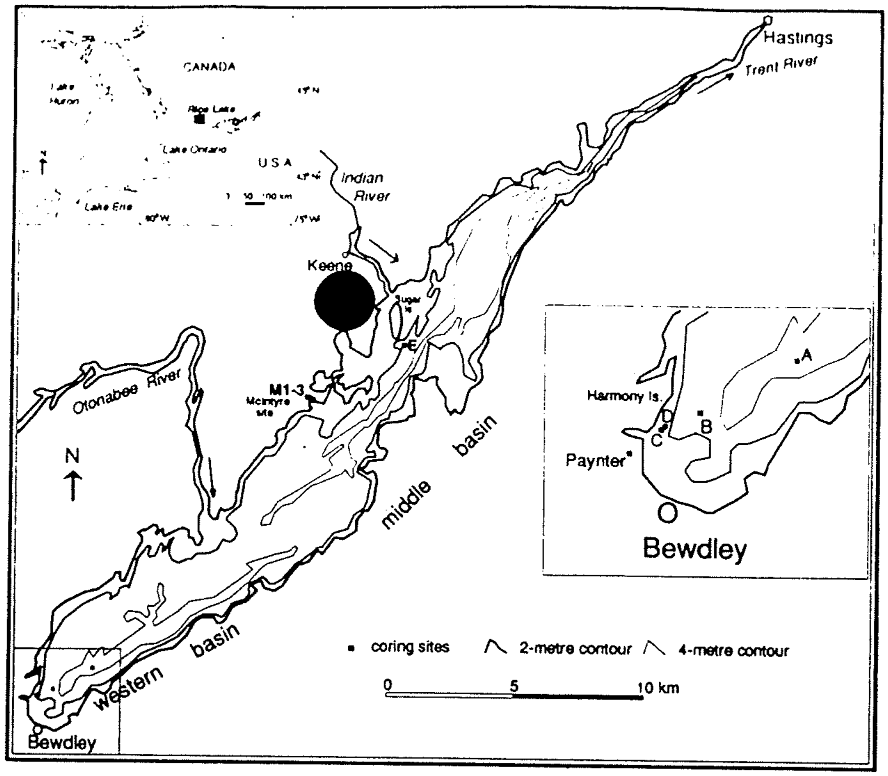


Figure 1 Map showing location, bathymetry, and coring sites of Rice Lake. Bathymetry data is from the Great Lakes Hydrographic Chart No. 2022, Canadian Hydrographic Service, Department of Fisheries and Oceans Canada (1987). The 2 m contour approximates the predam shoreline.

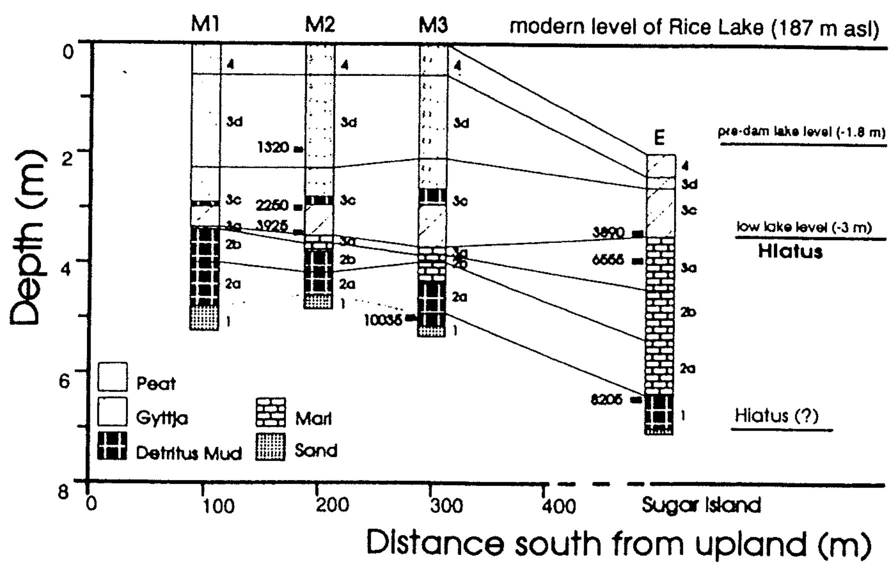


Figure 6 Sediment stratigraphy diagram of cores M1, M2, M3 at McIntyre site, and core E from the middle basin of Rice Lake. Redrawn from McAndrews (1984).

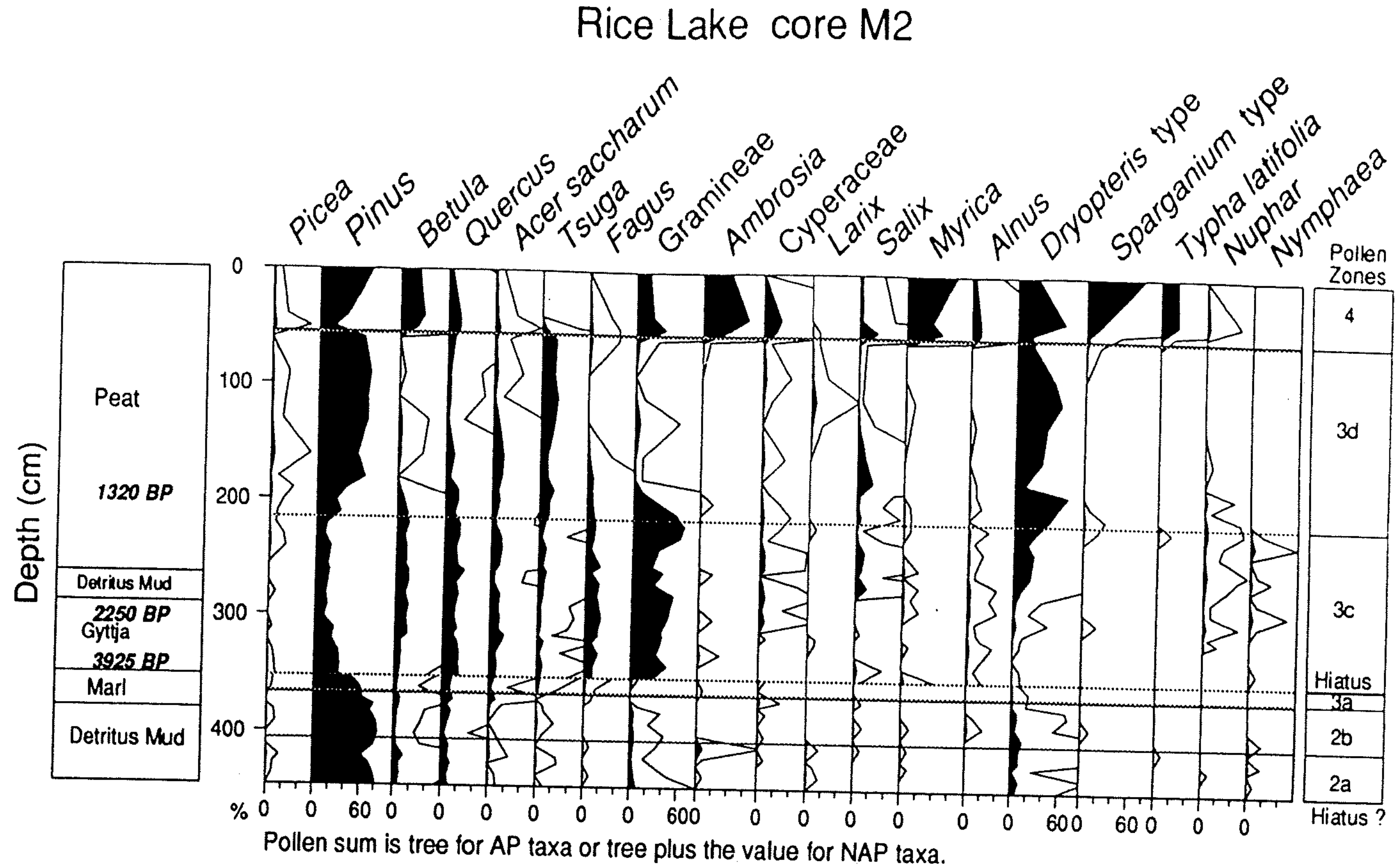


Figure 8 Pollen percentage diagram of core M2 at McIntyre site of Rice Lake. Open curves are ×10 exaggeration. Redrawn from McAndrews (1984).

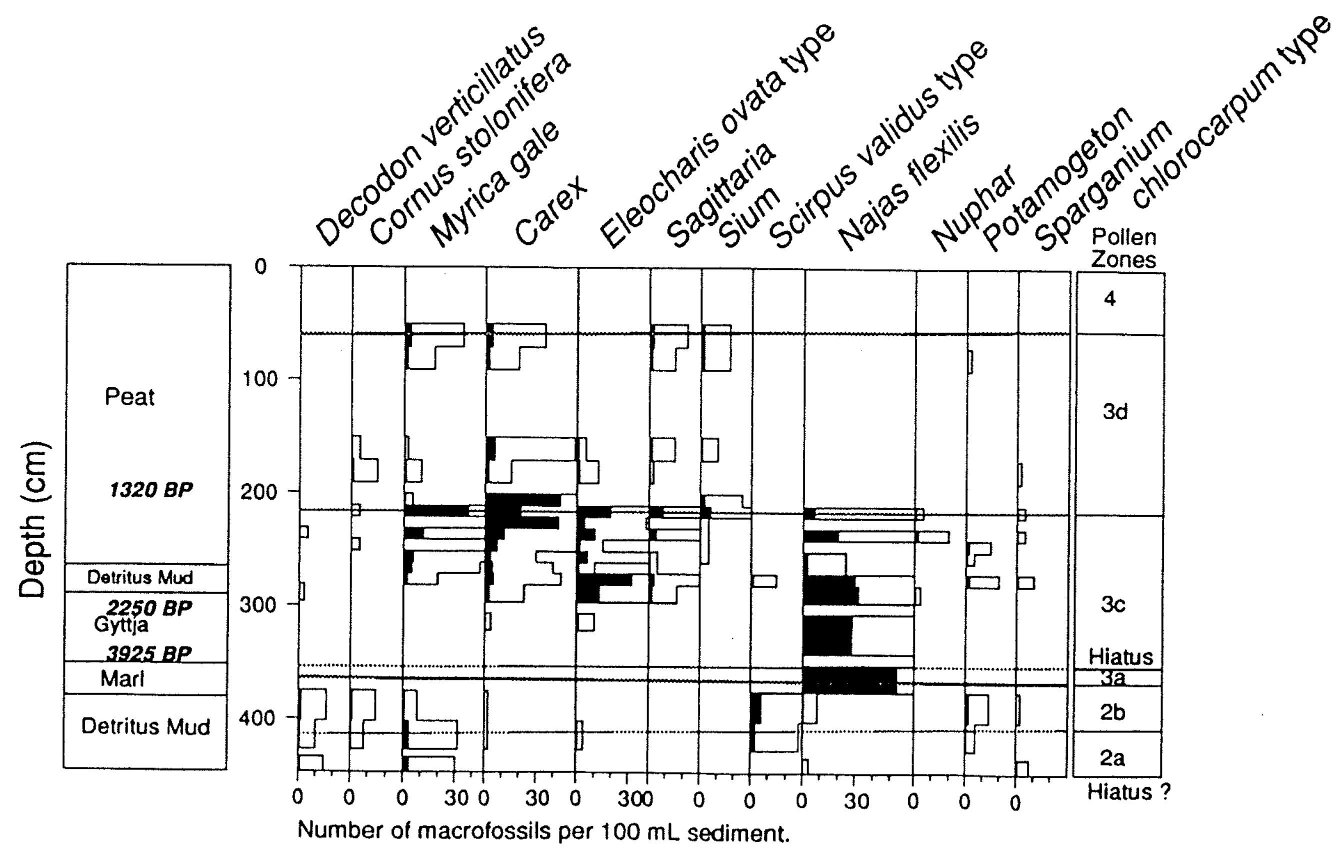


Figure 10 Plant-macrofossil diagram of core M2 at McIntyre site of Rice Lake. Open bars are ×10 exaggeration. The samples at 0–50, 90–150, 190–200, 295–305, and 340–350 cm were not analysed for plant macrofossils. Drawn from McAndrews (1984).

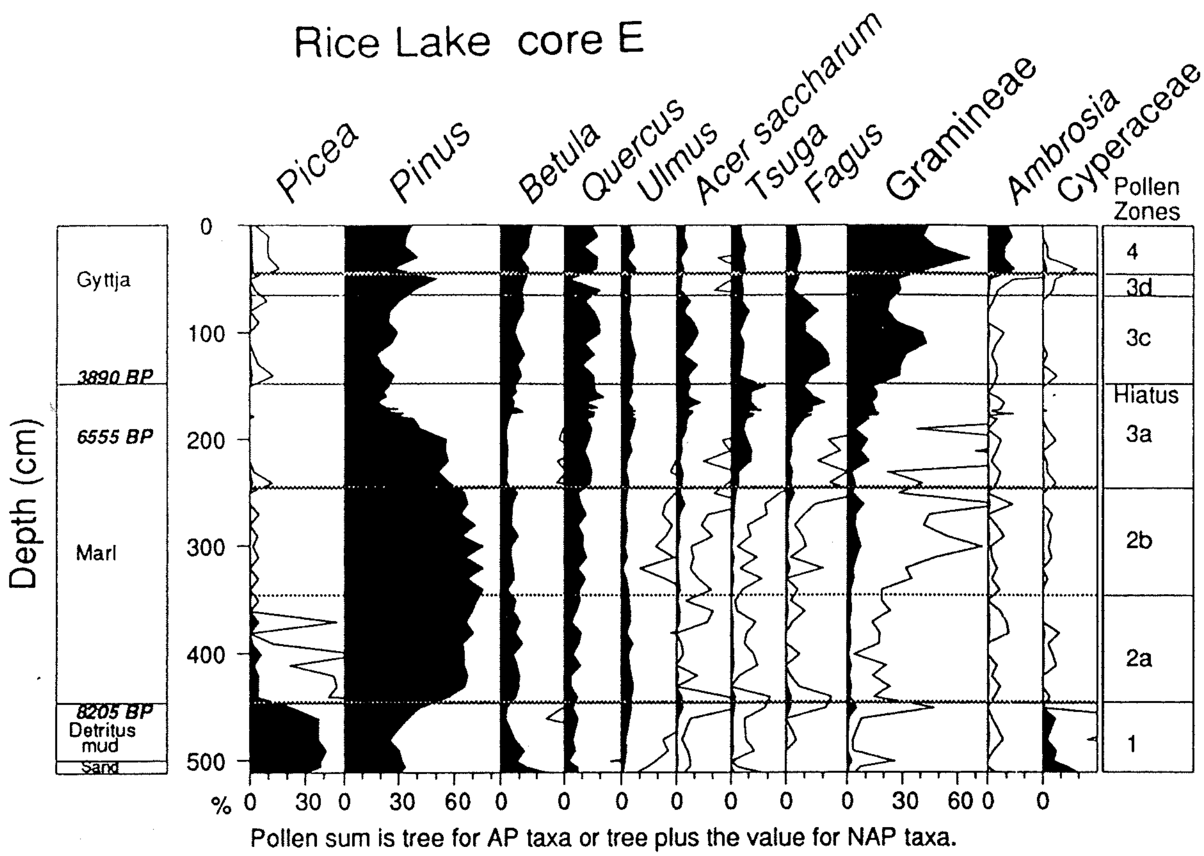
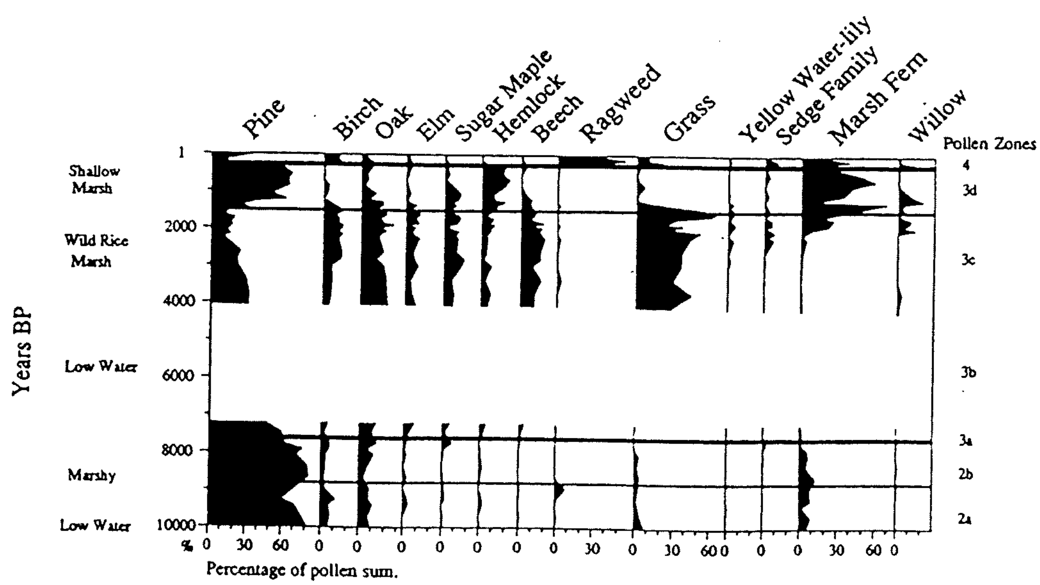


Figure 7 Pollen percentage diagram of core E at Rice Lake. Open curves are ×10 exaggeration. Redrawn from McAndrews (1984).

Figure 10.8: Pollen diagram from Rice Lake Marsh (core 2) adjacent to the McIntyre Archaic site (adapted from McAndrews 1984b).

The chronology is controlled by three radiocarbon dates. The pollen sum is upland plants; wetland plant pollen types are individually added to the sum before their percentages are calculated.



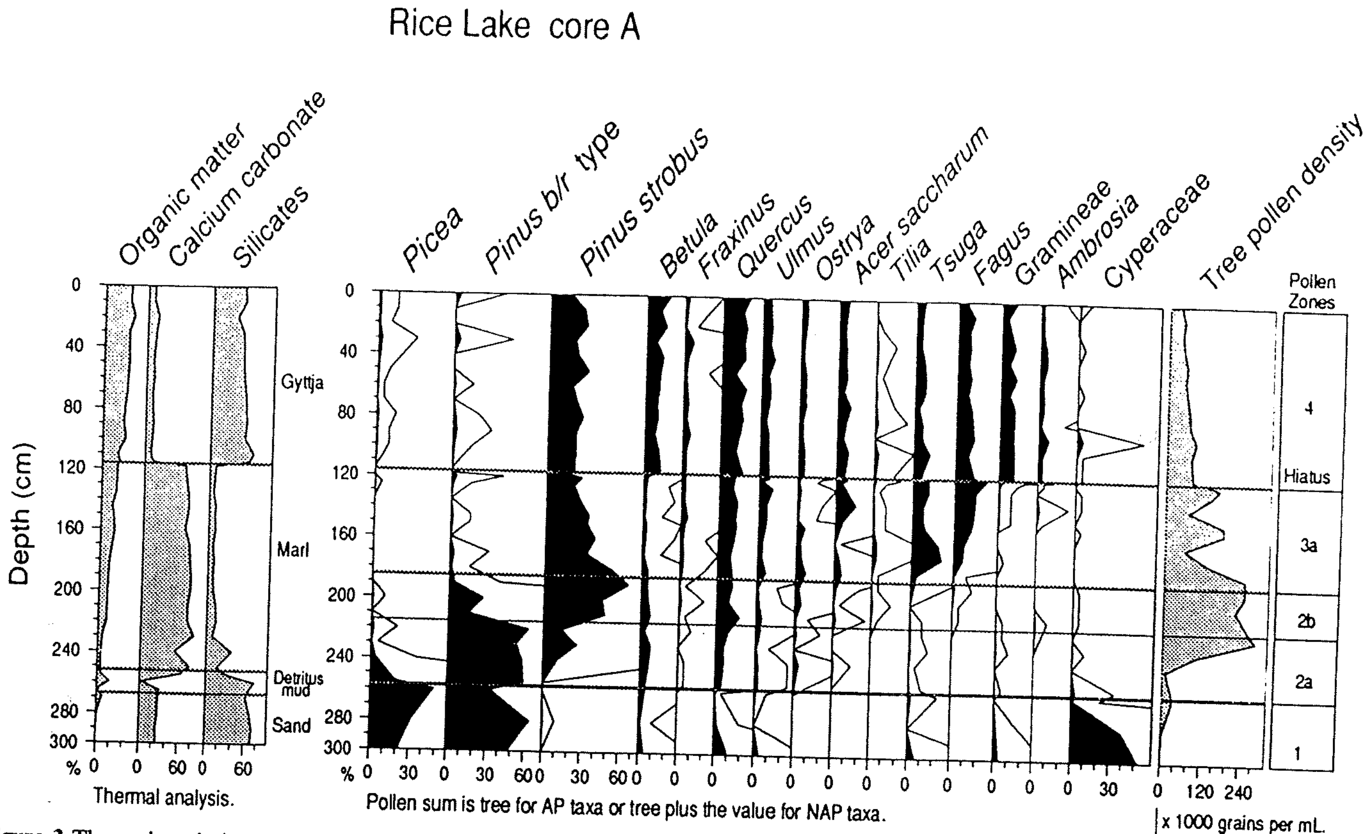


Figure 3 Thermal analysis, pollen percentage, and tree-pollen-density diagrams of core A at Rice Lake. Open curves are ×10 exaggeration. Selected taxa only are shown, but complete data available from the Royal Ontario Museum.

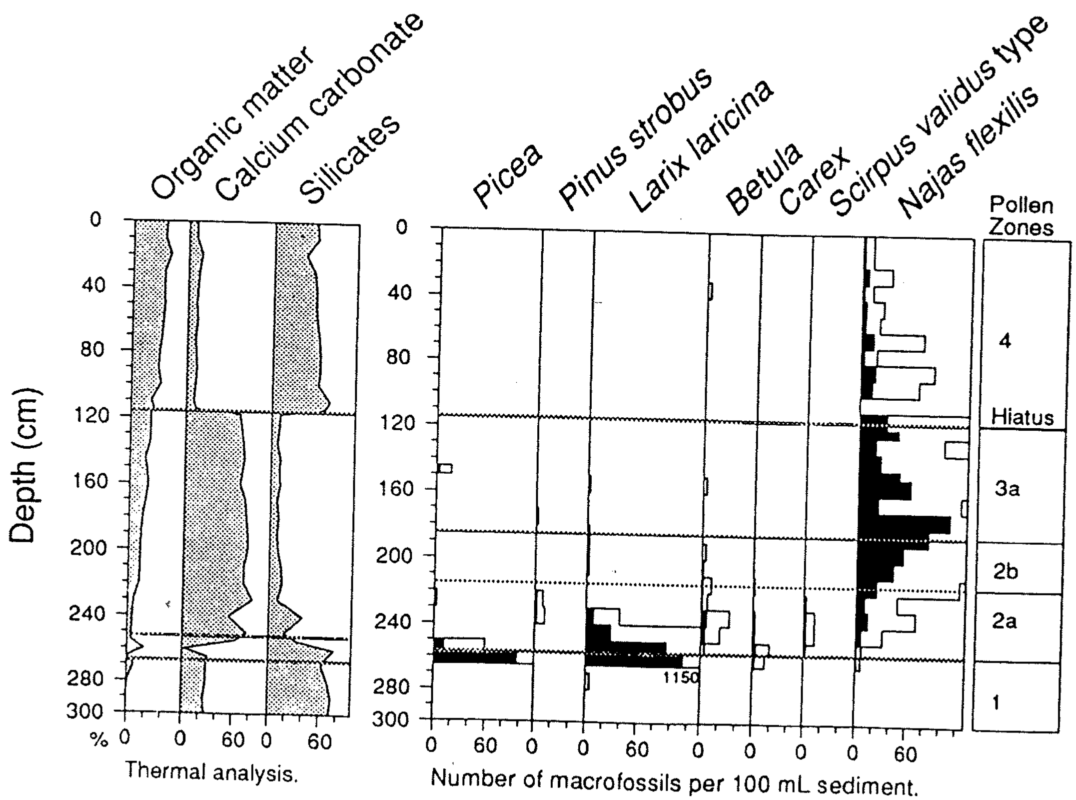


Figure 9 Thermal analysis and plant-macrofossil diagrams of (**a**) core A and (**b**) core B at Rice Lake. Open bars are ×5 exaggeration for core A and ×10 exaggeration for core B. The samples at 0–55, 145–155, 250–255, 295–321, and 565–570 cm for core B were not analysed for plant macrofossils.

Rice Lake core B

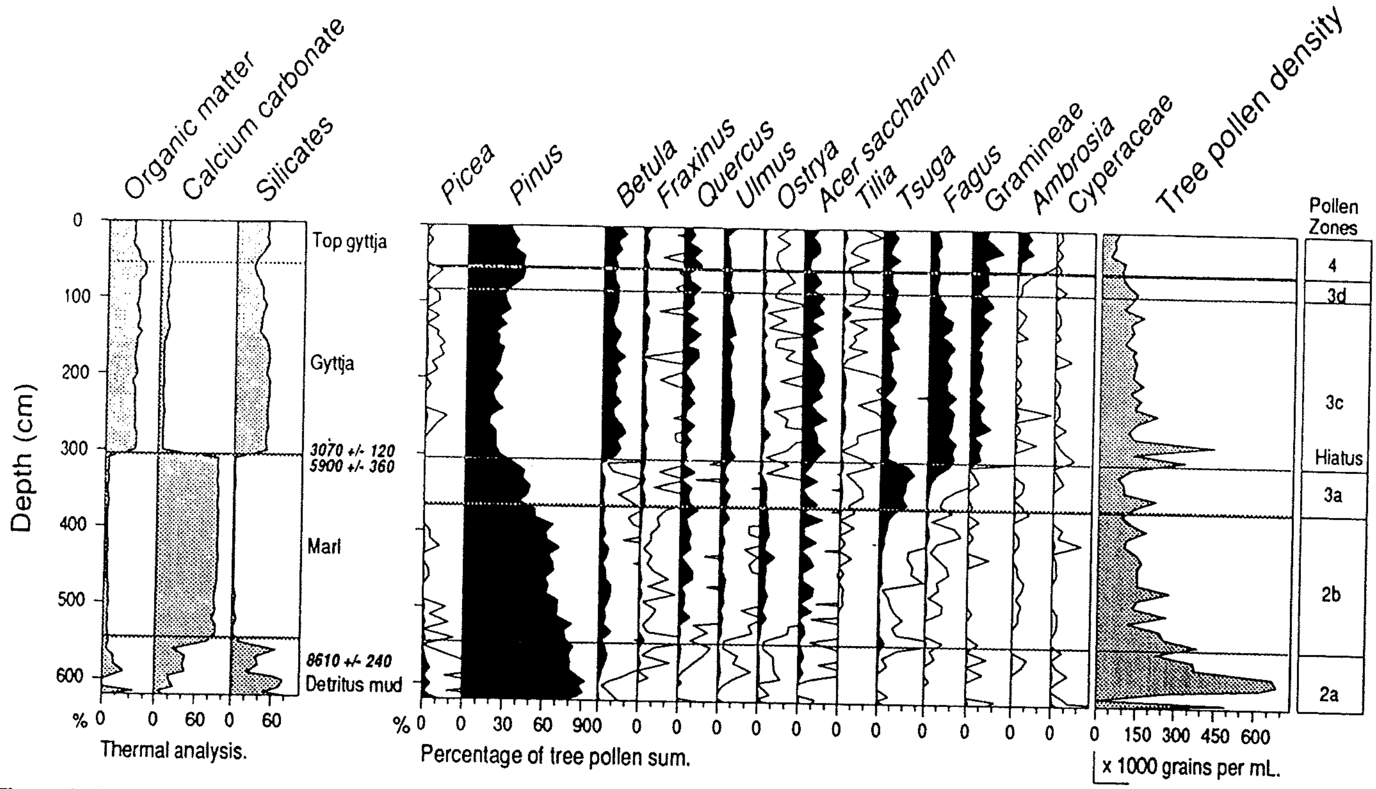


Figure 4 Thermal analysis, pollen percentage, and tree-pollen-density diagrams of core B at Rice Lake. Open curves are ×10 exaggeration. Selected taxa only are shown.

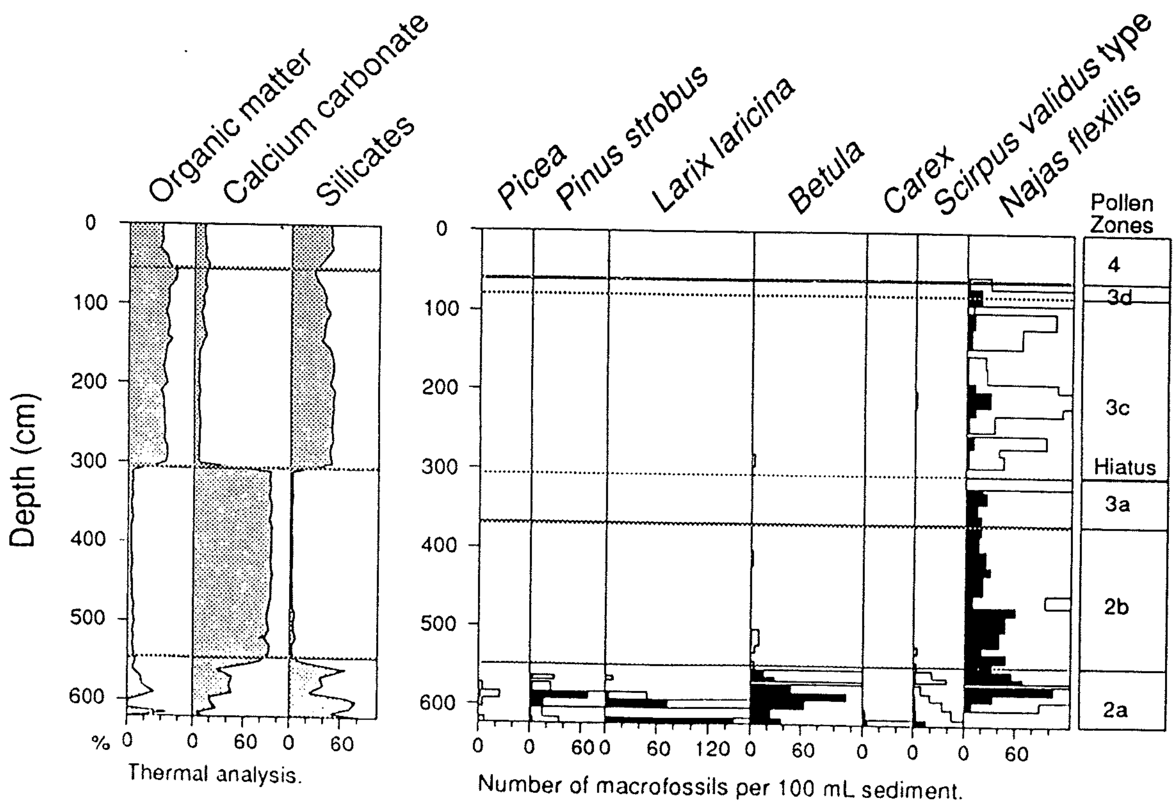


Figure 9 Thermal analysis and plant-macrofossil diagrams of (**a**) core A and (**b**) core B at Rice Lake. Open bars are ×5 exaggeration for core A and ×10 exaggeration for core B. The samples at 0–55, 145–155, 250–255, 295–321, and 565–570 cm for core B were not analysed for plant macrofossils.

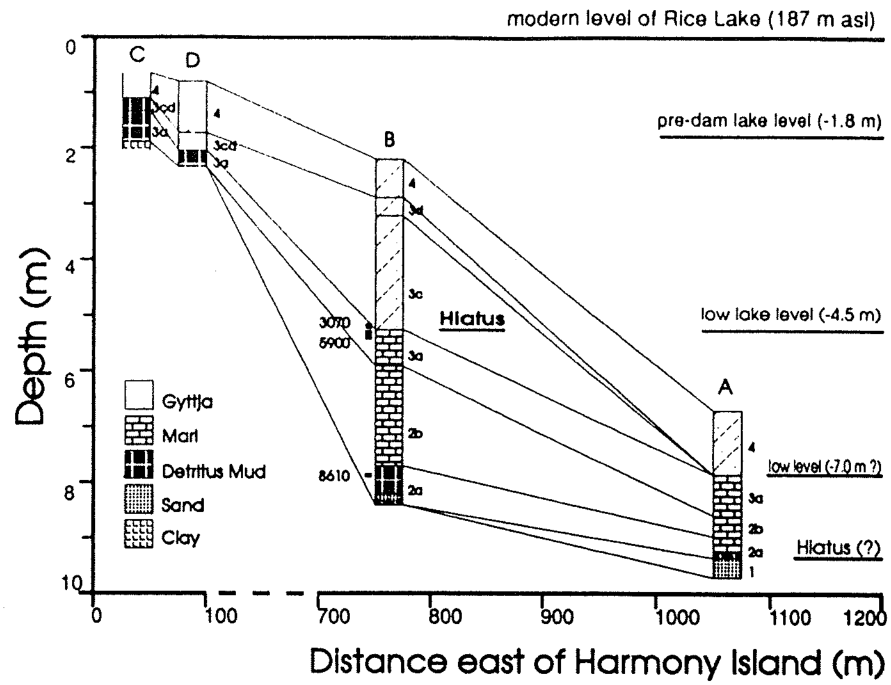


Figure 2 Sediment stratigraphy diagram of cores A, B, C, and D from the western basin of Rice Lake showing lithology, radiocarbon dates, and regional pollen-zone boundaries.

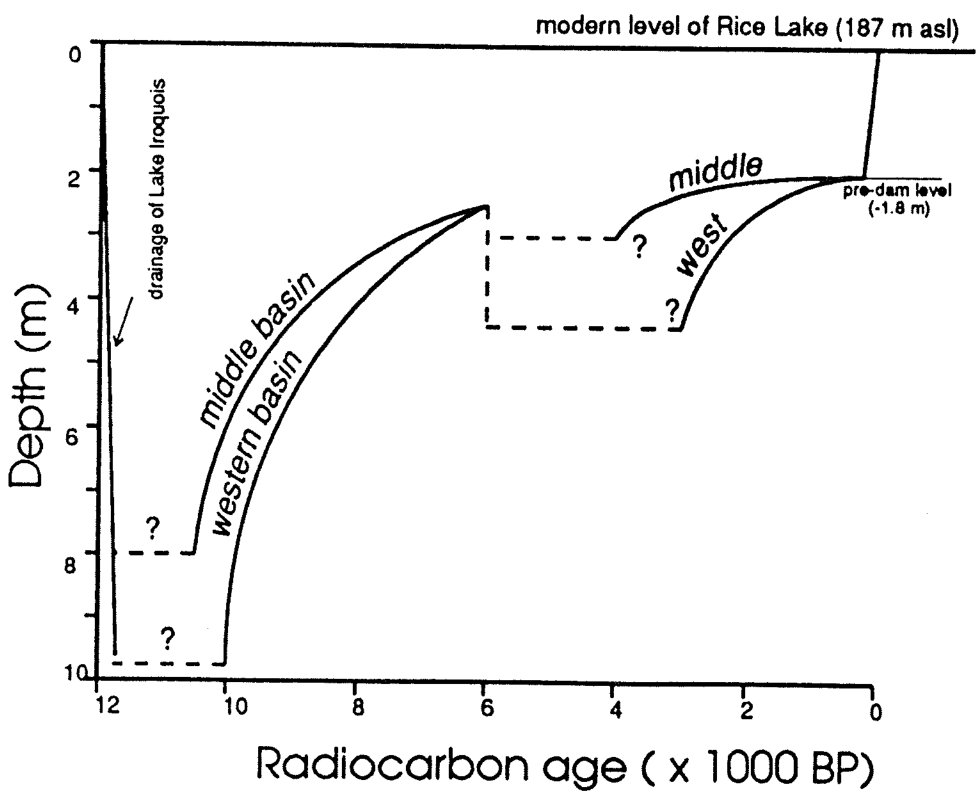
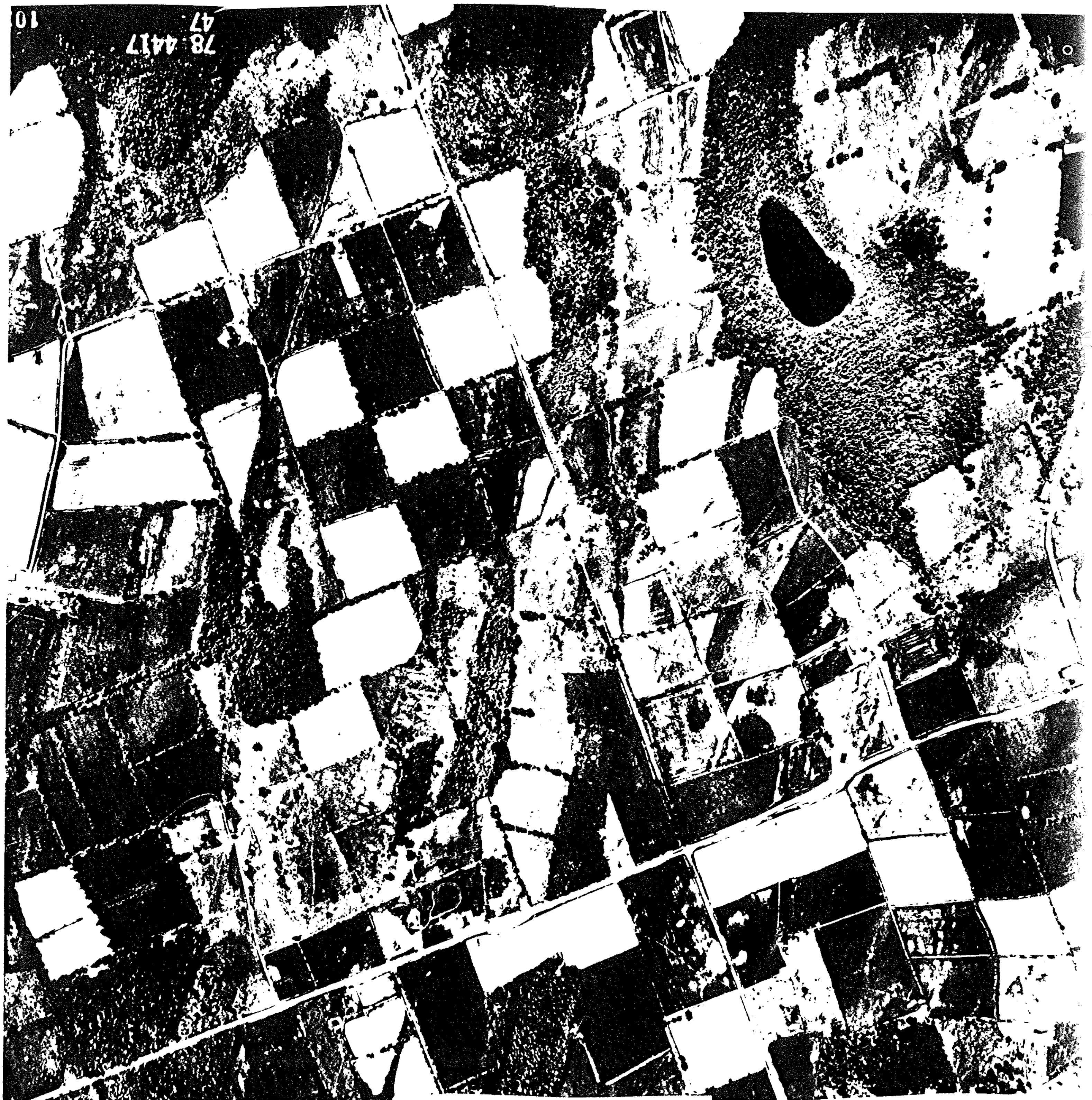


Figure 12 Water-level changes in the western and middle basins of Rice Lake.

Webb's Lake

Late Glacial vegetation history and wetland forest succession.



Webb's Lake -- are there late glacial climatic fluctuations?

Webb's Lake lies at 44° 13.9'N, 78°2.7'W in the Peterborough drumlin field; at 247 m asl it is above the level of Glacial Lake Iroquois. Because it is also a depression between drumlins, unlike kettle lakes, it has yielded a thick, and probably long, late glacial record. Water was 380 cm deep at the coring site.

The Peterborough climate station at 244 m asl for 1965-1990 has a mean July temperature of 20.0°C, a mean January temperature of 9.4°C and a mean annual precipitation of 882 mm.

The pollen diagram displays the main taxa calculated on a sum of 200 tree pollen. July temperatures were calculated from pollen-climate transfer functions for regions G, B and J (Bartlein and Whitlock (1993).

Sparse macrofossils include Picea, Larix, Thuja, Betula papyrifera, B. allegheniensis, Carex, Dulichium, Brasenia, Najas flexilis, Batrachium and Dryas integrifolia.

Most of surrounding drumlins are farmed although on steep slopes there are remnant woodlots dominated by sugar maple. The lake is ringed by conifer swamp.

Upland

Fraxinus americana
Prunus serotina
Betula papyrifera
Ulmus americana
Acer saccharum
Tsuga canadensis
Thuja occidentalis
Quercus rubra
Populus grandidentata
P. tremuloides
Ostrya virginiana
Malus cf. sylvestris
Fagus grandifolia expected but not seen
Amelanchier cf. arborea
Rhus typhina

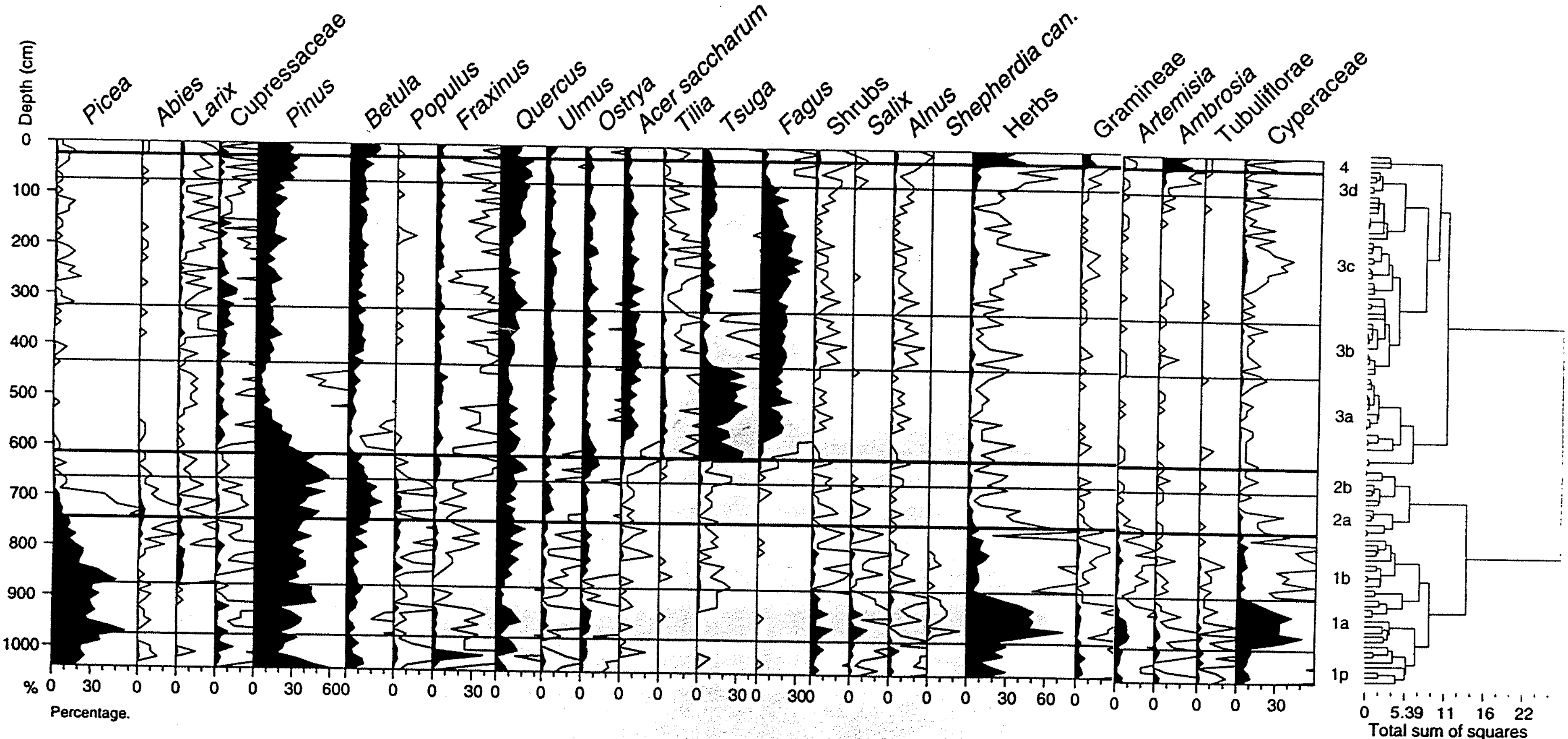
Wetland

Fraxinus ?nigra	*Abies balsamea*	*Cornus stolonifera*
Betula papyrifera	*Pinus strobus*	
B. lutea	*Thuja occidentalis*	
Ulmus americana	*Larix laricina*	
U. ?rubra	*Picea mariana*	
Tsuga canadensis	*Salix*	

Webb's Lake

webbs.pol August 17, 1998. J. McAndrews, analyst.

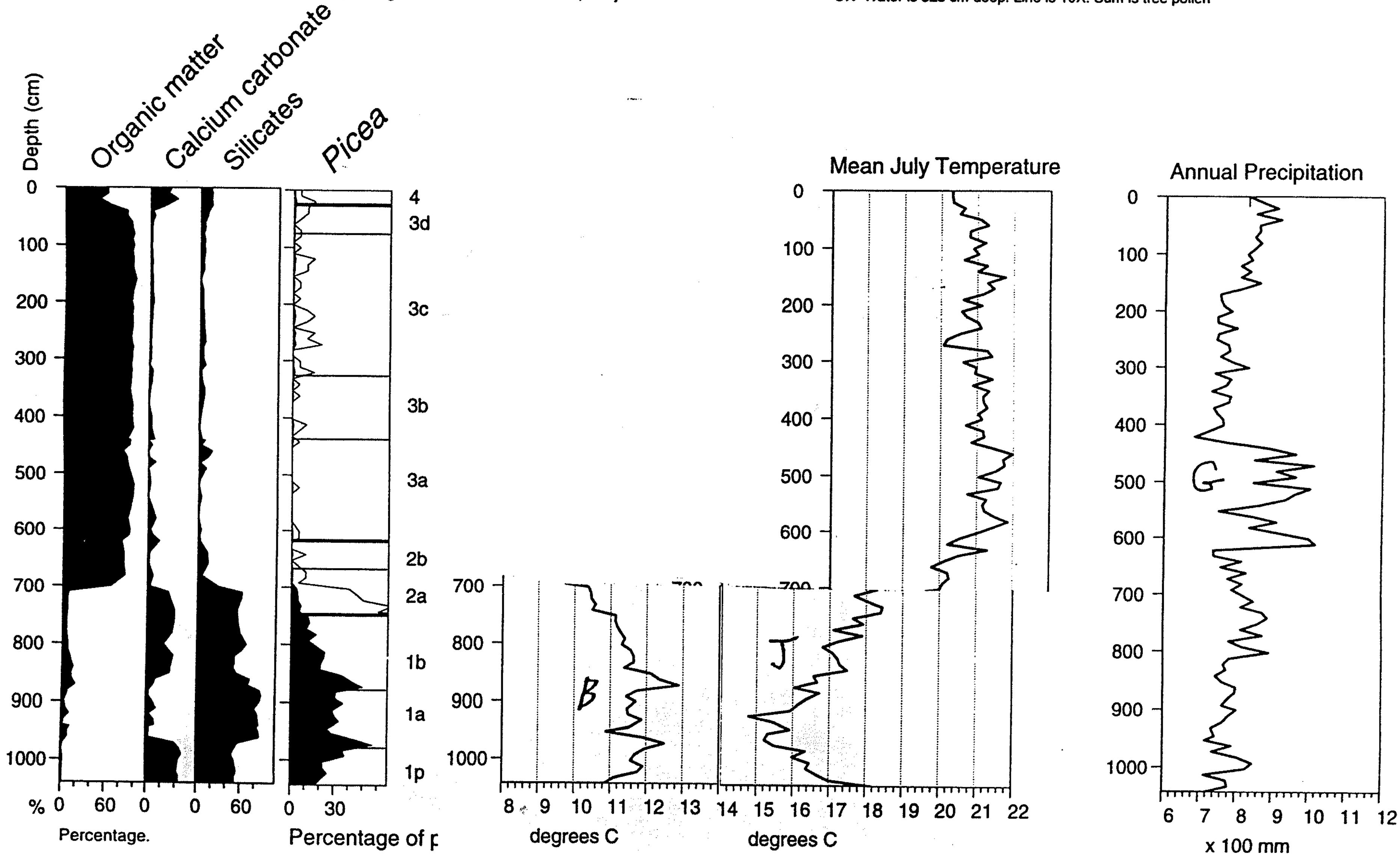
ON Water is 325 cm deep. Line is 10X. sum is tree pollen



Webb's Lake

webbs.pol August 17, 1998. J. McAndrews, analyst.

ON Water is 325 cm deep. Line is 10X. Sum is tree pollen



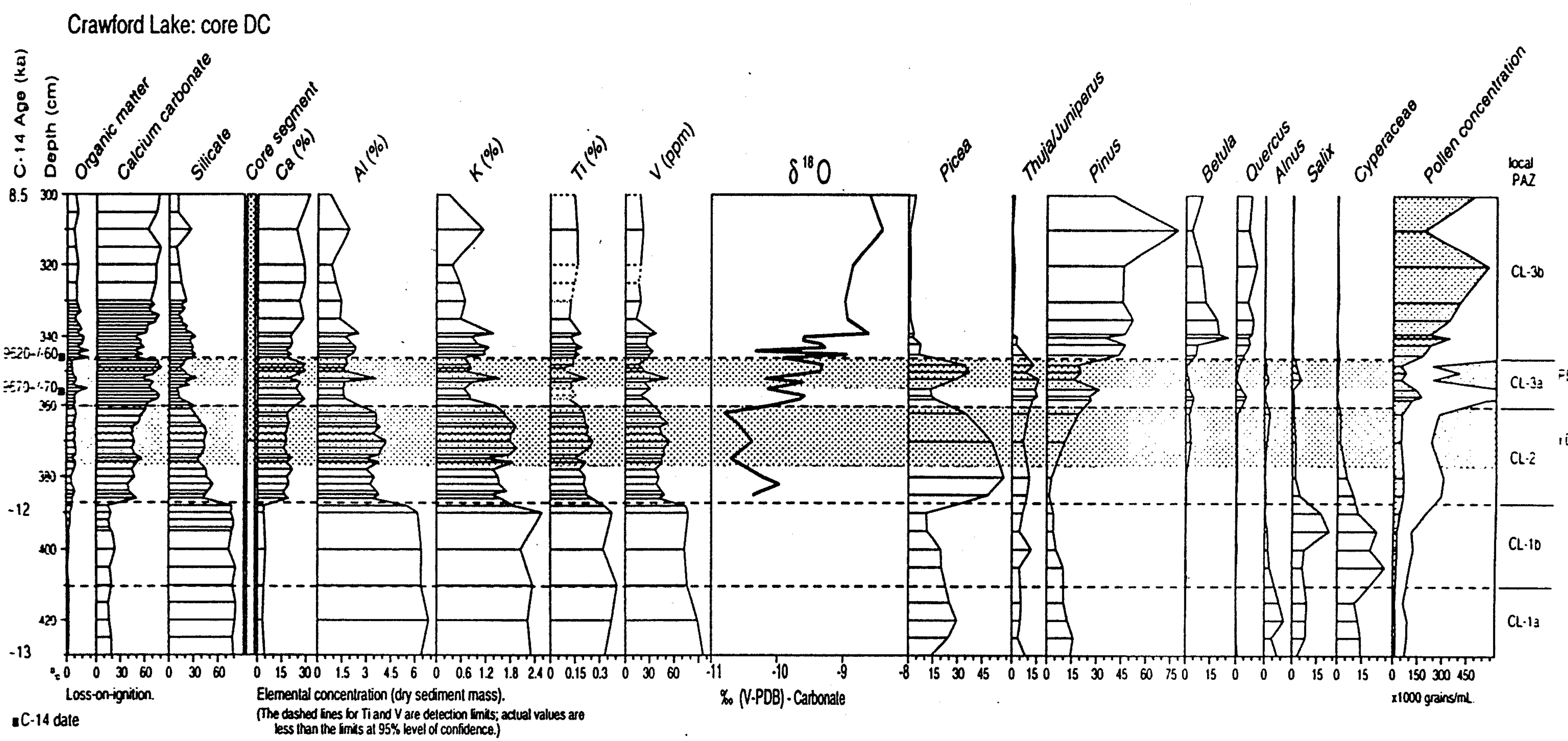


Figure 4.15. Summary diagram for core DC at Crawford Lake. The two shaded bands indicate the Younger Dryas event (YD) and Preboreal (Crawford) Oscillation (PB).

From:

Yu, Z. (1997): Late Quaternary paleoecology of the southern Niagara Escarpment, Ontario, Canada: A multiple proxy investigation of vegetation and climate history. PhD Thesis, University of Toronto, 380 pp.

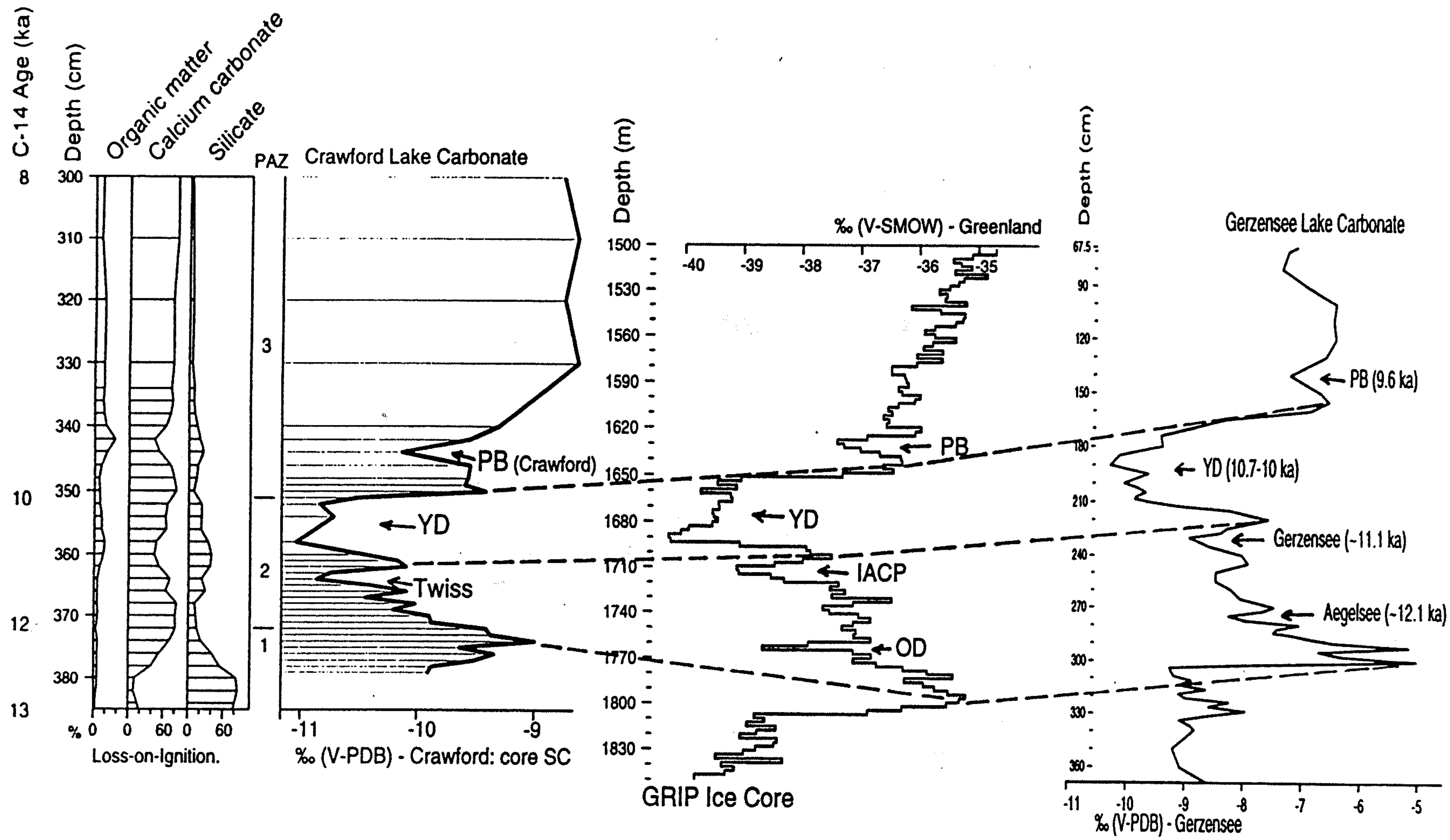


Figure 4.10. Oxygen isotope ($\delta^{18}O$) profile of lake carbonate from core SC at Crawford Lake, and tentative correlation with the oxygen isotope profile of GRIP ice core from Greenland Summit (Dansgaard et al., 1993) and oxygen isotope profile of lake carbonate from Gerzensee Lake, Switzerland (Eicher, 1980). PB - Preboreal Oscillation (Lotter et al., 1992); YD - Younger Dryas cold event; IACP - intra-Allerød cold period (Lehman and Keigwin, 1992); OD - Older Dryas; Gerzensee - Gerzensee Oscillation (Eicher, 1980; Lotter et al., 1992; correlates with IACP in Greenland and Atlantic Ocean [Lehman and Keigwin, 1992], Killarney Oscillation in Atlantic Canada [Levesque et al., 1993] and Twiss Oscillation [this study]); Aegelsee - Aegelsee Oscillation (Lotter et al., 1992). V-PDB = Vienna Peedee belemnite; V-SMOW = Vienna standard mean ocean water.

Yu, Z. (1997): Late Quaternary paleoecology of the southern Niagara Escarpment, Ontario, Canada: A multiple proxy investigation of vegetation and climate history. PhD Thesis, University of Toronto, 380 pp.

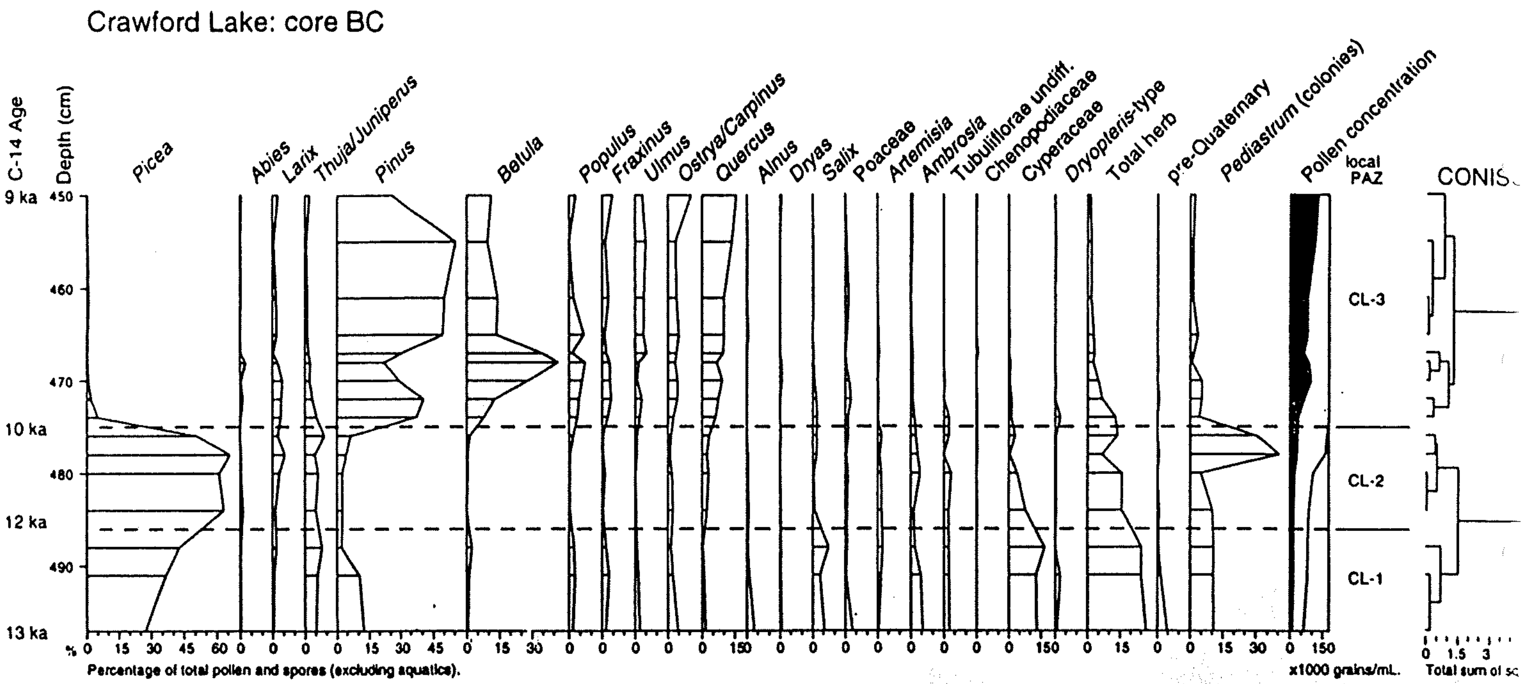


Figure 4.14. Summary percentage pollen diagram with total pollen concentration of core BC from Crawford Lake.

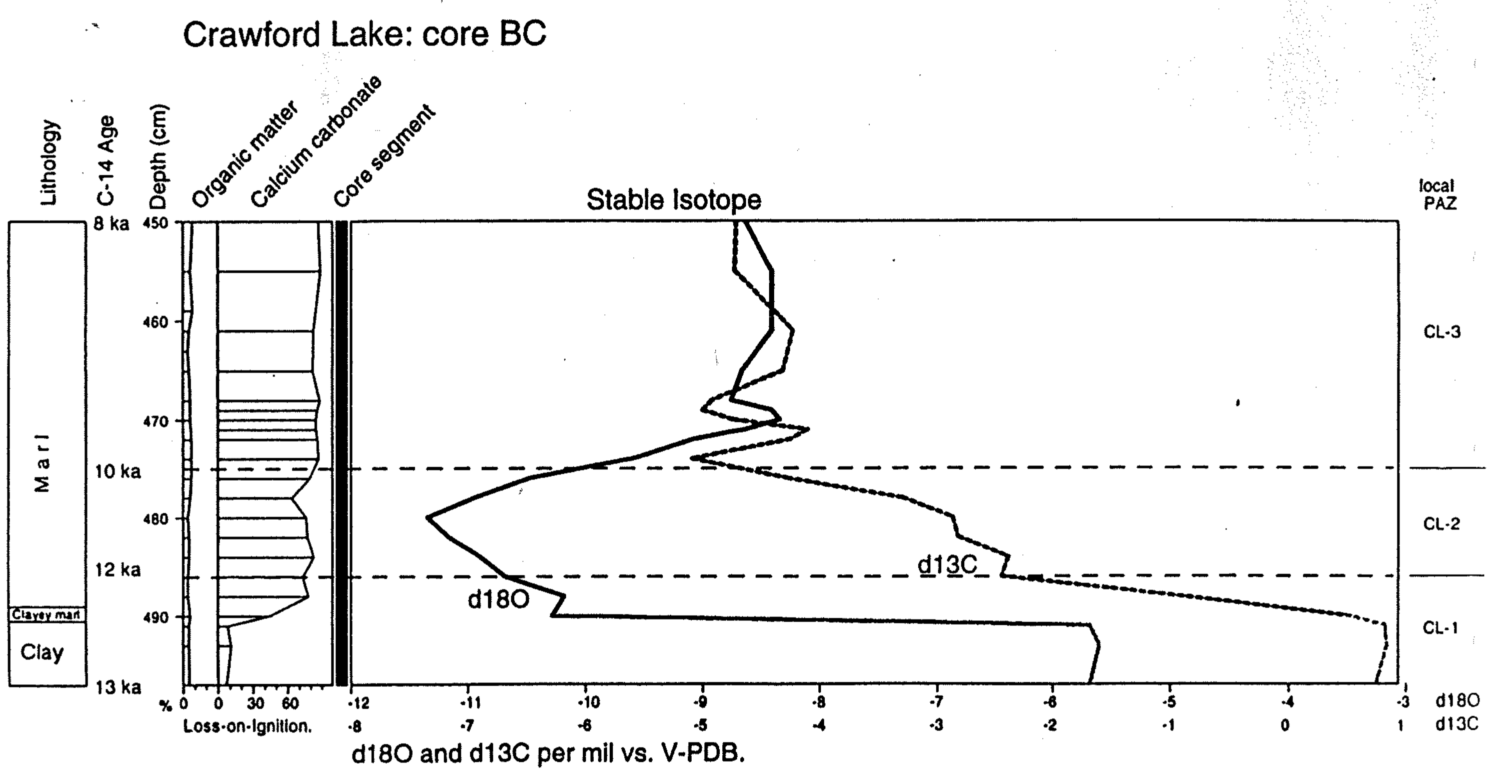


Figure 4.11. Loss-on-ignition and stable isotope ($\delta^{18}O$ and $\delta^{13}C$) results of core BC from Crawford Lake. Basal light-grey lines of the $\delta^{18}O$ and $\delta^{13}C$ curves were from clay samples, which have no paleoclimate significance due to detrital dolomites from bedrock.

Yu, Z. (1997): Late Quaternary paleoecology of the southern Niagara Escarpment, Ontario, Canada: A multiple proxy investigation of vegetation and climate history. PhD Thesis, University of Toronto, 380 pp.

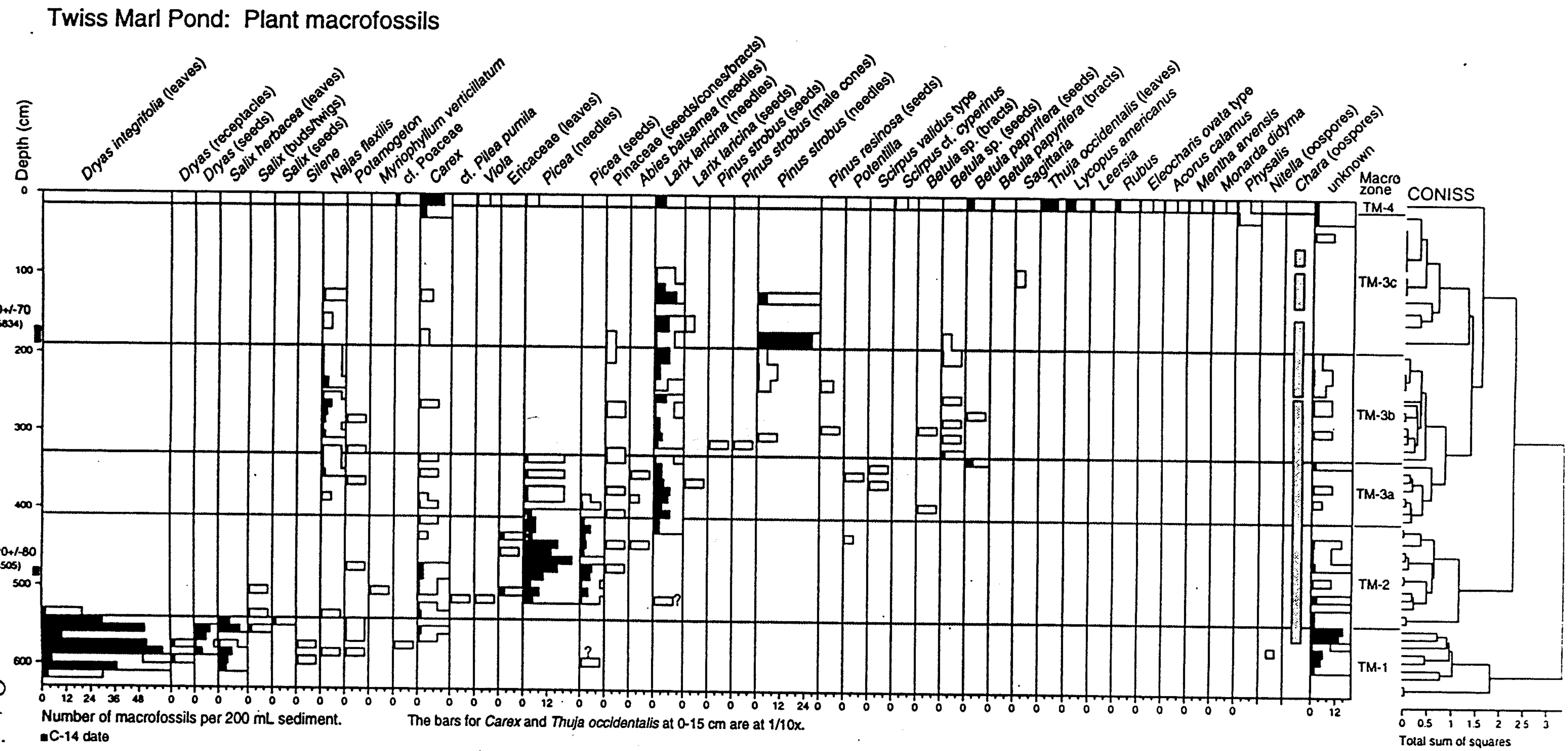


Figure 2.13. Plant-macrofossil concentration diagram of Twiss Pond. The samples at 30-40, 80-90, 135-150 and 245-250 cm were not analyzed for macrofossils. Open bars are 10X exaggeration. Note scale changes for *Carex* and *Thuja occidentalis* leaves at 0-15 cm (at 1/10).

Yu, Z. (1997): Late Quaternary paleoecology of the southern Niagara Escarpment, Ontario, Canada: A multiple proxy investigation of vegetation and climate history. PhD Thesis, University of Toronto, 380 pp.

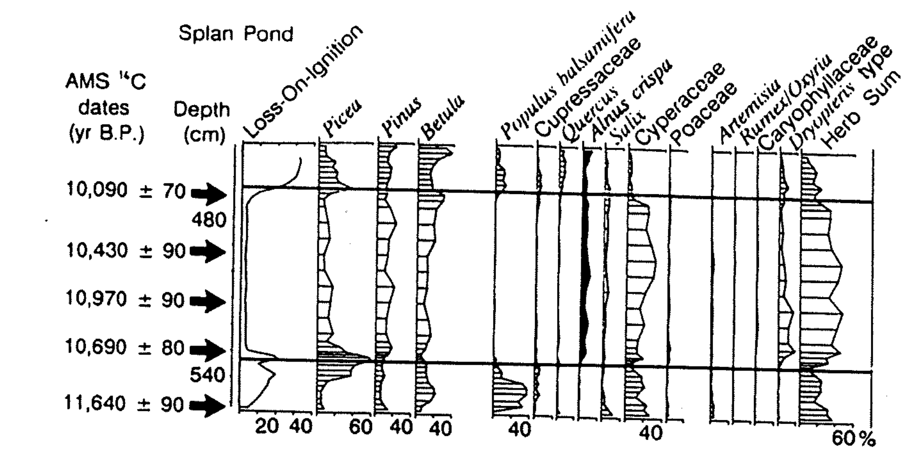


FIG. 3. Summary pollen percentage diagram for Splan Pond (modified from Mayle *et al.* 1993a). Younger Dryas boundaries are based on the LOI curves and are represented by the continuous horizontal lines.

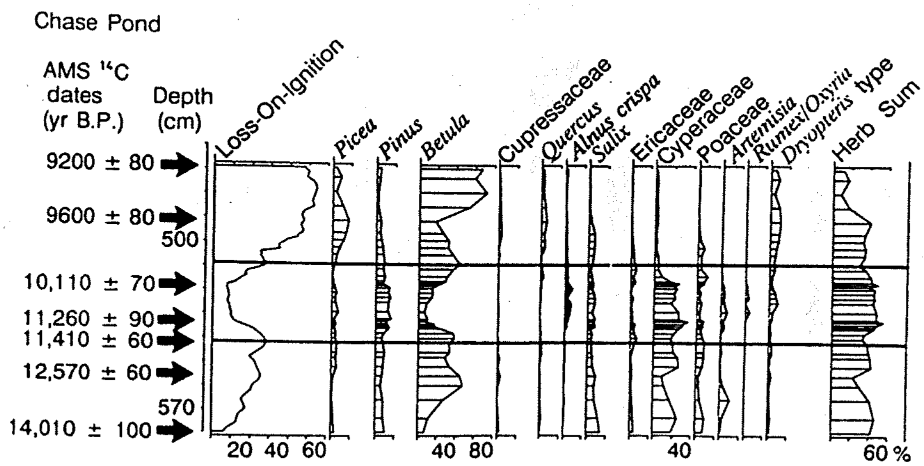


FIG. 4. Summary pollen percentage diagram for Chase Pond (modified from Mayle *et al.*, 1993a). Younger Dryas boundaries are based on the LOI curves and are represented by the continuous horizontal lines.

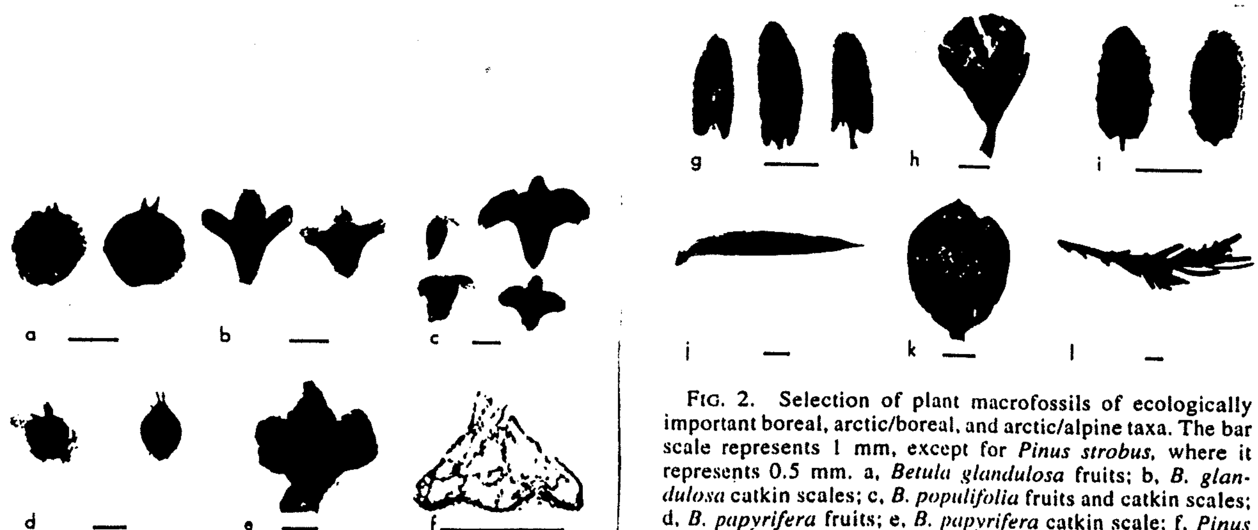


FIG. 2. Selection of plant macrofossils of ecologically important boreal, arctic/boreal, and arctic/alpine taxa. The bar scale represents 1 mm, except for *Pinus strobus*, where it represents 0.5 mm. a, *Betula glandulosa* fruits; b, *B. glandulosa* catkin scales; c, *B. populifolia* fruits and catkin scales; d, *B. papyrifera* fruits; e, *B. papyrifera* catkin scale; f, *Pinus strobus* needle (transverse section), from Younger Dryas of Splan Pond; g, *Dryas integrifolia* leaves; h, *Salix herbacea* leaf; i, *Empetrum* leaves; j, *Juniperus communis* needle; k, *Vaccinium uliginosum* leaf; l, *Cassiope hypnoides* twig.

From:
Mayle, F.E. & Cwynar, L.C. (1995): A review of multi-proxy data for the Younger Dryas in Atlantic Canada. Quat. Science Reviews 14: 813-821.
Mayle, F.E. & Cwynar, L.C. (1995): Impact of the Younger Dryas cooling event upon lowland vegetation of maritime

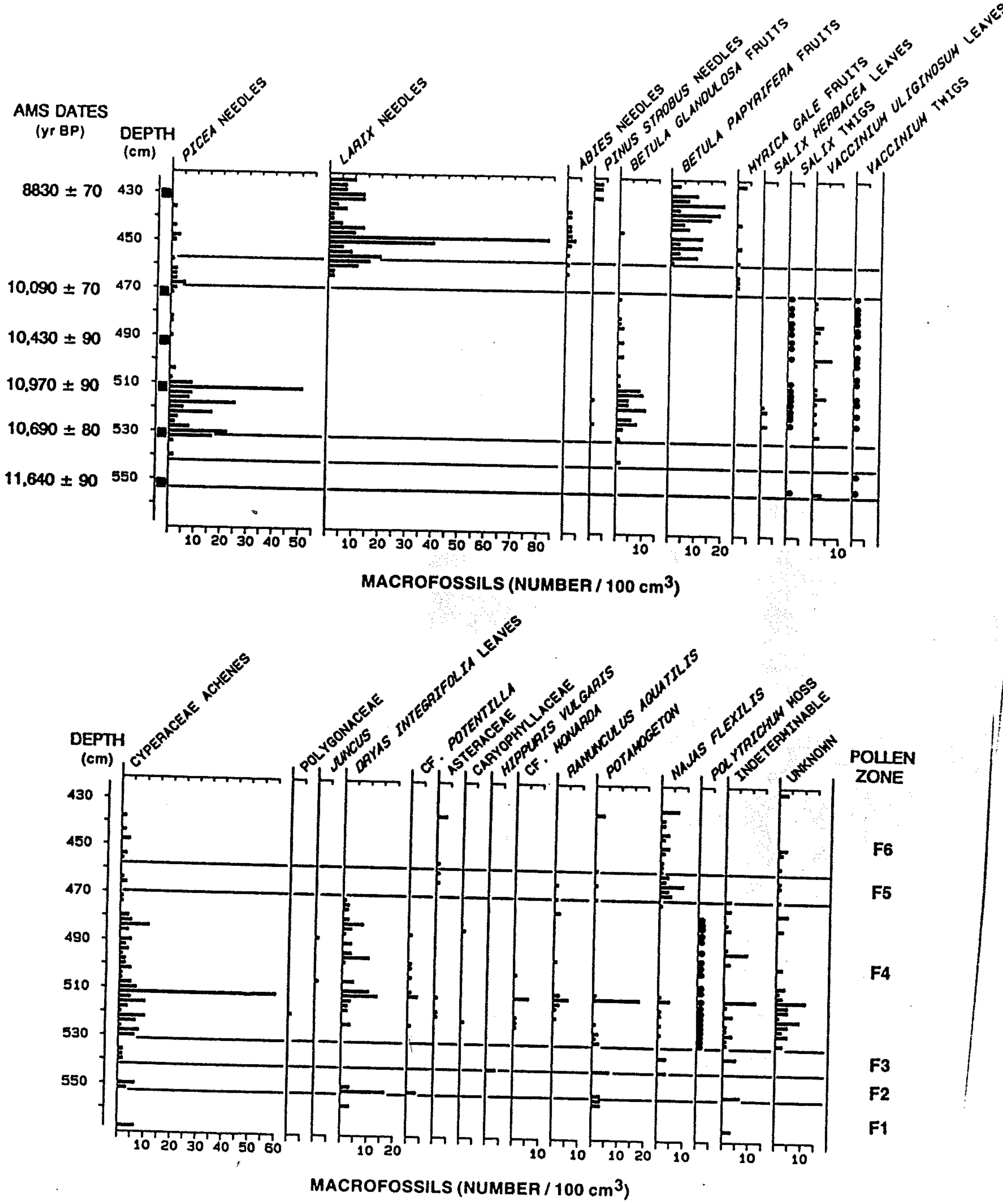
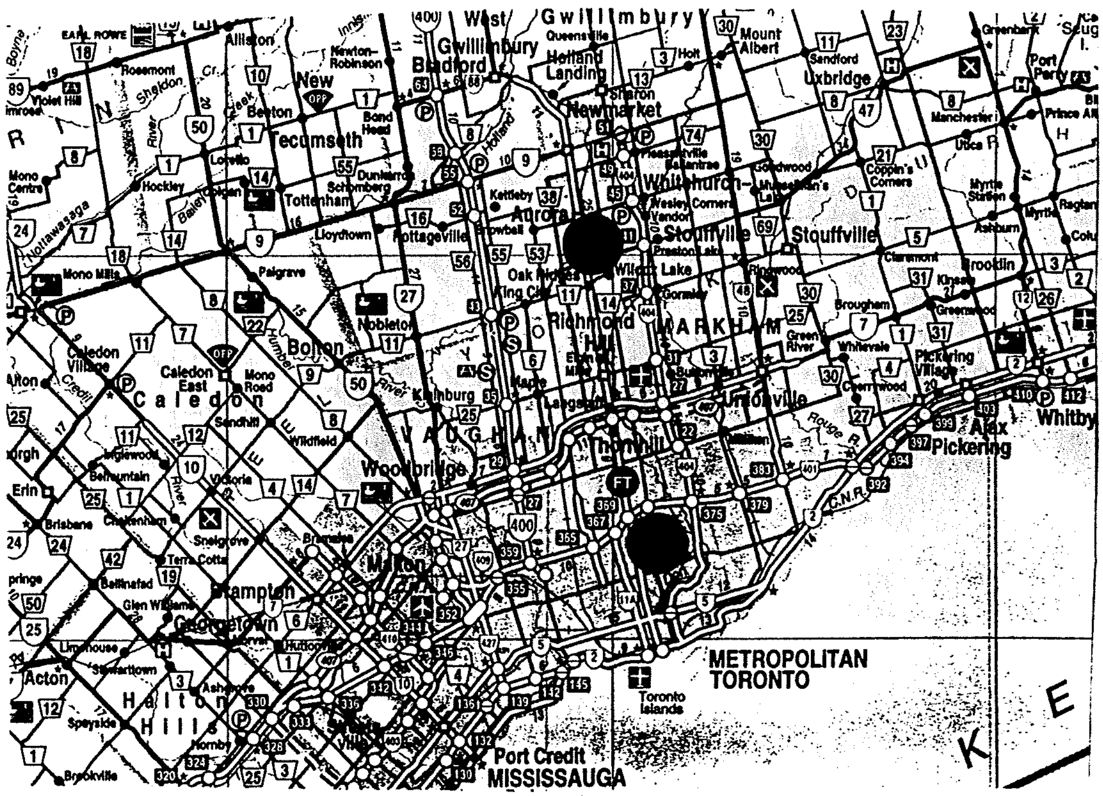


FIG. 5. Splan Pond macrofossil concentration diagram. ■: stratigraphic position of AMS ^{14}C dates.

August 27

Main themes:

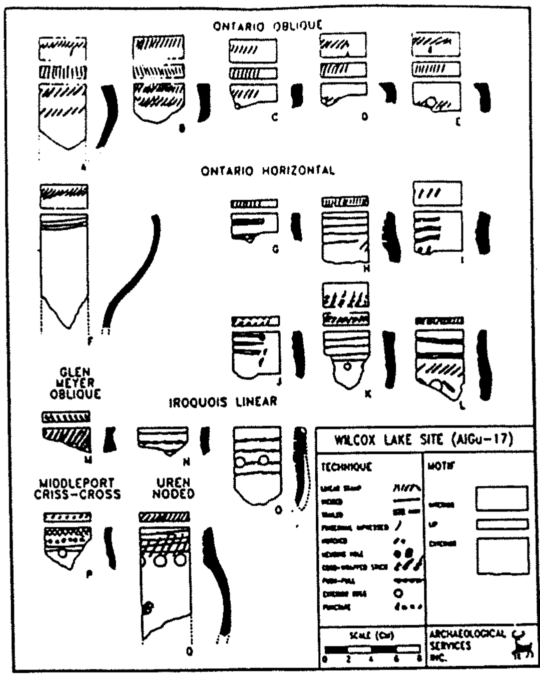
Prehistoric human impact
&
Eemian (Sangamonian) Interglacial vegetation history



Breakfast at the McAndrews Country House and at the Campbellford River Inn.

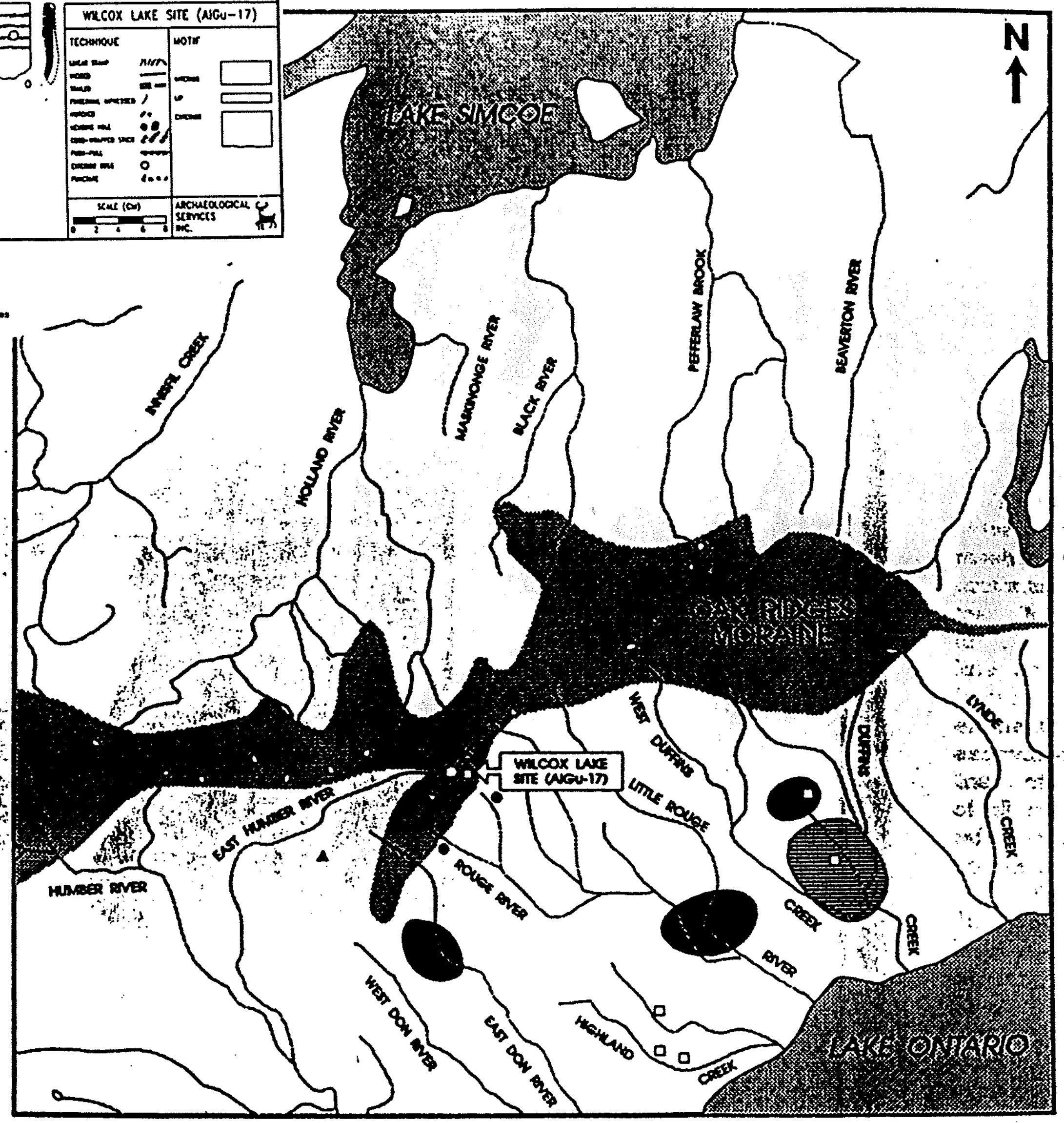
8.30 a.m.	Departure for **Wilcox Lake**: Detailed Holocene vegetation history and prehistoric Human impact at Wilcox Lake.
Lunch	at Wilcox Lake.
2 p.m.	Departure for the famous Don Brickyard section
3 p.m.	**Don Brickyard** section: Vegetation history of the Eemian (Sangamonian) Interglacial.

Overnight in Toronto (Hart House University of Toronto Tel. -416-978-7274 and Victoria College, Tel. -416-585-4524). Dinner on your own in Toronto.
Optional program with J.N.Haas: Night boat tour to the Toronto Islands with beautiful sky-scraper skyline, etc.



Wilcox Lake

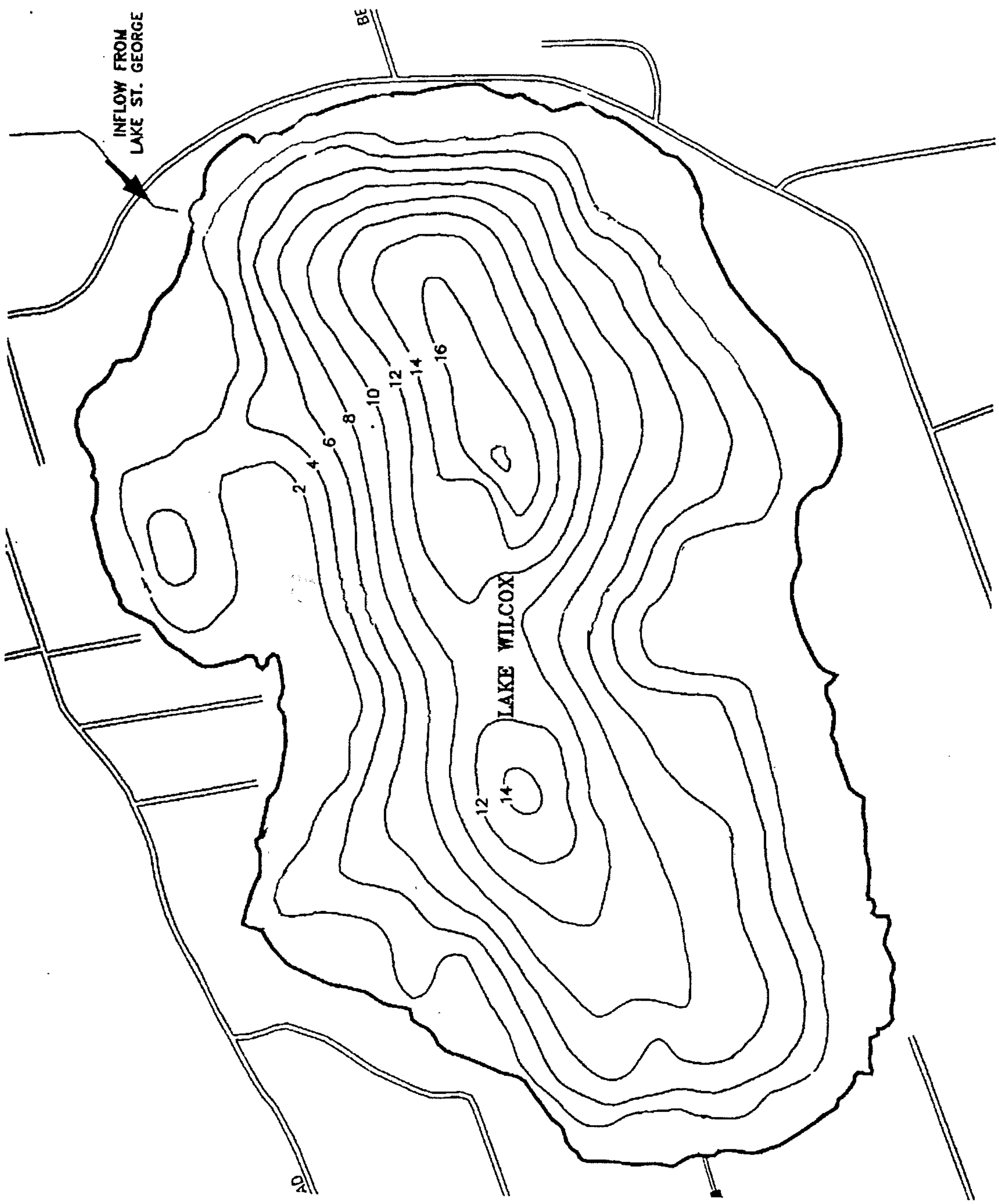
Figure 13. Wilcox Lake Site: Rim Plans and Profiles



- EARLY IROQUOIAN CLUSTER
- EARLY MIDDLE IROQUOIAN SITES
- LATE MIDDLE IROQUOIAN SITES/CLUSTERS
- CLOSEST LATE IROQUOIAN SITES

0 KILOMETRES 25

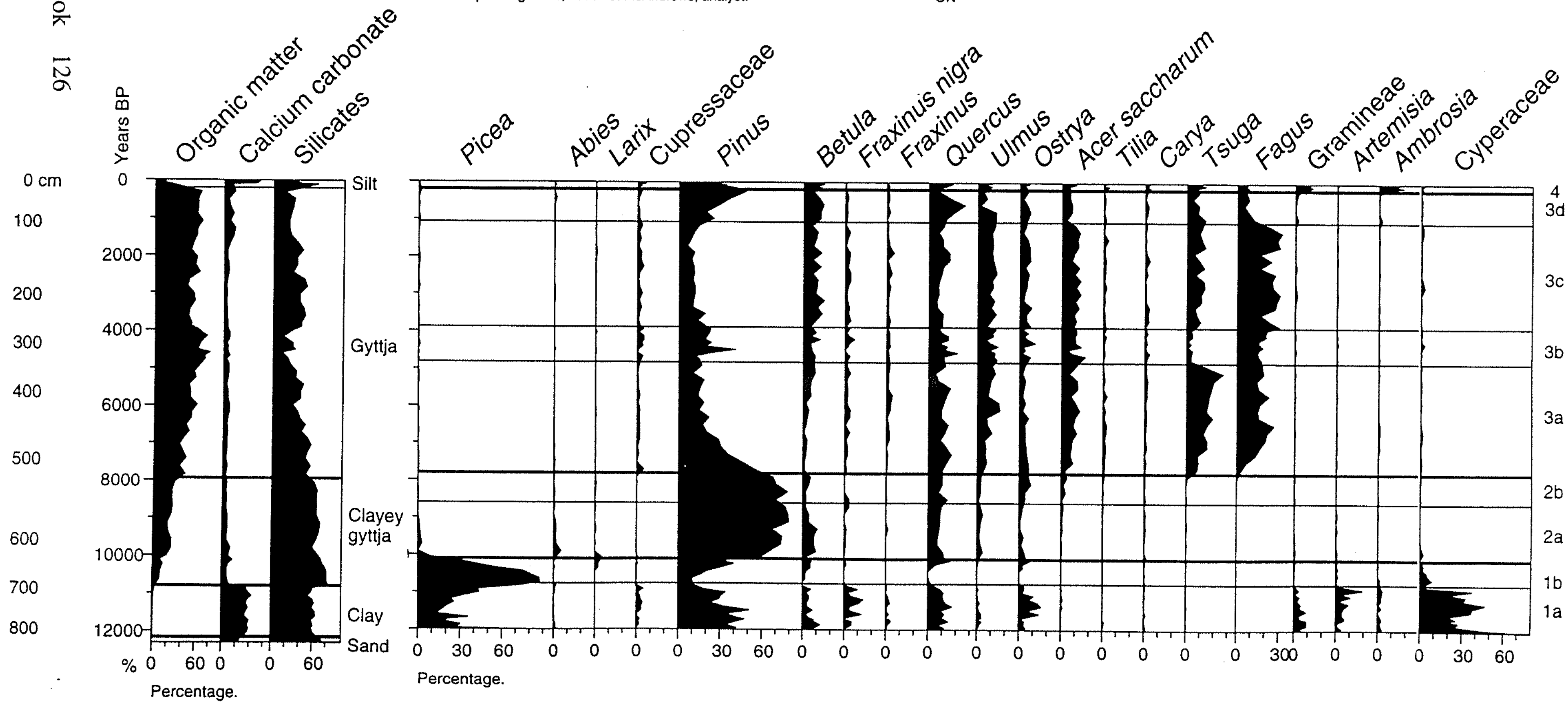
Figure 1. Location of the Wilcox Lake Site (AlGu-17) on the Oak Ridges Moraine


INFLOW FROM
LAKE ST. GEORGE
LAKE WILCOX
2
4
6
8
10
12
14
16
12
14


287
78-4366
48

Wilcox Lake

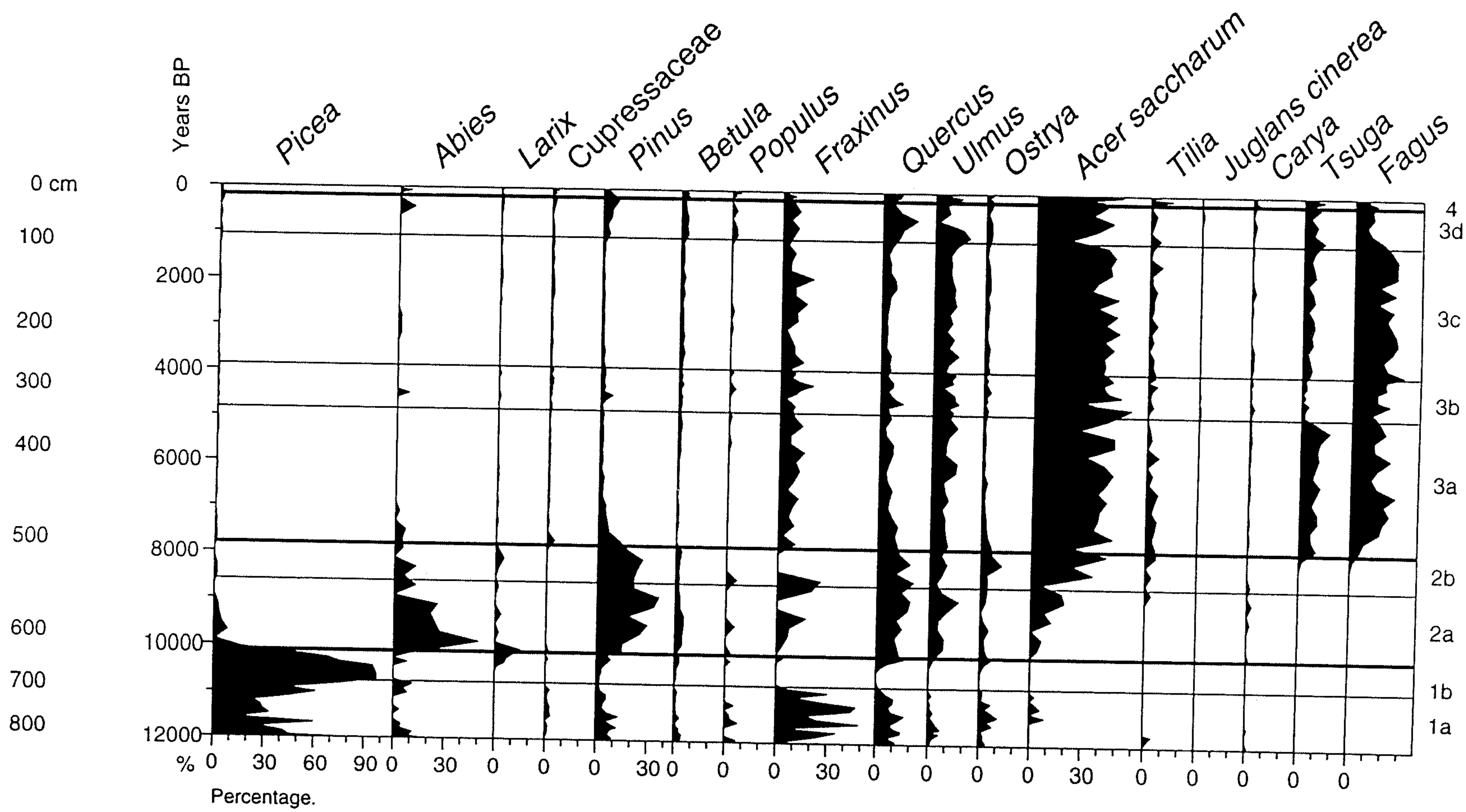
wilcox98.pol August 18, 1998. J. McAndrews, analyst. ON



Wilcox Lake Biomass

wilcox98.pol August 18, 1998. J. McAndrews, analyst.

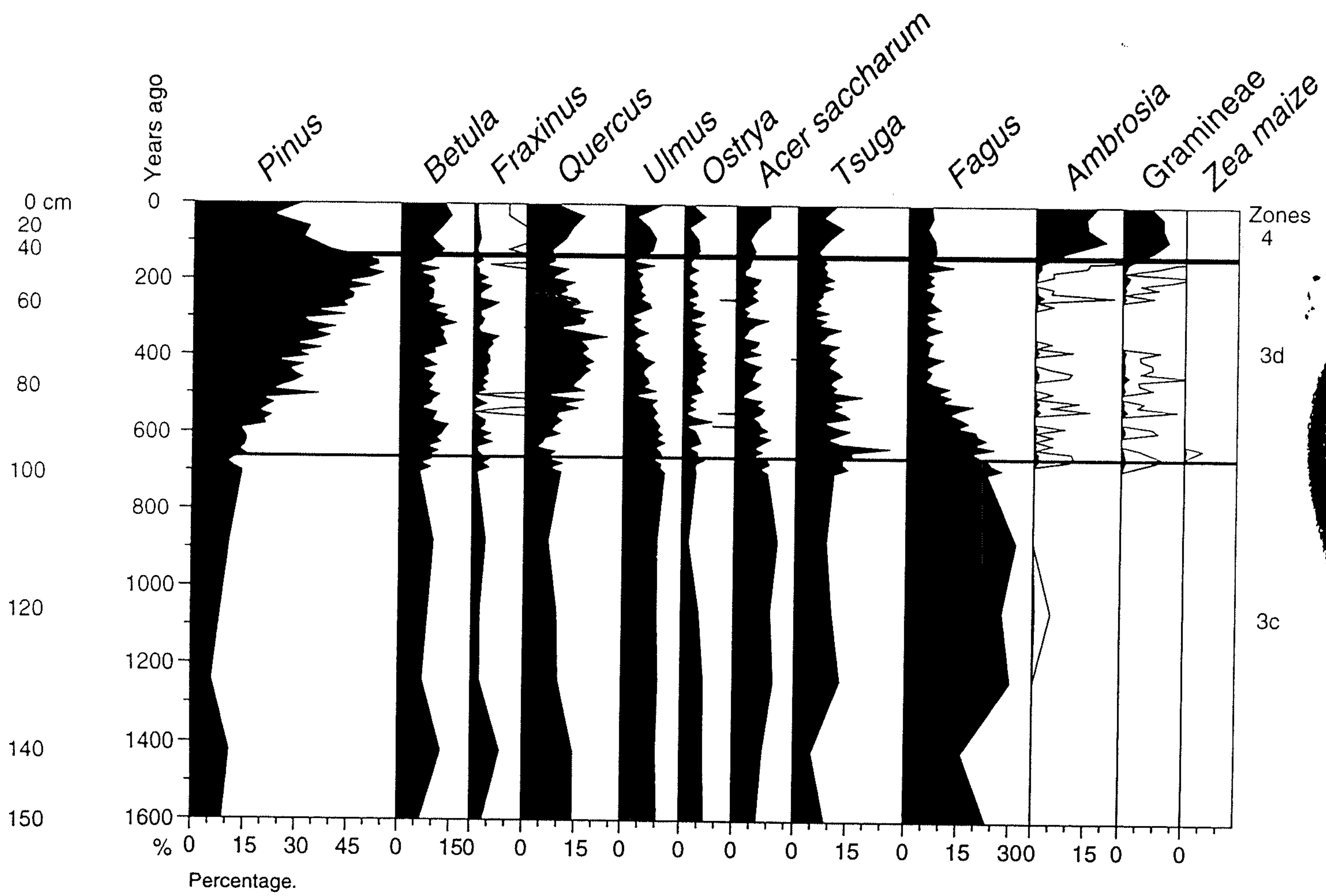
ON

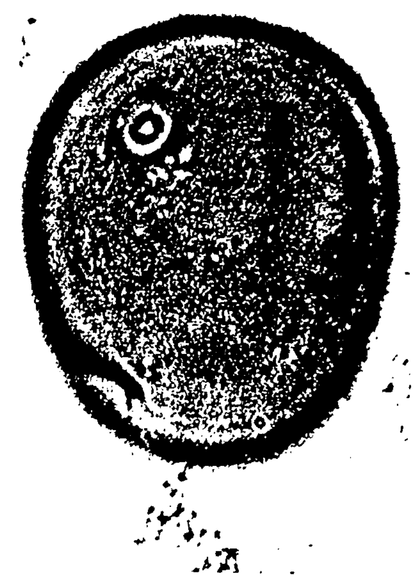


Wilcox Lake

wilcoxct.pol March 28, 1998 C. Turton and J. McAndrews, analysts.

Collected January 24, 1998. Tree sum. 10X exaggeration.





Sangamon (Eemian) Interglacial

Don Valley Brickyard, Toronto

The sandy Don and clayey Scarborough Formations were deposited in an ancient bedrock valley by rising water in the Lake Ontario basin. These deposits are underlain by Illnoian-aged York Till and Ordovician shale and overlain by fluvial and glacial deposits culminating in Glacial Lake Iroquois sand deposited 12,500 BP. In its lower part the Don FM contains a flora and fauna indicating climate was slightly warmer than today. At the top of the Don Fm is a leached and oxidized horizon that is interpreted either as subaerial weathering linked to an hiatus or simply as a groundwater aquifer. This oxidized horizon has poor pollen preservation which probably accounts for the anomalous pollen assemblage and temperature reconstruction.

The pollen sum is 200 tree pollen. Temperatures and and precipitation were reconstructed using the transfer function for region G (Bartlein and Webb (1985); they were summarized with a three-point running mean. For the topographically comparable climate station on the Toronto Islands the mean July temperature is 20.3°C, mean January temperature is -4.0°C and mean annual precipitation is mm.

The pollen diagram begins with a warm climate deciduous forest assemblage containing the now southern *Nyssa* and *Liquidambar* but dominated by *Quercus.* It was succeeded by at first *Pinus* and then by cool climate *Picea* with increasing shrubs and herbs, particularly *Sphagnum.* Climatic reconstruction indicates that the climate was more continental during the last interglacial, with warmer summers and colder winters.

Macrofossil were abundant and well-preserved. The Don Fm features three cycles of aquatic plants suggesting lake water level fluctuations. In the Scarborough Fm the abundant macrofossil are best interpreted as being derived from the erosion of a wetland which also included *Sphagnum.*

The Fernbank site near Ithaca NY is probably contemporaneous but reflects its more southern location with higher *Quercus* and *Carya*.

Eyles, N. and N.E. Williams. 1990. The sedimentary and biological record of the last interglacial/glacial cycle at Toronto, Canada. *In* P. U. Clark, P. D. Lea, Eds., The Record of the Last Interglacial/Glacial Transition in North America. Geological Society of America Special Paper 270. pp. 119-137.

Terasmae, J. Contributions to Canadian Palynology No.2. Part II: A palynological study of Pleistocene interglacial beds at Toronto, Ontario. Geological Survey of Canada, Bulletin 56, pp. 23-40.

c:\texts\donpoll.txt 980818

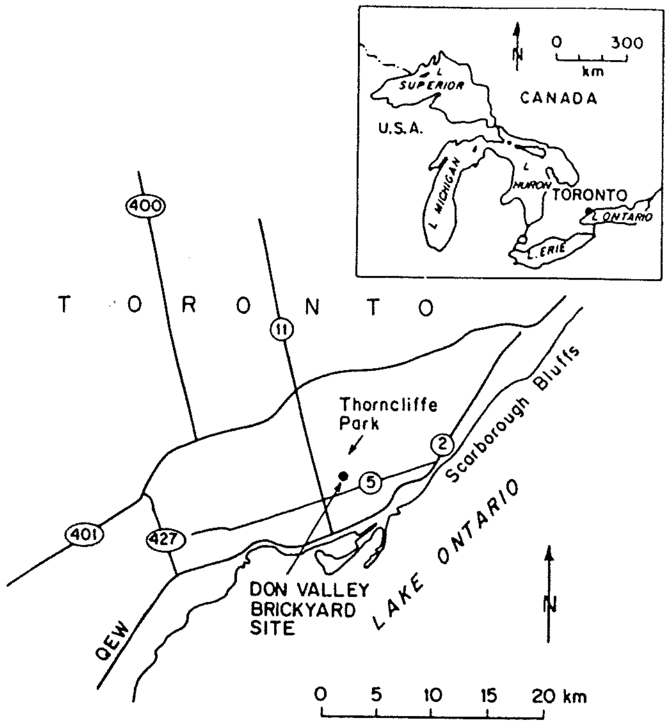


FIG. 1. Location map of Don Valley Brickyard. QEW, Queen Elizabeth Way.

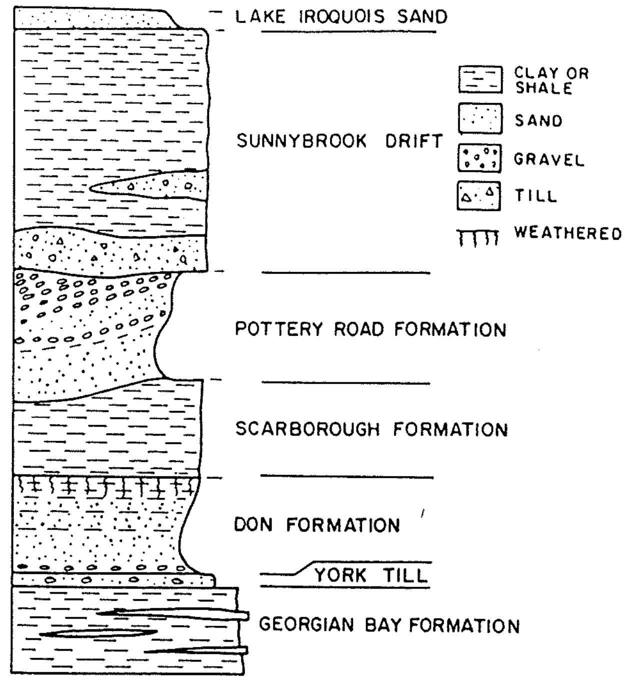
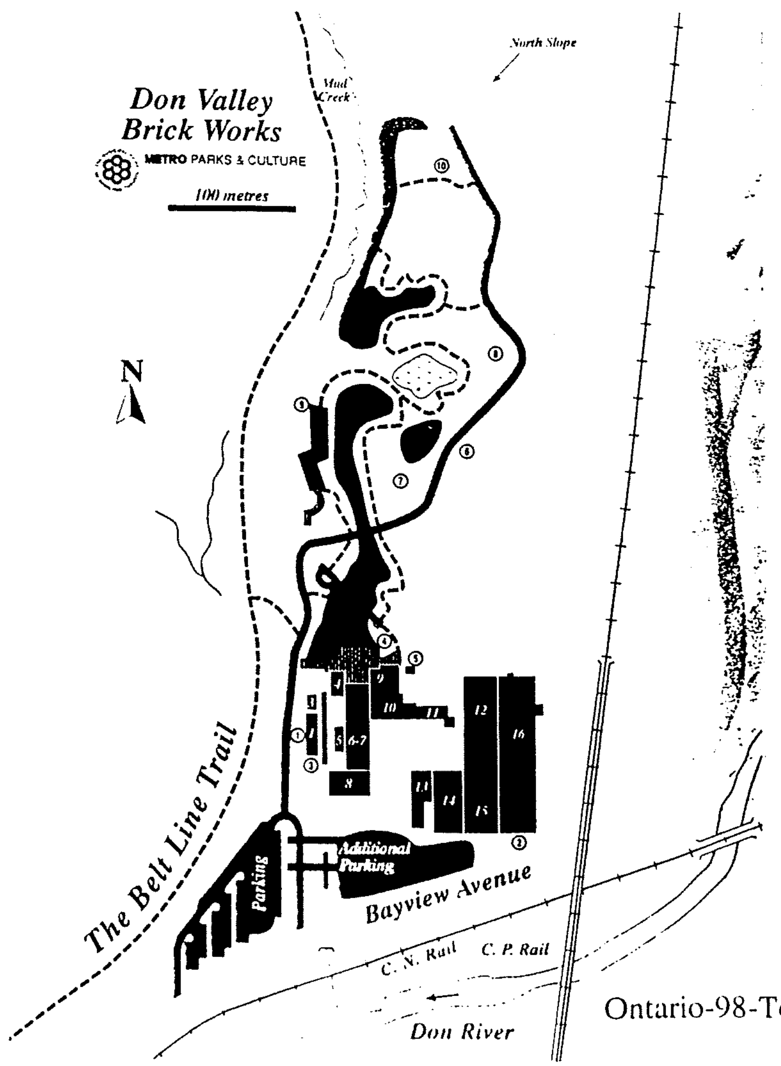


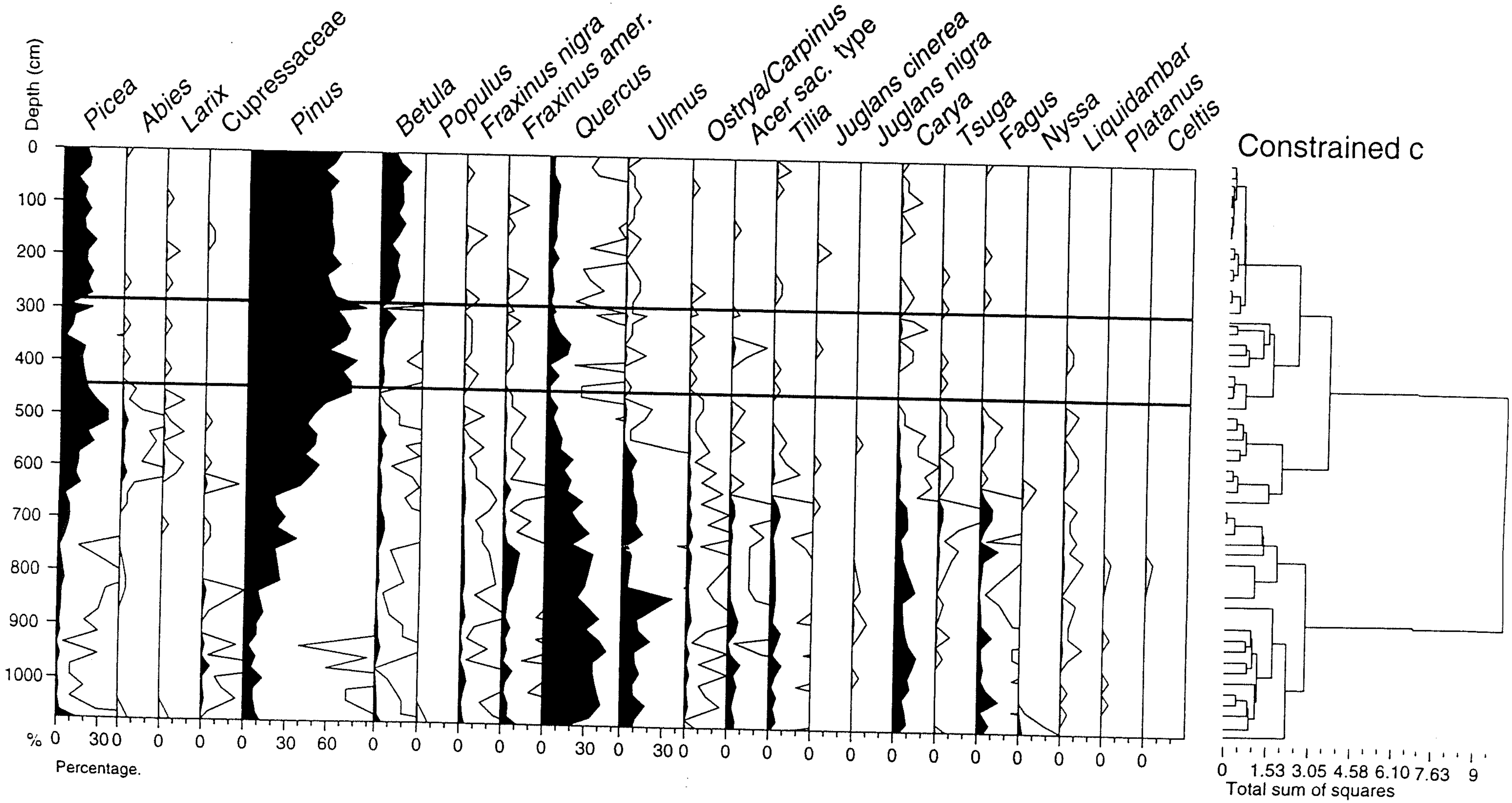
FIG. 2. Sketch of stratigraphic sequence at the Don Valley Brickyard.



Don Brickyard Section Tree Pollen

tree don84.pol July 28, 1997 J.McAndrews, analyst. Ontario.

Sum of 200 tree pollen including Betula except 127 in 1075.

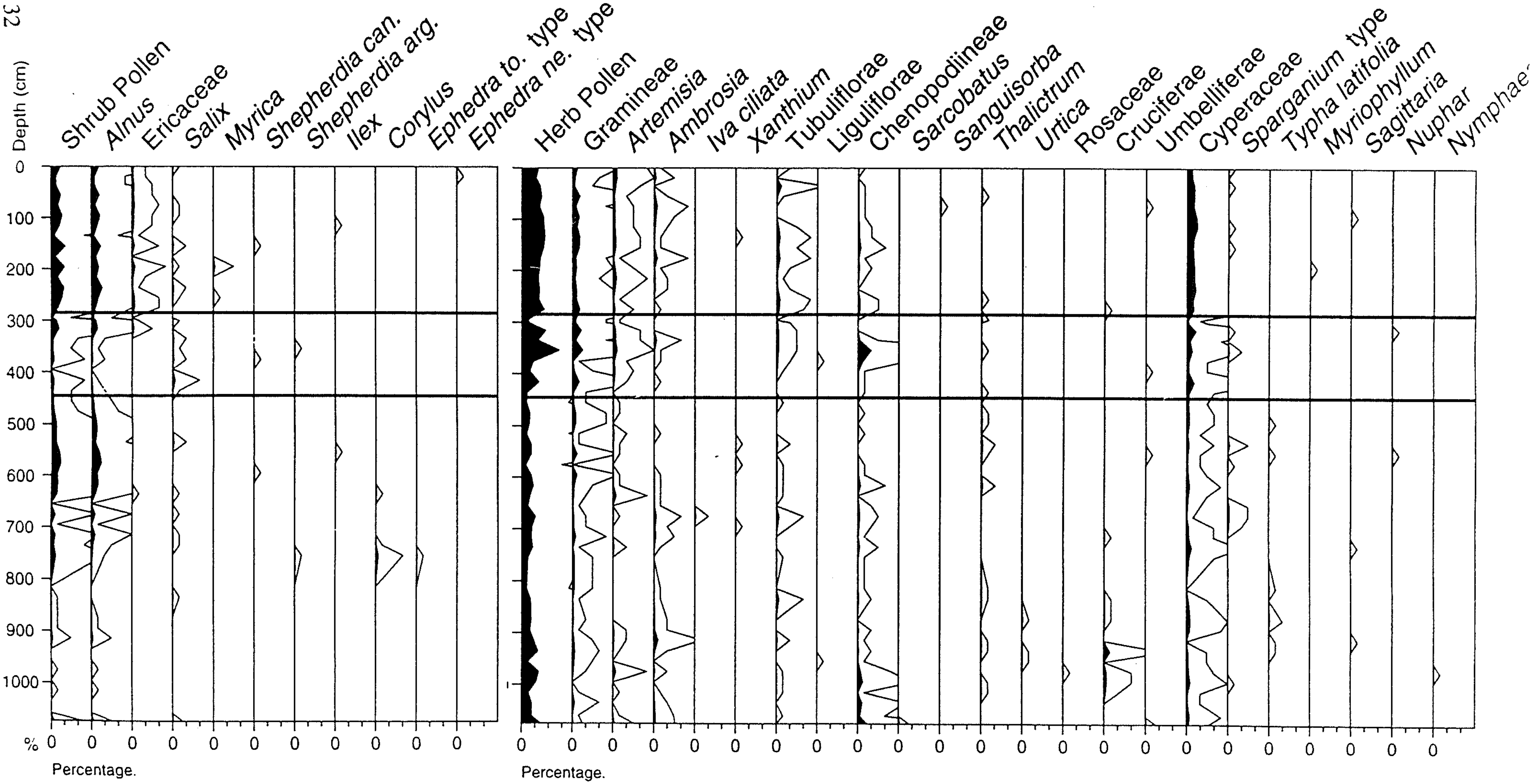


Don Brickyard Section Shrub Don Brickyard Section Herb Pollen

shrub don84.pol July 28, 1997 J.McAndrews, analyst. Ontario.

herb don84.pol July 28, 1997 J.McAndrews, analyst. Ontario.

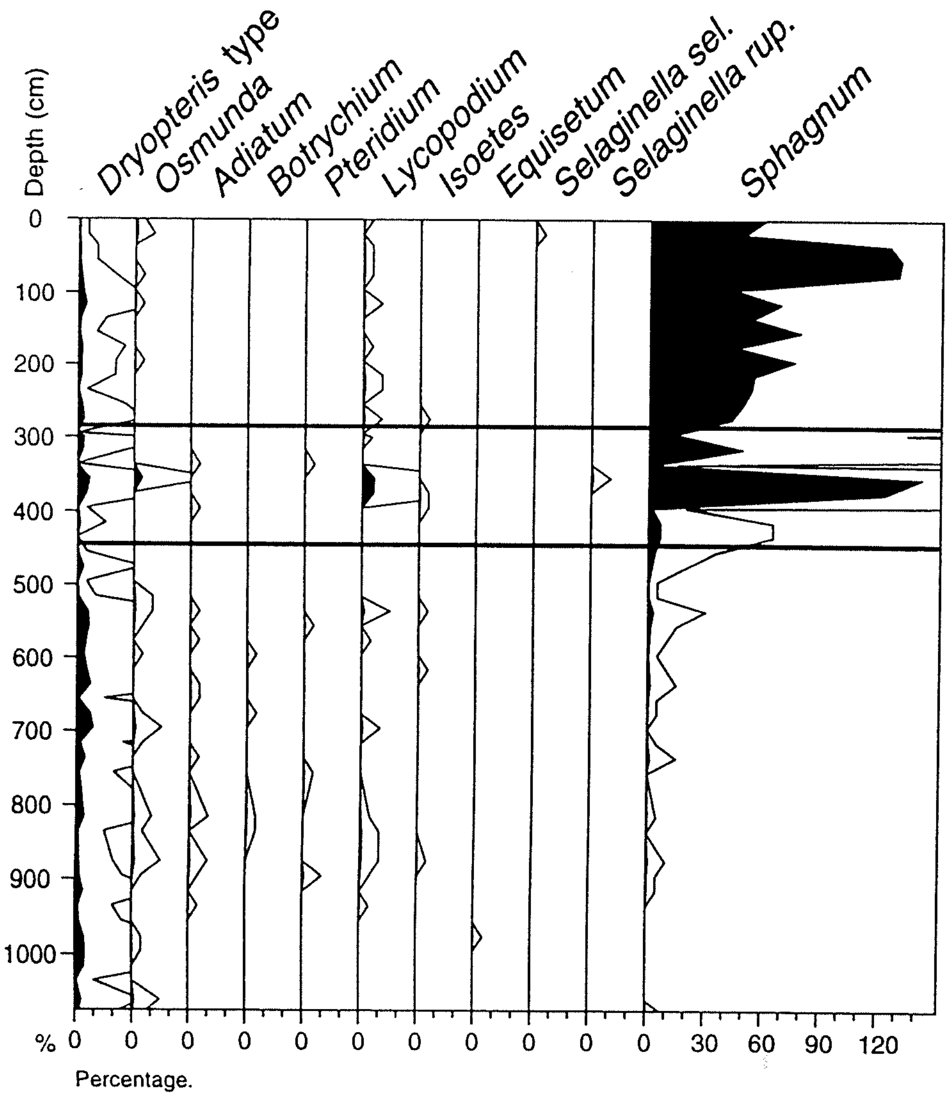
Sum is 200 tree pollen including Betula except 127 at 1075.



Don Brickyard Section Cryptogam Spores

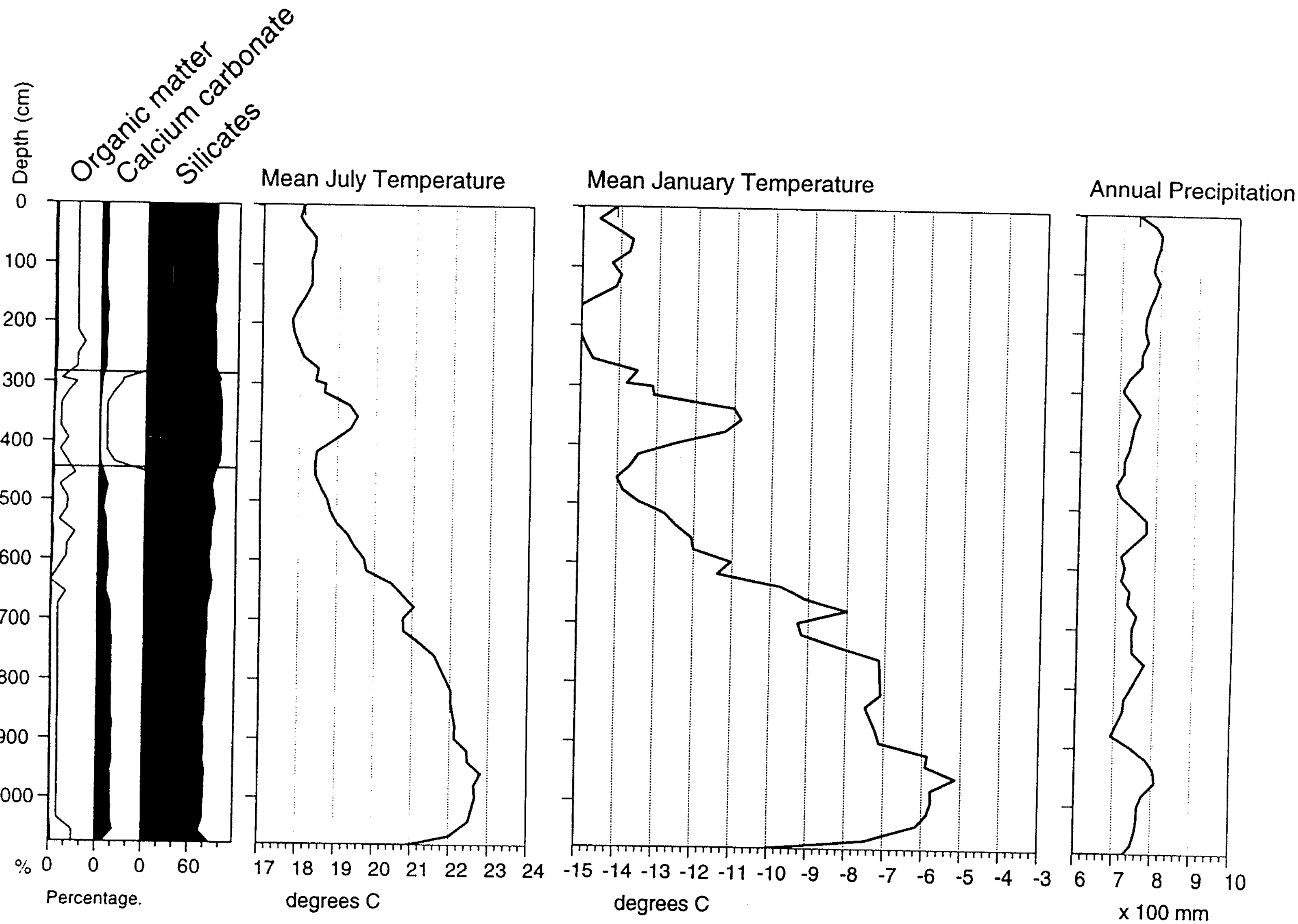
spores don84.pol July 28, 1997 J.McAndrews, analyst. Ontario.

Sum is 200 tree pollen including Betula except 127 at 1075.



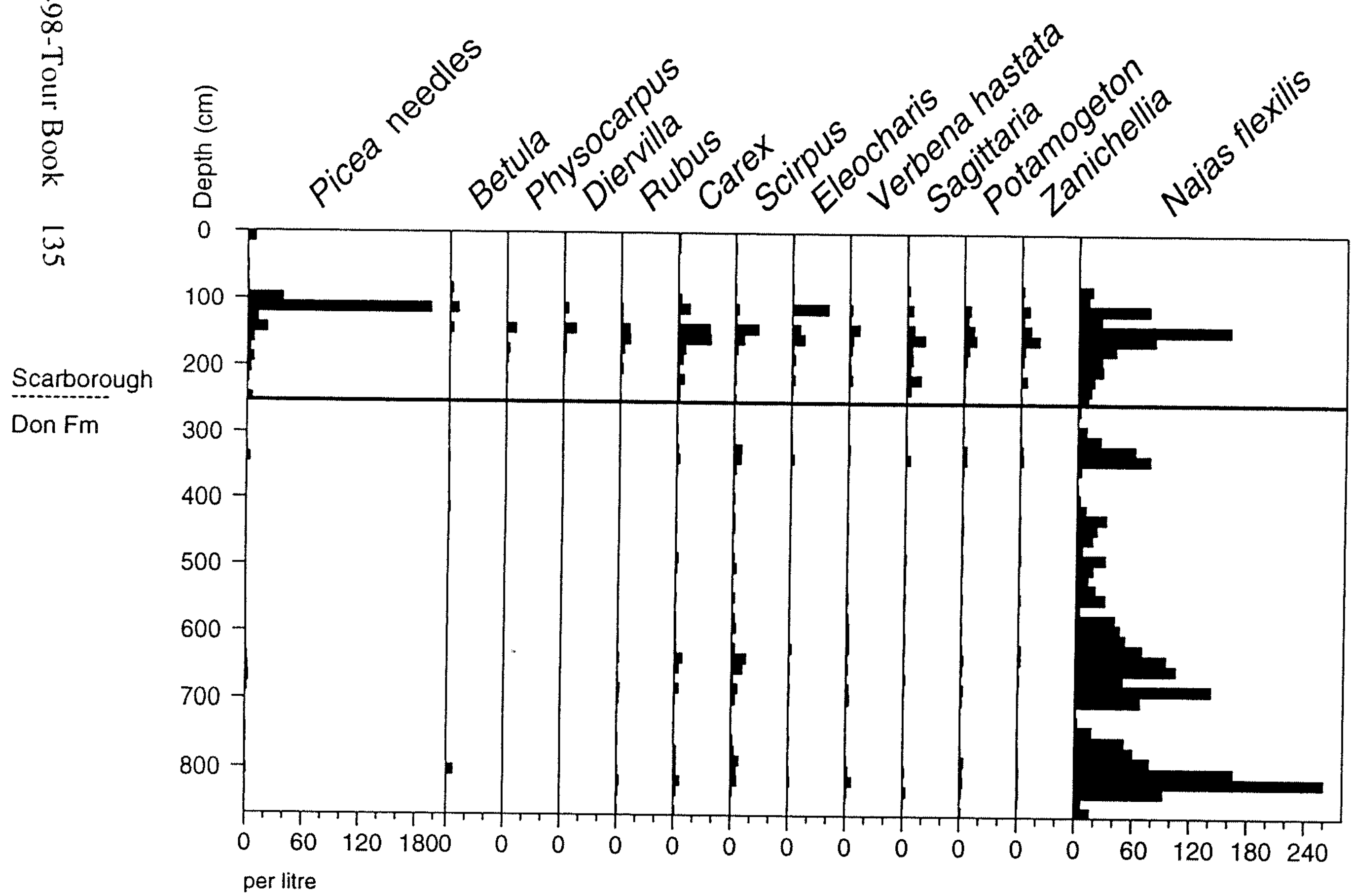
Don Brickyard

don84.loi July 25, 1997



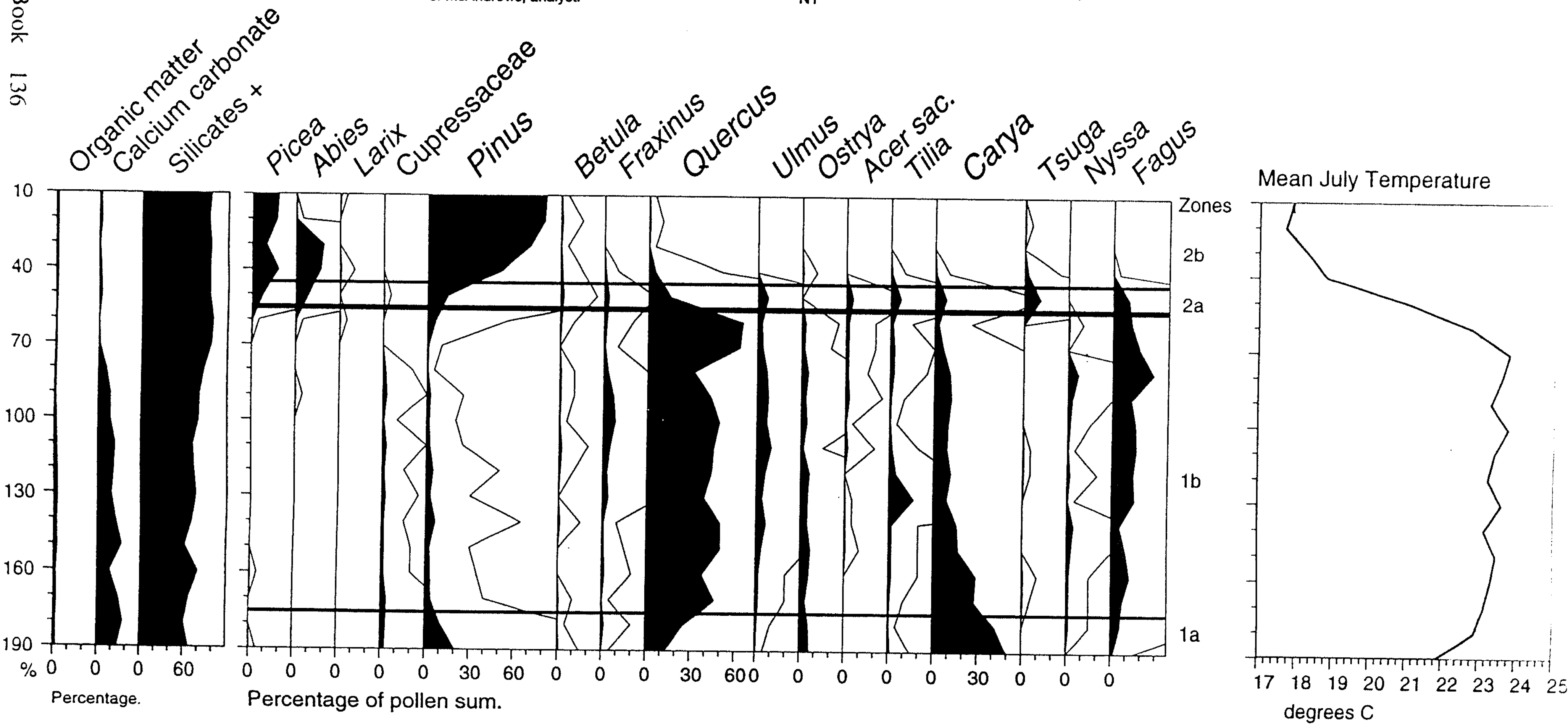
Don Brickyard Section selected macrofossils

donm3.mac August 18, 1998



Fernbank Fernbank Section

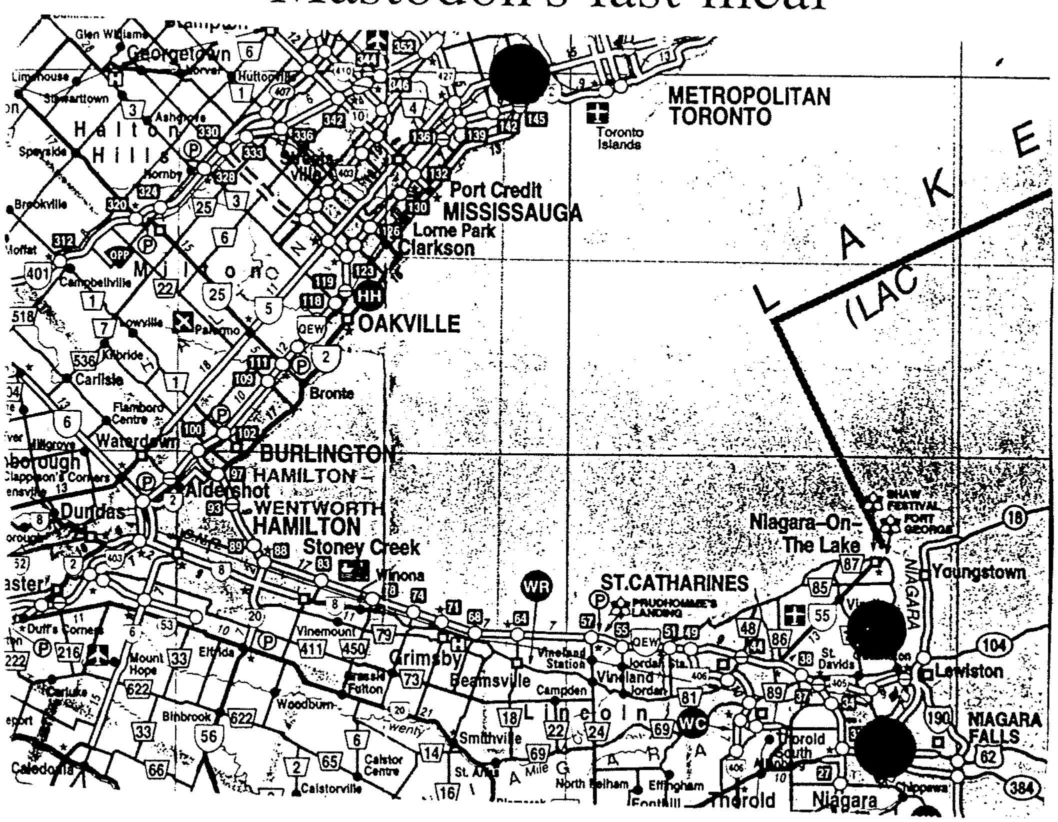
fern98.loi June 22, 1998 J. McAndrews, analyst. NY



August 28

Main themes:

Lake Ontario water level changes since 12'500 BP
&
Mastodon's last meal



Breakfast at your own at the Hart House.

7.30 a.m.	Departure for the Toronto-Humber Valley & Niagara Falls:
8.30 a.m.	**Humber Valley**: Lake Ontario water levels since 12'500 BP
9.30 a.m.	Departure for Niagara Falls. Geology of Niagara Falls.
Lunch	and Visit of **Niagara Falls** on your own. Optional program: sensational (and wet...) boat-trip into the mist of Niagara Falls!
2.30 p.m.	Departure for Niagara Peninsula: View of Whirlpool Rapids, visit of **Niagara Glen Forest** and presentation of the last mastodons and mammoths in North-eastern America: The mastodons last meal at the **Hiscock** site (New Yoork, U.S.A.)! A pollen and macrofossil study.
4 p.m.	Official end of the 1998-excursion through S-Ontario.
4.15 p.m.:	Winery tour at **Hillebrand Estates Winery**.
5.15 p.m.	Departure for Toronto.
8.30 p.m.	Optional **CN-tower-closing-dinner**.

Overnight in Toronto (Hart House University of Toronto Tel. -416-978-7274 and Victoria College, Tel. -416-585-4524).

Lower Humber Valley - a special place John H. McAndrews

Meander scar wetlands: how did they originate and what was their vegetation history?

The lower Humber Valley from Brule Park, just north of Bloor Street, southward to Lake Ontario features wild floodplain land within urban Toronto. Forty-meter high bedrock cliffs of 450 million year old Ordovician marine shale define the 300 m wide valley. In postglacial but prehistoric time, the river flowed in a sinuous course to erode meanders in the bedrock cliffs; later the river assumed a straighter course down the valley. On alternate sides of the modern river, marshes grew in these old meander sites, but in the past two centuries these marshes have mostly disappeared under a cover of mineral soil. This soil is either landfill rubble used to create park land or flood-deposited sediment that now support forested levees enclosing clay-bottomed ponds.

The most interesting part of this section of the valley is Pond 7 which can be easily reached from the southeast end of the Bloor Street bridge by following the path down the cliff to the floodplain and its pond. Beavers episodically colonize this pond and fell Populus deltoides and Fraxinus americana trees. Water birds such as blue heron and duck are also common. Occasionally large introduced fish can be seen, carp in the pond and Pacific salmon in the river. The floodplain forest is dominated by alien Acer negundo, Salix X, and Acer platinoides in addition to the native Populus, Fraxinus and Ulmus americana. Vitis riparia vines hang from the trees in this lush forest. Weedy herbs cover the forest floor, including the native Ambrosia trifida, the alien and attractive Impatiens glandulifera and the not so attractive Aliaria officinalis.

These aliens and weeds thrive in this seasonally disturbed floodplain environment. In spring, during snow melt, the river rises carrying ice blocks down stream. When the blocks run aground at a bend in the river, an ice block dam forms across the river causing water to rise and spread over the floodplain. Ice blocks floating down stream strike and scar floodplain trees up to 3 m above normal water level. This flood water also carries suspended sediment; sand is deposited on the levees along the channel and the finer silt and clay in the backswamp and pond where the current is slower. There is also local erosion on the levee surface, especially near tree trunks where there is turbulence during floods. This deposition and erosion encourages the growth of weedy herbs that, after the flood subsides, grow quickly on the fertile soil beneath the forest canopy. On the other hand, the perennial floodplain trees must tolerate periods of waterlogged soil which accounts for the absence of upland trees such as Quercus, Acer saccharum and Fagus.

The lower Humber valley has also been a special place in human history. From Lake Ontario upstream to Bloor street where the rapids begin, the river is navigable; it forms the southern end of the early historic Toronto Portage to the Upper Great Lakes. Until the late 18th century, canoes from windy Lake Ontario entered the relatively calm river mouth to be unloaded for the portage northward over the Oak Ridges Moraine to the Holland River. At this point canoeing began again down river, across Lake Simcoe and along the Severn River to Georgian Bay. Just above the head of navigation, on Baby Point there was a 17th century Seneca Indian village, Teiaiagon. This village hosted a French trading post, the first European settlement in the Toronto region (Robinson 1965). It was also a crossroad because it was located at the most convenient ford on the Humber River for people walking along the shore of Lake Ontario. For these early people, the floodplain also provided fertile soil for growing corn, and the river itself was a fishery for Atlantic salmon.

In 1750, the interest of European nations intensified when the French erected Fort Toronto at the mouth of the river. The fort was succeeded by a trading post which persisted for the rest of the century. In 1793, Britain's Lieutenant Governor Simcoe built a saw mill on the abandoned site of a French sawmill at the head of navigation near the Old Mill, a ruin which dates from 1850. Here a dam was built and water was diverted to power a saw mill and later, after road building, a grist mill. For these reasons, the first European settlement in the Toronto Region was along the lower reach of the Humber River. However, Simcoe rejected the Humber Portage as the route to Georgian Bay and opened Yonge Street to replace it.

What then were the geological events which produced these landforms that made the valley so attractive for human travel and settlement? A good place to begin is around 12,500 BP, when the continental glacier melted out of the Lake Ontario basin but persisted in the St. Lawrence valley. With the valley plugged with ice, glacial Lake Iroquois filled the Ontario basin to an elevation of 130 m above modern sea level at Toronto, well above the present Lake Ontario level of 75 m. This lake had its shoreline northward at Lawrence Avenue and deposited sand over the lower Humber Valley region (Sharpe 1980). When the ice melted, Lake Iroquois drained to the low level of early Lake Ontario. A valley offshore from the Humber river indicates that the prehistoric river eroded the bedrock to 115 m below the modern level of Lake Ontario (Lewis et al. 1995), which was probably the surface of early Lake Ontario. However, the lake still drained to the sea because the sea was 40 to 50 m lower than today. Since then, Lake Ontario has risen to its present level because of isostatic tilting. This basin tilting and subsequent flooding has produced still-water estuaries which serve as harbors for towns such as Port Credit and Oakville and, to a lesser extent, for the former commercial fishing boats and now the modern pleasure craft marina on the lower Humber River.

Basin tilt was not the only factor in flooding; distant stream capture also contributed to a relatively brief episode of shoreline flooding which has left its imprint in the Humber valley. Until about 5,000 BP, the upper three Great Lakes (Lakes Superior, Michigan and Huron) discharged to the sea via the Ottawa River. Southward crustal tilt of their basins then caused additional outlets at Sarnia-Port Huron and Chicago and flow through the North Bay outlet to the Ottawa River diminished. By 2,000 BC, all of the Great Lakes discharged through Lake Ontario as they do today. Because the Lake Ontario outlet to the St. Lawrence River was not adapted to this larger discharge, Lake Ontario rapidly rose about 15 m to perhaps 2 m above its present level and formed estuaries along the shore. This event, called the Nipissing Flood beginning 4,000 years ago, helps to explain the valley landforms.

The lower Humber valley displays two stages of postglacial development. Before 4,000 BP the river eroded meander loops into alternate sides of the valley.

Since then these loops have been abandoned, and the river now flows in a relatively straight channel. The timing and cause of this channel change has been worked out by studying the sediment beneath the floodplain ponds (Weninger and McAndrews 1989). Sediment cores lifted from beneath meander ponds 3, 5, and 7 penetrate to river channel gravel and contain sediments deposited since 4,000 BP.

In the meander pond of site 7, beneath 50 cm of water, we lifted a 590 cm-long core of soft sediment before being stopped by hitting the channel gravel (Fig. 1). Overlying the gravel which dates to just before 3,500 BP, is silt deposited in an estuary formed during the 1,400 years of high water that marks the Nipissing Flood. In this silt, fossil pollen and seeds are both sparse and poorly preserved indicating seasonally drying. About 2,100 BP, this mud-flat silt was replaced by organic mud containing well preserved fossil pollen and seeds of pond and marsh plants indicating that a river levee had formed which isolated a pond surrounded by marsh. This new environment was a response to the waning of the Nipissisng flood in Lake Ontario; the river extended southward in a relatively straight course through the mud flat. The new floodplain slowly accumulated sediment to keep pace with the renewed rise of Lake Ontario due to basin tilt.

About 1,200 BP, the pond filled in to become a marsh. This marsh persisted until the 19th century when deforestation of the river catchment caused increased flood frequency and intensity; these flood waters carried soil eroded from newly-tilled fields. Over-bank flooding was intensified, especially in spring when the farm fields were deeply frozen. Sand levees were enhanced and clay began to encroach on the marshes causing the dominance of Typha. Since the early 20th century, the marshes have disappeared under a deposit of sand and clay, probably the result of intense soil erosion during road and building construction. Fossil pollen indicates Ulmus, Salix, Populus and Acer negundo then invaded these newly-enhanced levees on the sites of former marshes to form the modern floodplain forest and pond that beaver have come to inhabit.

To a casual visitor the Humber valley appears to be a benign landscape. However, in October, 1954, Hurricane Hazel caused a record flood which peaked 6 m above normal water levels. The turbulent water swept away homes and caused loss of life (Kennedy 1979), but there is only a little evidence of landscape change from this tragic event. In the clay-bottomed ponds this flood deposited a layer of coarse sand; on the levee Fraxinus tree rings are relatively narrow for the five years after the flood indicating diminished growth perhaps due to flood erosion which exposed and killed roots. In the longer term Lake Ontario is rising at a rate of about 20 cm per hundred years and because of this, the lower valley will again become flooded from wall to wall. With time the estuary will broaden and expand, forming flood ponds and levees upstream (Brule Park will develop a pond) as it destroys them downstream.

Figure 1. Fossil pollen and seed diagram from sediments beneath pond of site 7. The 590 cm long core was lifted from beneath 50 cm water. The chronology is based on three radiocarbon dates. Pollen percentages are calculated on counts of 200 tree pollen; only selected pollen types are shown. Note that pollen of floodplain trees is historic. The seeds of selected wetland plants show that a sterile mud flat which was deposited during the Nipissing Flood was succeeded by a marshy pond and marsh after the Flood had receded. In the 19th century, the succession to the Typha and Zizania marsh was probably due to increased mineral sedimentation.

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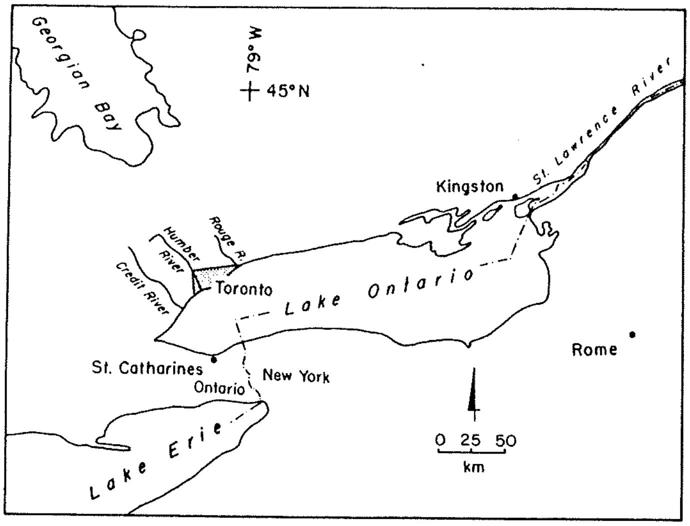


FIG. 1. Location of Humber River and study area (43°38′N, 79°28′W) in southern Ontario.

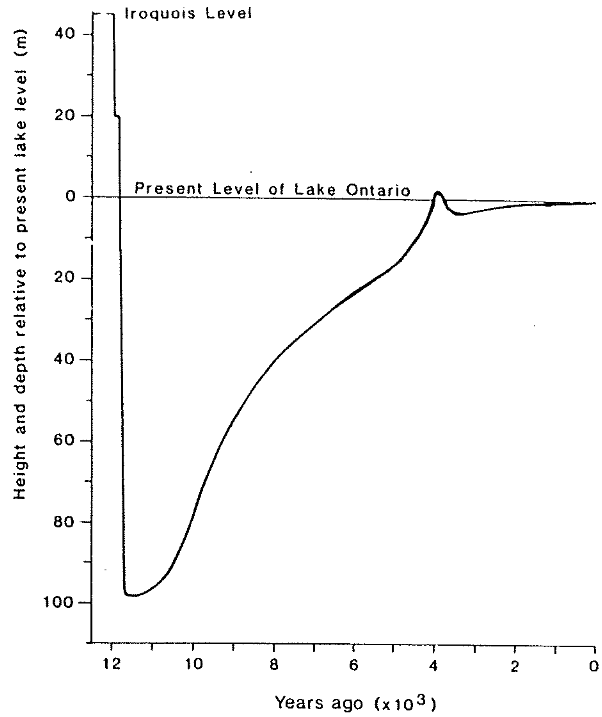
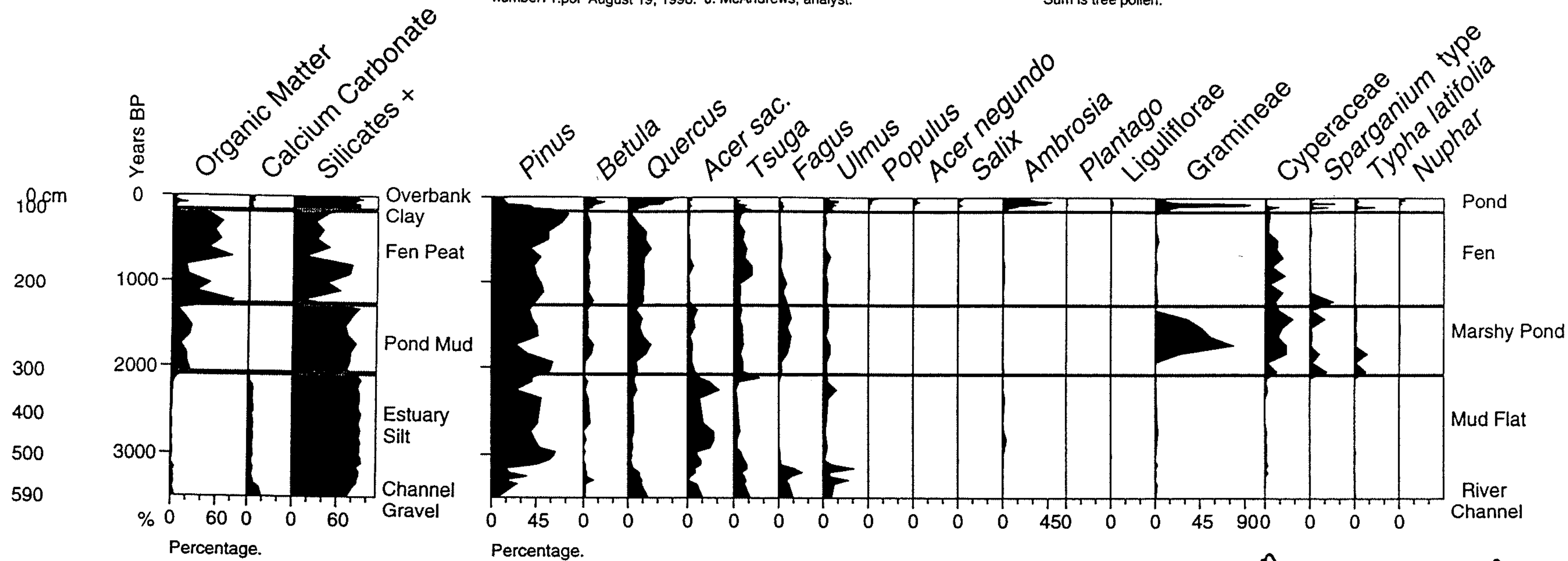


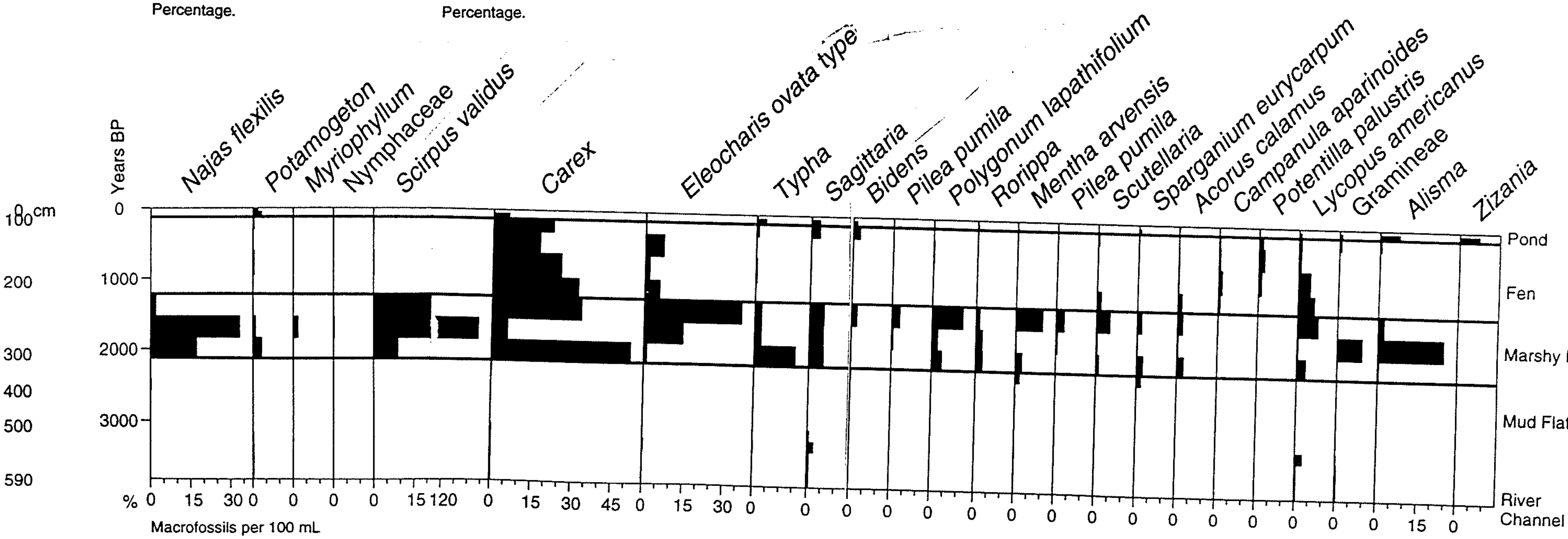
FIG. 2. Lake Ontario water-level curve since deglaciation. Redrawn from Anderson and Lewis (1985).

FIG. 3. Airphoto (1978) of the study reach between Bloor Street and Lake Ontario. Pond 5 has been whitened for clarity. Ponds 1, 6, and 8 have been artificially filled over the past century.

Humber Valley Pond 7

humber71.pol August 19, 1998. J. McAndrews, analyst. Sum is tree pollen.





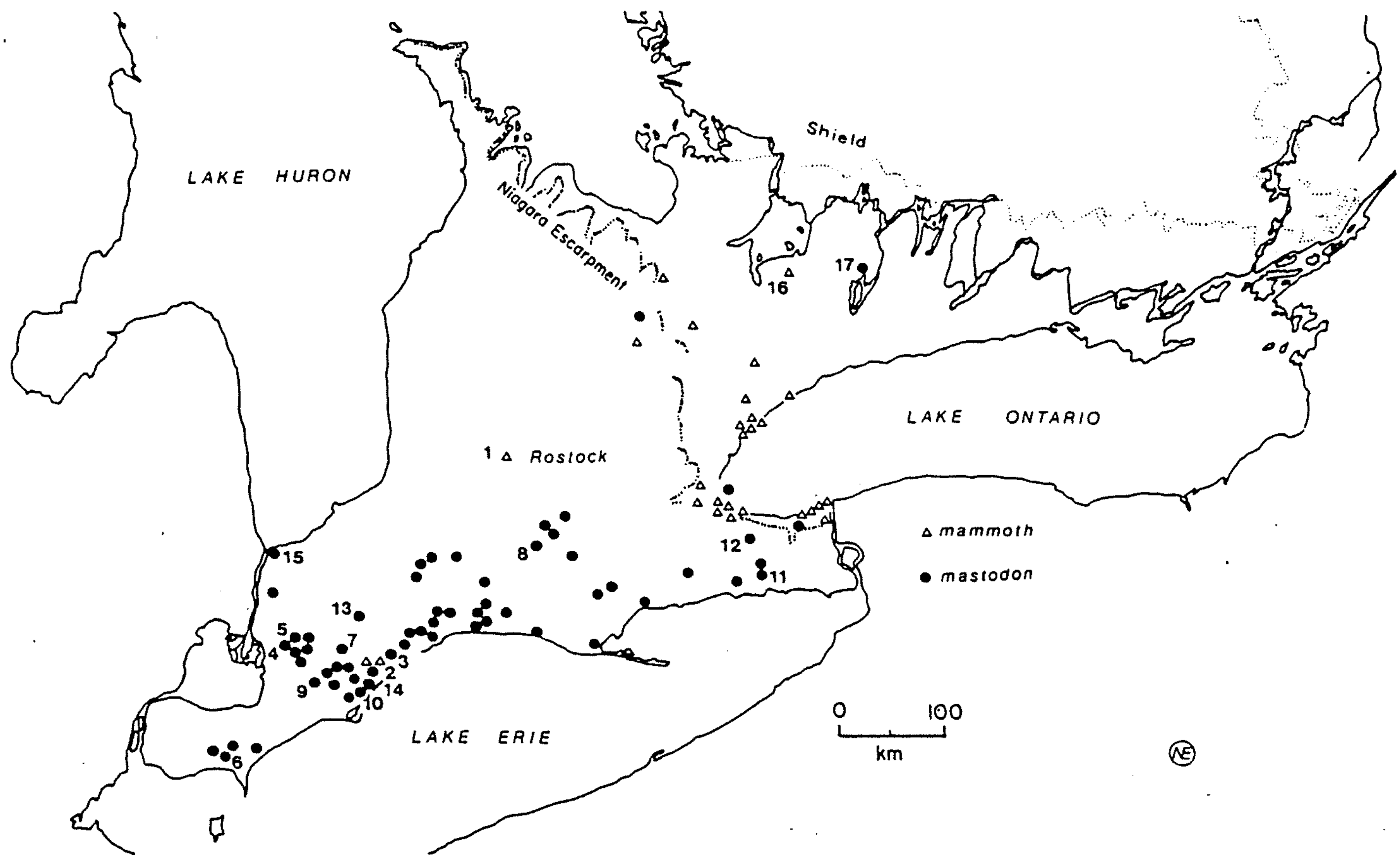


FIGURE 1—Map of southern Ontario showing location of postglacial mastodont and mammoth finds. Southwestern and south-central Ontario are separated by the Niagara Escarpment. Site identifications are in Table 2, except 16—Egypt mammoth, and 17—Lake Scugog proboscidean.

Mastodons' Last Meal: Fossil pollen and macrofossils of the Hiscock Site

Jock McAndrews

The **Hiscock Site** near Buffalo NY in its oldest level has yielded scattered **bones of at least twenty mastodons** together with bones of other extinct animals including stag-moose, giant beaver and short-faced bear. There were also bones of extant caribou and condor. Fluted points indicate man was present. Radiocarbon dates indicate that both animals and man lived here **11,000 to 10,000 BP.** Plant material preserved with the mastodon bones suggest remains of mastodon food.

The Site was formed by spring sapping of glacial drift deposited about 12,000 BP. The **spring water** attracted mastodon and other animals. At 10,000 years ago the spring flow diminished and the site became a **marsh**. After AD 1800 the marsh was used by settlers for drinking water and later was partly drained for farming.

During the **1996 excavation** sediment samples were collected from a pit face at 2 cm intervals at depths from 14 cm to 98 cm. **Loss on ignition** was done on subsamples of 0.8 ml which were dried at 100°C and weighed. Then they were ignited at 550°C for two hours and weighed; **organic matter** was calculated as percent of the dry weight. The residual ash percentage was designated as **mineral matter**. **Pollen analysis** was done on 0.8 ml subsamples by first concentrating pollen from the sediment matrix by digestion and sieving. The pollen-rich residue was stained and mounted in silicone oil. Fossil pollen were identified by comparison with the modern pollen collection at the Royal Ontario Museum and using illustrated key of McAndrews et al. (1973). Tree and herb pollen was identified at 300X magnification until a count of 100 tree pollen was reached. Pollen percentages were calculated and graphed.

Plant macrofossil analysis was done on 200 ml subsamples. Macrofossils were concentrated by sieving with water on a 0.5 mm mesh sieve. Fossil seeds, needles and twigs were identified by comparison with the modern plant collection at the Royal Ontario Museum.

There are two main stratigraphic units, a lower **Pleistocene unit** and an overlying **Holocene unit**; the boundary at 76 cm dates at 10,000 years ago. The **Pleistocene** unit is predominantly mineral with abundant spruce and herb pollen and spruce twigs and needles; it is designated the **Spruce-mastodon biozone**. The **Holocene** unit has organic sediment with varying amounts of mineral matter and contains three biozones. The **Pine-deer biozone** is dominated by pine pollen and deer bones, the **Maple-deer biozone** has abundant maple pollen and deer bones and the historic **Ragweed-cow biozone** has abundant ragweed and cat-tail pollen together with more mineral matter.

The Hiscock Site springs developed well after deglaciation. Springs attracted herds of mastodons which in turn attracted the carnivorous short-faced bear and the scavenging condor. Early man may have been both a hunter and scavenger. We estimate that **thousands of mastodons** visited the site between 11,000 and 10,000 years ago and that perhaps 200 mastodons died and left there bones to fossilize. Plant material from dung and gut contents accumulated on the wet soil around the springs.

Mastodon diet was varied. They ate **spruce** because the fossil spruce twigs are the correct length to be sheared by mastodon molars and they lack the digestible bark. Spruce needles are represented by relatively indigestible needle bases and tips. Spruce may not have been a regular part of mastodon diet because it is not eaten by modern browsers such as moose; it may have been famine food. **Herbs** were also part of their diet as indicated by abundant pollen of grass, sedge, aster type, rose family and other herb pollen. The source plants mostly grow on the upland away from the springs and were carried to the spring site as gut contents. Thus mastodons were also grazers as well as browsers, like the modern elephant.

1. **Mastodon diet** is indicated by plant macrofossils and fossil pollen in the mastodon bone level.
2. **Spruce twigs and needle fragments** are the undigested part of mastodon food. Because spruce is not eaten by any modern mammals, spruce may have been a famine food.
3. **Upland herbs** were also grazed because of the abundance of fossil pollen.

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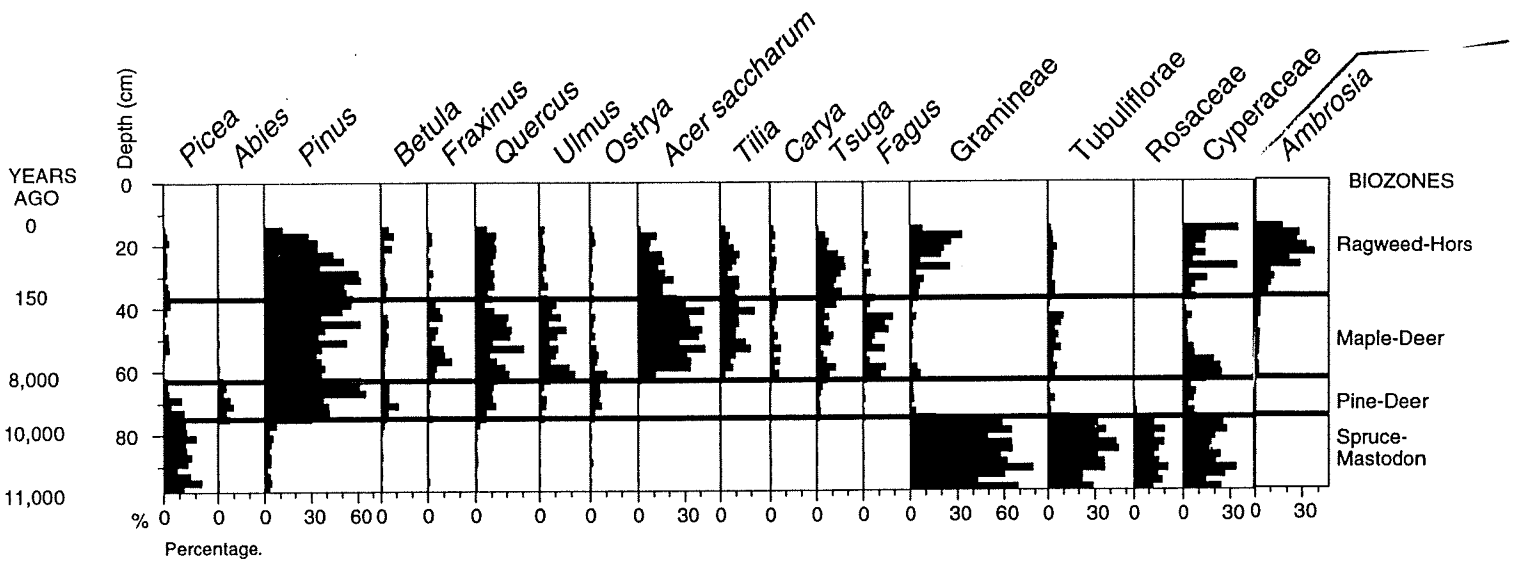
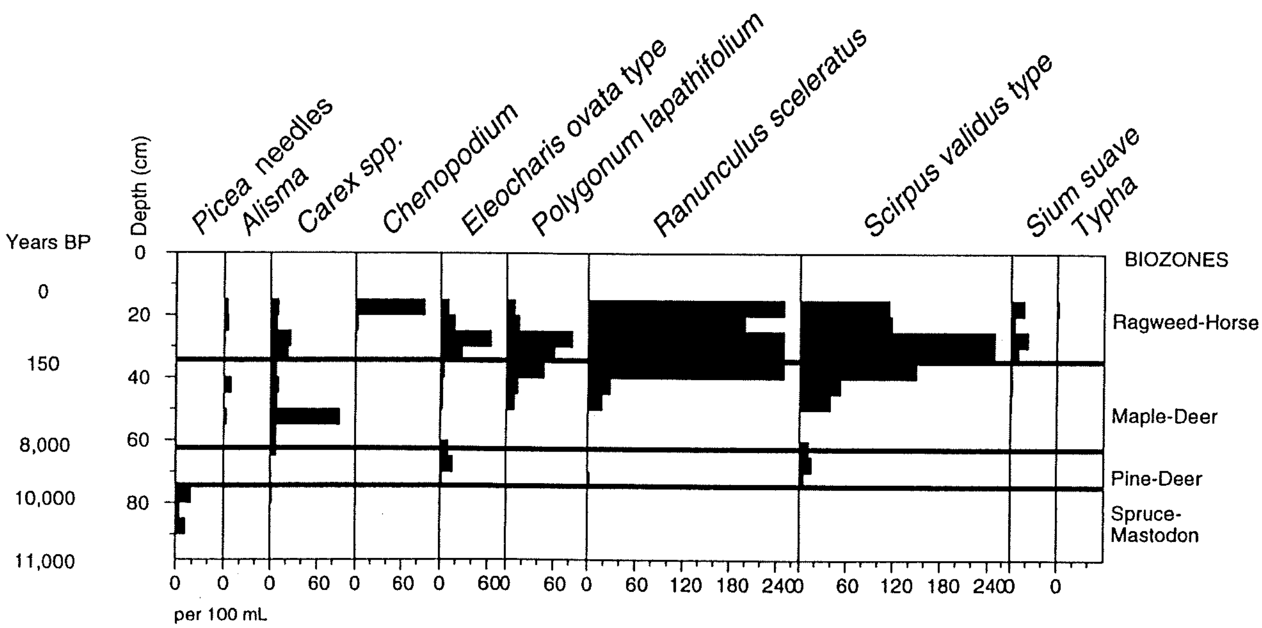
Hiscock Mastodon Site

hiscoc96.pol August 20, 1998. J. McAndrews, analyst. Tree pollen is sum. Herbs add on.





August 29

Main themes:

Laboratory visit and discussion

Toronto visit and shoping

Breakfast on your own at the Hart House.

The whole day for those interested: **Visit the McAndrews-labs**, discuss specific pollen and macrofossil material, view some pollen diagrams etc..
At Lunch time take a drink and a snack there, in order to prepare for the flight over the Atlantic!

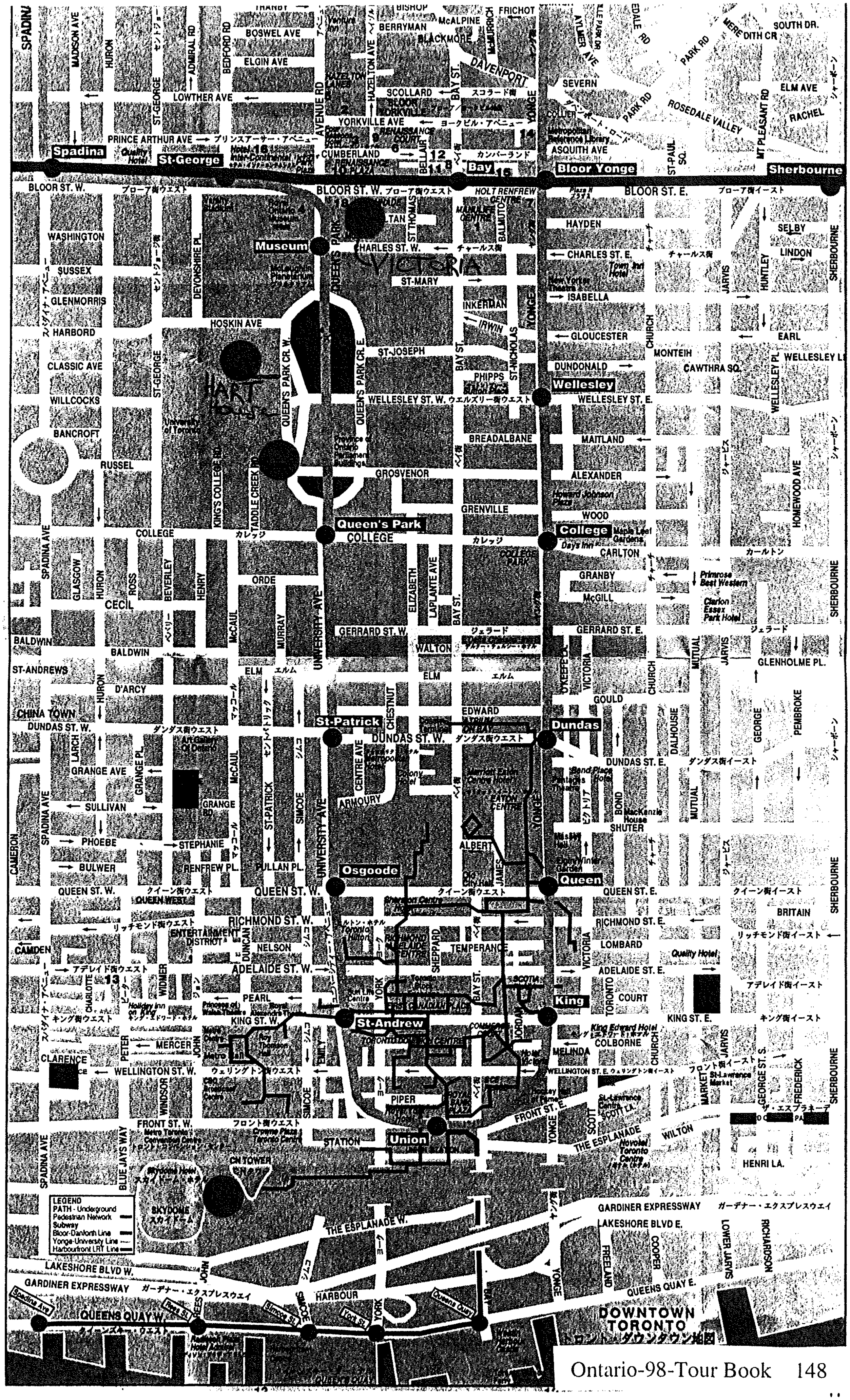
Visit Toronto on your own: sight-seeing and shopping in Toronto. Some suggestions: Visit the **Royal Ontario Museum** and its exhibitions. Visit the Farmers market at **St.Lawrence Market:** There you can get all canadian products you might think of (Maple syrup, honey, salmon, BSE-free Beef, lobsters and much more). Or visit the **BCE-building** with its extraordinary architecture (nearby the farmers market). Enjoy a walking tour through down-town between the sky-scrapers. Enjoy a bus tour in Toronto. Visit the Toronto-Islands (if you have not done so before).

For the group flight:

4.30 p.m. at latest!	Individual Departure for Toronto-Airport by taxi or bus.
5.30 p.m. at latest!	Check-in at Toronto-Airport.
7.45 p.m.	Departure for Zürich (via Rome)

August 30

2.10 p.m. Arrival at Zürich-Airport. Return to your destination.


SPADINA
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McALPINE
FRICHOT
DAVENPORT
SCOLLARD
YORKVILLE AVE
CUMBERLAND
BAY ST.
YONGE
SEVERN
ROSEDALE VALLEY
PARK RD
ELM AVE
RACHEL
MT PLEASANT RD
SOUTH DR.
ASQUITH AVE
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St-George
Bay
Bloor Yonge
Sherbourne
BLOOR ST. W.
BLOOR ST. E.
HOLT RENFREW CENTRE
HAYDEN
SELBY
LINDON
WASHINGTON
SUSSEX
GLENMORRIS
HARBORD
CLASSIC AVE
WILLCOCKS
BANCROFT
RUSSEL
DEVONSHIRE PL.
ST-GEORGE
Museum
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VICTORIA
ST-MARY
ISABELLA
INKERMAN
IRWIN
HOSKIN AVE
ST-JOSEPH
GLOUCESTER
CHURCH
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HART HOUSE
University of Toronto
QUEEN'S PARK CR. W.
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ST-NICHOLAS
PHIPPS
MAITLAND
BREADALBANE
KING'S COLLEGE RD
TADDLE CREEK RD
GROSVENOR
ALEXANDER
HOMEWOOD AVE
Howard Johnson Plaza
GRENVILLE
WOOD
Queen's Park
COLLEGE
College
Maple Leaf Gardens
Days Inn
CARLTON
SPADINA AVE
GLASGOW
HURON
ROSS
BEVERLEY
HENRY
CECIL
ORDE
ELIZABETH
LAPLANTE AVE
GRANBY
McGILL
Primrose Best Western
Clarion Essex Park Hotel
McCAUL
MURRAY
UNIVERSITY AVE
GERRARD ST. W.
GERRARD ST. E.
BALDWIN
WALTON
GLENHOLME PL.
MUTUAL
ST-ANDREWS
ELM
D'ARCY
CHESTNUT
EDWARD
O'KEEFE LA.
GOULD
DALHOUSIE
GEORGE
PEMBROKE
CHINA TOWN
DUNDAS ST. W.
St-Patrick
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LARCH
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GRANGE PL.
Art Gallery of Ontario
SULLIVAN
GRANGE RD
ST-PATRICK
SIMCOE
CENTRE AVE
ARMOURY
EATON CENTRE
BOND
MacKenzie House
SHUTER
CAMERON
PHOEBE
STEPHANIE
BULWER
RENFREW PL.
PULLAN PL.
ALBERT
JAMES
Osgoode
Queen
QUEEN ST. W.
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QUEEN WEST
BRITAIN
RICHMOND ST. W.
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ENTERTAINMENT DISTRICT
CAMDEN
DUNCAN
NELSON
YORK
SHEPPARD
TEMPERANCE
VICTORIA
LOMBARD
Quality Hotel
ADELAIDE ST. W.
ADELAIDE ST. E.
WIDMER
CHARLOTTE
PEARL
TORONTO
COURT
King
KING ST. W.
KING ST. E.
St-Andrew
PETER
MERCER
JOHN
CLARENCE
EMILY
JORDAN
COLBORNE
MELINDA
WELLINGTON ST. W.
WELLINGTON ST. E.
King Edward Hotel
WINDSOR
PIPER
FRONT ST. W.
FRONT ST. E.
STATION
Union
SCOTT
THE ESPLANADE
WILTON
MARKET
FREDERICK
GEORGE ST. S.
HENRI LA.
BLUE JAYS WAY
CN TOWER
SKYDOME
LEGEND
PATH - Underground Pedestrian Network
Subway
Bloor-Danforth Line
Yonge-University Line
Harbourfront LRT Line
THE ESPLANADE W.
GARDINER EXPRESSWAY
LAKESHORE BLVD E.
LAKESHORE BLVD W.
FREELAND
COOPER
LOWER JARVIS
RICHARDSON
HARBOUR
QUEENS QUAY E.
QUEENS QUAY W.
Spadina Ave
Simcoe St.
York St.
Queens Quay
DOWNTOWN TORONTO

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