Canadian Association of Palynologists
Association Canadienne des Palynologues

NEWSLETTER

Volume 18 Number 2 October 1995

Special Issue

Greetings and welcome to the 28th AASP Meeting! It is my privilege to present this special issue of the *CAP Newsletter* to participants at the conference. It will also be mailed to all other CAP members in Canada and around the world who cannot be at the meeting.

AASP 1995
Ottawa Canada
a CAPital experience

This issue is designed to introduce Canadian palynologists and palynology projects to our colleagues from AASP. Following a short history of the Association, it contains a series of articles submitted by CAP members describing their research projects and laboratories around Canada. The articles are arranged in rough geographic order, starting on the west coast of Canada and ending in southern England. Palynologists who would like to join the Association can find a membership form on p. 44.

The breadth and diversity of articles contained in this issue is a most impressive tribute to the continuing vitality of the discipline in Canada. The opportunity to attend conferences, such as this AASP meeting, gives us all a chance to learn about aspects of palynology and earth sciences that we may not normally encounter.

I have spent some time this summer trying to write a description of palynology as part of a guide to careers in earth sciences designed for high-school students. This was a useful, if difficult, exercise. How do you explain what a palynomorph is without dragging in more jargon? And convey the fascination of looking at strange yet beautiful objects under the microscope to a generation obsessed with video games? This Special Issue and the papers at this meeting show that we are adept at communicating with each other, practitioners in the same field. A new challenge for us, and something to ponder as we head back to our labs, is how to explain the relevance of palynology to an increasingly sceptical public and thus ensure its survival in academic and other institutions.

The response to my request for contributions for the Special Issue was amazing. My thanks to all the contributors to this Special Issue: Ian Campbell, Rob Fensome, Douglas Hallett, Martin Head, Richard Hebda, Len Hills, David Jarzen, Susan Jarzen, Joyce Macpherson, Pierre Richard, Jim Ritchie, Zicheng Yu, and Bob Vance. And thanks to Yves Beaudoin for technical assistance.

ISSN 1188-3596

A SYNOPSIS OF THE CANADIAN ASSOCIATION OF PALYNOLOGISTS

The original concept of the **Canadian Association of Palynologists (CAP)** was proposed in Calgary at the 1974 Geological Survey of Canada's annual meeting of palynologists. The proposal was initiated by Wayne W. Brideaux. No further action was taken on this proposal until 1978, again at a meeting of the GSC palynologists in Calgary when Sedley Barss, Jonathan Bujak and Graham Williams agreed to circulate a questionnaire to Canadian palynologists seeking their support of such a nationalistic organization. Of 100 questionnaires, 51 were returned, 44 in favour of the formation of a **Canadian Association of Palynologists**. In April 1978 Graham Williams presented details of **CAP** to the Executive of the American Association of Stratigraphic Palynologists who extended their support to the new group.

The first Executive was elected and officially met for the first time on January 8 1979, at the Atlantic Geoscience Centre, Bedford Institute of Oceanography, Dartmouth, Nova Scotia. The Executive included:

D.C. McGregor, President
D.M. Jarzen, President-elect
P.J.H. Richard, Secretary-Treasurer
J.P. Bujak, Newsletter Editor
M.S. Barss, Steering Committee
G.L. Williams, Steering Committee

Table 1 lists the **CAP** Executive from 1979 to the present. The two-year term of office began in 1987.

CAP was affiliated with the International Commission for Palynology [ICP] (later the International Federation of Palynological Societies [IFPS]) in January 1979, through an invitation of the then President, Alfred Traverse. In 1979 John Utting was voted the **CAP** Councillor to the ICP. John held this position from 1979 to 1987. David Jarzen was elected to hold the position of Councillor from 1988 to 1992, and re-elected for 1992 to 1996.

CAP has produced a newsletter, with two issues per year, since 1978 — even before the election of its first Executive. Newsletter editors have played an important role in the success of **CAP**, inasmuch as regular annual meetings are not always possible. The Newsletter serves as the vital link in our communication. Sincere appreciation is certainly due for the efforts of our Newsletter editors: Jonathan Bujak (1978-1981); Bert van Helden (1982-1985); Judith Lentin (1986-1988); and currently, Alwynne Beaudoin (1989 - present).

In January 1987, through the yeoman service of the then Secretary-Treasurer, Rob Fensome, **CAP** was officially incorporated as a non-profit organization (see ***CAP Newsletter* 10, No. 1,** for details). Although **CAP** is basically a "newsletter organization," its incorporation established a set of Bylaws from which to guide the organization.

Since its formation in 1979, **CAP** has hosted and contributed to several important international meetings within Canada, including the 20th Annual Meeting of the American Association of Stratigraphic Palynologists (AASP) in Halifax, Nova Scotia [7-9 October 1987]; the 23rd Annual Meeting of the AASP in Banff, Alberta [10-13 October 1990]; and this year, the 28th Annual Meeting of AASP in Ottawa, Ontario [10-14 October 1995]. The Calgary group of **CAP** members, led by the co-organizers Len Hills and Jan Jansonius, initiated and won a bid to host the

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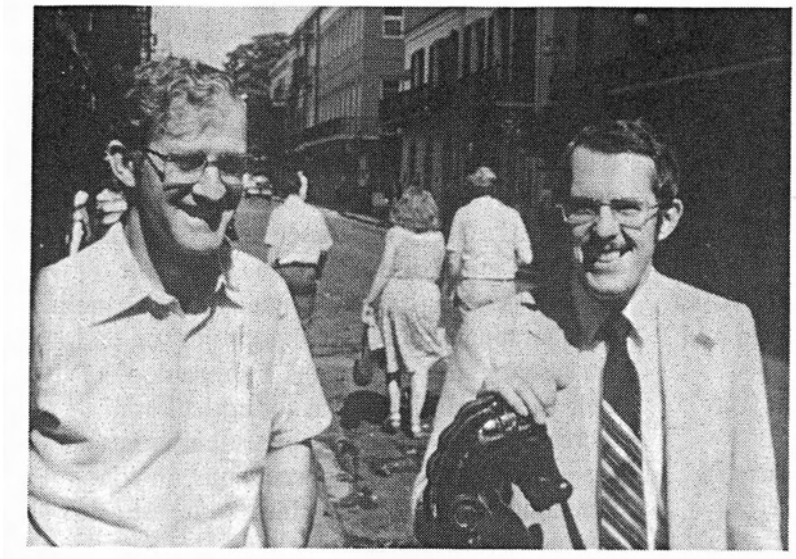
TERM	PRESIDENT	PRESIDENT-ELECT	SECRETARY-TREASURER	NEWSLETTER EDITOR
1979	D. Colin McGregor	David M. Jarzen	Pierre J.H. Richard	J. Bujak
1980	David M. Jarzen	Jan Jansonius	Jocelyn Legault	J. Bujak
1981	Jan Jansonius	Richard Hebda	Jocelyn Legault	J. Bujak
1982	Richard Hebda	Geoffrey Norris	Jocelyn Legault	Bert van Helden
1983	Geoffrey Norris	(office not filled)	Jocelyn Legault	Bert van Helden
1984	M. Sedley Barss	Jan Terasmae	Rob Fensome	Bert van Helden
1985	Jan Terasmae	Rolf W. Mathewes	Rob Fensome	Bert van Helden
1986	Rolf W. Mathewes	Wayne W. Brideaux	Rob Fensome	Judith K. Lentin
1987-1988	Wayne W. Brideaux	Bert van Helden	Martin Head	Judith K. Lentin
1989-1990	Bert van Helden	J. Bujak & G. Williams (shared term)	Martin Head	Alwynne Beaudoin
1991-1992	Graham L. Williams	Elliott Burden	Martin Head	Alwynne Beaudoin
1993-1994	Elliott Burden	Glen MacDonald	Martin Head	Alwynne Beaudoin
1995-1996	Glen MacDonald	Ian D. Campbell (nominated)	Martin Head	Alwynne Beaudoin

Table 1: **Canadian Association of Palynologists Executive** 1979 to present



Sedley Barss and Wayne Brideaux, early CAP organizers, discussing CAP in New Orleans, 1981. Photo: D.M. Jarzen

6th IPC (International Palynological Congress of the International Federation of Palynological Societies) at Calgary, Alberta [26 August - 01 September 1984]. **CAP**'s most recent endeavour organized by Alwynne Beaudoin, Bert van Helden and David McIntyre was the Symposium, "Palynology in Canada — Palaeoecological and Stratigraphic Applications" held with the Geological Association of Canada meetings at Edmonton on May 18 1993.

D.M. Jarzen and S.A. Jarzen
Canadian Museum of Nature
Ottawa, Ontario

Far and wide....

PALYNOLOGICAL ACTIVITIES AT THE GEOLOGICAL SURVEY OF CANADA

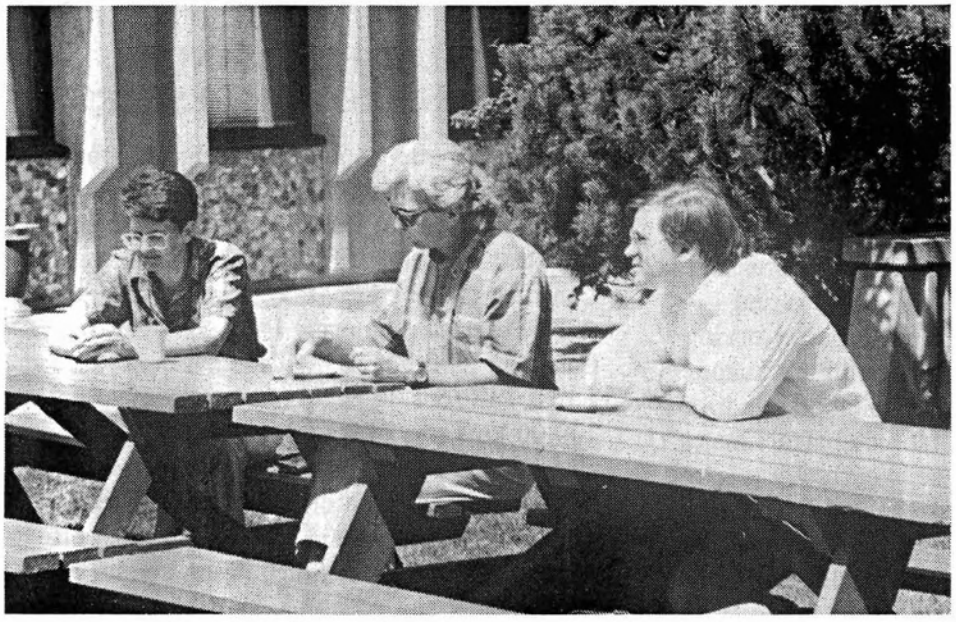
Palynology is still alive at the Geological Survey of Canada (GSC) in spite of staff and budget reductions. There are now palynologists at four GSC centres and the following is a brief overview of current activities, east to west.

Rob Fensome, Peta Mudie and Graham Williams are based at **GSC Atlantic** (formerly Atlantic Geoscience Centre), located at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia. Interest in oil and gas exploration in offshore eastern Canada waxes and wanes and currently seems to be going through a waxing spell. Hence, Graham and Rob continue to examine Mesozoic-Cenozoic material from the Grand Banks of Newfoundland and the Scotian Shelf as part of a collaborative resource modelling program. Graham and Rob also remain active in database development, palynomorph diversity studies, and their "hobbies" such as the Eisenack Catalog of Fossil Dinoflagellates, New Series and the "Lentin and Williams" Index of Fossil Dinoflagellates. Currently working with Rob and Graham is a visiting scientist, Raquel Guerstein, from Universidad Nacional del Sur, Bahia Blanca, Argentina, who is investigating Cenozoic material from both the Grand Banks and Argentina.

Peta is working on climate change studies, using annual varves from Saanich Inlet, British Columbia, to correlate toxic dinoflagellate cyst blooms with El Niño years. Her current interests also include the palynology of Miocene to Pleistocene sediments of ODP sites on the Iberia Abyssal Plain, off northwest Spain, and of Quaternary sapropels of the Aegean and Marmora Seas.

At **GSC Quebec** (formerly Quebec Geoscience Centre) at Saint-Foy, Michelle Garneau is working on macrofossil and pollen analysis of Holocene sediments from the Canadian Arctic, St. Lawrence Valley and Ontario. Much older are the fossils analyzed by Aicha Achab and Esther Asselin, who are examining the Lower Paleozoic chitinozoan assemblages of eastern Canada. Current foci are Ordovician assemblages of the St. Lawrence Lowlands and Silurian-Lower Devonian assemblages of Quebec and Nova Scotia. Aicha and Esther work in close collaboration with local colleagues Azzeddine Soufiane and Bo Liang, both of the Institute National de la Recherche Scientifique (INRS). The activities of this team also include development of an integrated image and data acquisition system.

In the Nation's Capital, Ottawa, apart from the research of Colin McGregor (whose current pursuits will be discussed below in conjunction with palynologists at GSC Calgary), only Quaternary palynologists are represented, affiliated with GSC's **Terrain Sciences Division**. Individuals here are Thane Anderson, Bob Mott (Emeritus Scientist) and Hélène Jetté. Thane is collaborating with others in a project on the Quaternary stratigraphy and hydrogeology of the Oak Ridges Moraine, a major agricultural/ recreational resource area in southern Ontario. He is also using pollen successions, in conjunction with other disciplines, to investigate possible tsunami-laid deposits in Newfoundland and Cape Breton Island. Bob is pursuing his



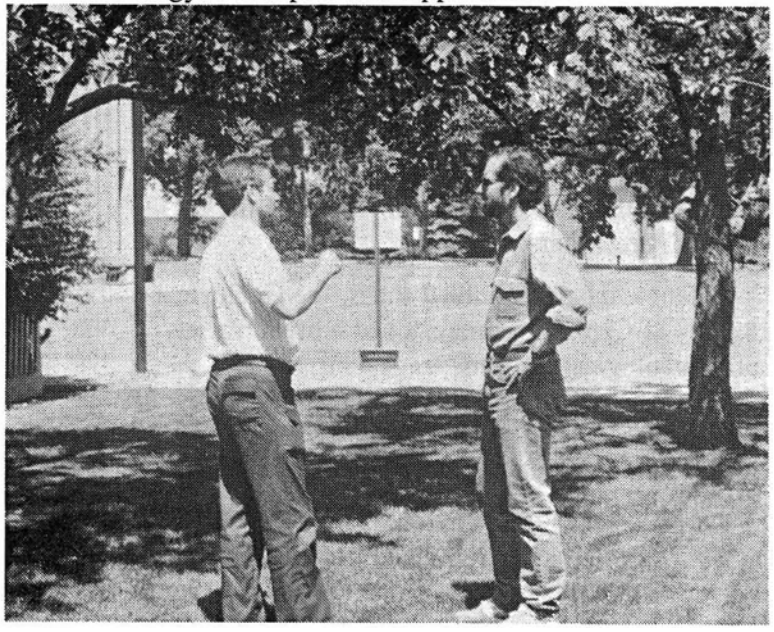
Hélène Jetté, Bob Vance and Ian Campbell share conversation in the sunshine at a meeting at GSC Calgary. (Photo: ABB, June 1993).

studies on a part-time basis on the late glacial-early Holocene transition in Nova Scotia.

Hélène has been modelling the forests and climate of Canada, 6,000 years B.P., using transfer functions. This time was one of warmer climates than now and provides a glimpse of conditions that might be expected with global warming. Unfortunately, this project is affected by budget cuts.

Also in the Terrain Sciences Division is the Environmental Services Laboratory, staffed by Sheridan Hipwell and Alice Telka, whose multifarious activities include pollen analysis in support of other projects.

The west is represented by Ram Kalgutkar, David McIntyre, Art Sweet, John Utting and James White, all at **GSC Calgary** (formerly Institute of Petroleum and Sedimentary Geology). Technically, Colin McGregor is also with GSC Calgary, but works in Ottawa. Colin (November) and Dave (September) are retiring after 38 years and 35 years respectively in palynology. We wish them both well in future endeavours, although Colin may not be completely lost to the Survey. He will decide later this year whether or not to return as a Emeritus Scientist working on Silurian and Devonian palynology - i.e., after finishing his duties as co-editor, with Jan Jansonius (who is a Visiting Scientist at GSC Calgary), of the AASP compendium "Palynology: Principles and Applications".



James White and Mel Reasoner talking palynology at a meeting at GSC Calgary. (Photo: ABB, June 1993).

Ram is studying fungal palynomorph taxonomy and stratigraphy, and is currently preparing an atlas of fungal palynomorphs. Art is continuing his work on Late Cretaceous and Paleogene pollen and spores, primarily in the Western Canada Sedimentary Basin. John specializes in Carboniferous to Triassic spores and is currently involved in several Canadian and international projects. James has been working with Neogene pollen and spores in the Yukon and Alaska in a GSC-USGS collaborative investigation of Neogene, high latitude paleoclimates. With several co-authors, he is currently preparing a synthesis of the Neogene and Quaternary paleoclimatology and palynostratigraphy in the study area. His studies are expanding to include the Jurassic and Lower Cretaceous in the Western Canadian Sedimentary Basin, especially the Jurassic-Cretaceous boundary.

in Calgary, but attached to the Terrain Sciences Division (it gets confusing, I know!), is Bob Vance. Bob's main interest is late Quaternary paleoclimatic reconstruction, and to this end he employs both palynology and plant macrofossil remains (also see next article). Bob's palynological work has focussed on records of vegetational change in western Canada and he plans to examine rare cores from the Canadian western interior that extend back to the late Pleistocene/ early Holocene; in this work, he hopes to gain a picture of the structure and movement of the Boreal Forest there.

Hence, despite troubled times, the Geological Survey of Canada has maintained a broad variety of palynological projects. In general, the emphasis has shifted towards more team-oriented, goal-focussed projects, especially those related to resources modelling and environmental aspects, though there is still a role for basic science.

Submitted by Rob Fensome,
with assistance from Thane Anderson,
Esther Asselin and James White

PALLISER TRIANGLE GLOBAL CHANGE RESEARCH

In 1860, after four years surveying what was to become the heartland of Canada's wheat production, Cpt. John Palliser returned with the view that the semi-arid grassland of the western Canadian interior would be "forever and comparatively useless". Ignoring Palliser's view, the Canadian government built the national railroad across Palliser's Triangle (an approximately 200,00 km^2 area of southern Alberta, Saskatchewan, and Manitoba), initiating a wave of settlement at the turn of this century. The area has since become one of the world's most productive agricultural regions, despite enduring severe social and economic hardships resulting from two decade-long bouts of hot, dry weather (the 1930s and 1980s). These effects of these drought episodes, combined with general circulation model (GCM) predictions of increased aridity in the North American interior due to increased greenhouse gas concentrations, have raised concern for the area's economic future. Although one hundred years of temperature records from the Canadian prairies support the view that the region is warming, it is impossible to assess how this historic trend and computer model predictions compare to long-term climatic variability, without consulting proxy climate records. Recognizing the importance of this perspective, the Geological Survey of Canada (GSC) established the Palliser Triangle Integrated Research and Monitoring Area (IRMA) to produce a high resolution paleoclimatic record for the region and to document the nature of landscape responses to a variety of past climatic regimes. Changes in climate and/or vegetation effect the efficacy of geologic processes. In some cases, local impacts can be extreme and increase the potential for natural hazards such as landslides and dust storms, or seriously affect shallow groundwater and surface water resources. It is these relationships between geologic processes and climate that are the

specific focus of the Palliser Triangle IRMA, and GSC global change research in general.

Development of a paleoclimatic record for Palliser's Triangle relies almost exclusively on sedimentary records from a select few of the numerous saline and hyposaline lakes within the poorly integrated drainages of this recently deglaciated terrain. Climate reconstructions will be based on regional lake-level and chemical responses to changes in the hydrologic balance. Analyses of cores from ten study sites is underway. Study sites have been chosen to form a series of transects emanating from the Cypress Hills (considered the hub of the Palliser Triangle), crossing climatically-sensitive elevation, hydrologic and vegetation gradients.

The strategy used to reconstruct the paleohydrology of individual lake basins utilizes multiple sensors in multiple cores from each lake. To facilitate this extensive undertaking, a multi-disciplinary, cooperative approach to data collection and analyses has been adopted. GSC resources have been devoted to core collection, description, photography and x-ray imagery, as well as development of preliminary chronostratigraphies, lithostratigraphies and plant macrofossil stratigraphies for each core. Remaining funds have been directed to graduate students working on specific paleoenvironmental parameters of the lake cores, under supervision of Canadian university collaborators with long-standing research interests in the study area. Others, although not receiving direct funding from the GSC, have accepted invitations to collaborate, increasing the breadth of data collected.

Most graduate student projects are nearing completion. Data compilations and interpretations of individual study sites are currently being prepared for publication. Final reports synthesizing the Palliser Triangle IRMA research are scheduled to appear in 1997. A special session of the Canadian Association of Geographers meeting (May 12-16, 1996 in Saskatoon, Saskatchewan) will feature much of this new research on Holocene climatic and geomorphic change in the southern Canadian prairies, and will be preceded by a three and a half-day fieldtrip to select study sites in southern Saskatchewan.

Paleolimnological records in the southern Canadian prairies contain detailed information on past hydrologic and climatic change in this important but climatically-sensitive agricultural region. The application of new approaches and techniques to the recovery and analysis of sedimentary records across this semi-arid grassland, coupled with documentation of geomorphic responses to climatic extremes, will provide a timely record of the varied landscape dynamics that have occurred over the last several millennia. Such information will provide land use planners and policy makers with a realistic view of the range of extremes experienced in the past, their frequency of occurrence, and, ultimately, clues regarding the nature of changes inhabitants of western Canada are likely to face in future.

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STRATIGRAPHIC PALYNOLOGY IN THE CANADIAN FOREST SERVICE

In the Canadian forest service, pollen is studied mainly from the reproductive perspective. The exception is my lab in Edmonton, where the main focus of pollen work is Holocene vegetation change.

Current projects are focussed mainly on the southern boreal forest and aspen parkland of western Canada. In the parkland, there is a particular problem of lakes drying out, some-

times seasonally, sometimes for longer periods. These playas are often highly saline, and pollen taphonomy in playas is an ongoing secondary research theme.

Another theme is the effects of anthropogenesis in the last 150 years. Although there was very little European settlement in most of the western Canadian Prairie until the late 1800's, anthropogenesis has been felt through the overhunting of bison, and possibly through the beaver fur trade.

A third theme is fire ecology, involving investigations of fire regime through quantification of sedimentary charcoal, and also through identification of the charcoal by Scanning Electron Microscopy. In conjunction with pollen analysis of the same sediments, it is hoped that we will be able to answer the chicken and the egg problem of the relationship between conifers and forest fire.

Finally, the pollen record is also being used to investigate past vegetation responses to climate change, which is the primary mandate of the lab. Since we are interested in the vegetation response, we must have independant information on the climate changes themselves; this is being provided by a number of other proxy data types, including oxygen isotopes (in co-operation with Tom Edwards at Waterloo), grain size (in co-operation with Celina Campbell at University of Alberta), mineralogy (in co-operation with Bill Last at University of Manitoba), diatoms (in co-operation with Michael Hickman at University of Alberta) and varve thicknesses where we have them.

In addition to pollen, our lab also studies tree rings using an X-ray densitometry system we developed over the past two years, and is involved in simulation modelling of forest development and succession.

Recent publications:

Campbell, I.D., 1995. Power function for interpolating dates in recent sediment. *Journal of Paleolimnology*, In Press.

Campbell, I.D., and J.H. McAndrews, 1995. Charcoal evidence for Indian-set fires: a comment on Clark and Royall. *The Holocene*, In Press.

Campbell, C., I.D. Campbell, C.B. Blythe, and J.H. McAndrews, 1994. Bison extirpation may have caused aspen expansion in western Canada. *Ecography* 17(4): 360-362.

Campbell, I.D., and C. Campbell, 1994. Pollen preservation: experimental wet-dry cycles in saline and desalinated sediments. *Palynology* 18: 5-10.

Campbell, I.D., and C. Campbell, 1994. The impact of late woodland land use on the forest landscape of southern Ontario. *Great Lakes Geographer* 1(1): 21-29.

Campbell, C., I.D. Campbell, and E.H. Hogg, 1994. Lake area variability across a climatic and vegetational transect in southeastern Alberta. *Géographie physique et Quaternaire* 48(2): 207-212.

Campbell, I.D., and G.L. Chmura, 1994. Pollen distribution in the Atchafalaya River, U.S.A. *Palynology* 18: 55-65.

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Report on 'Palaeoecology and Palaeoclimatology of the Pacific Northwest' session held during the AAAS (American Association for the Advancement of Science) Pacific Division meeting at the University of British Columbia, June 1995

Late in 1994, Ian Walker (Okanagan University College) and I were asked to organize a session for this years' AAAS meeting in Vancouver. It was suggested that we choose a topic to highlight recent research in palaeoecology and palaeoclimatology. After some discussion, we agreed to focus on a comparison between climate model simulations and proxy data for 6 ka and 18 ka BP in northwestern North America (roughly Alaska to Oregon, Wyoming to the western Northwest Territories, and the northeastern Pacific Ocean). The following is a summary report on this day-long session.

Following brief opening remarks, **R.S. Webb (NOAA Paleoclimatology Program)** set the stage for the session by outlining the importance of the two time slices (18 ka represents full glacial conditions, a time when surface boundary conditions were significantly different from those of today; and 6 ka, when seasonal solar forcing varied but sea surface temperature and terrestrial ice sheet extent were similar to the present). The need to assess the performance of general circulation models (GCMs) with the geologic record of climate change was also stressed, since GCMs are the primary means of predicting the effects of doubling atmospheric CO_2. A second introductory presentation by **O. Garcia (San Francisco State University)** provided a background for assessing climate change in the region by outlining current ocean-atmosphere dynamics in the eastern Pacific region. Garcia outlined correlation patterns, such as the see-saw in precipitation extremes between Alaska and California, and described significant North American climatic anomalies associated with the recent series of El Nino events and an unusually warm Pacific Ocean. **R.J. Oglesby (Purdue University)** followed with a discussion of efforts to better understand how a single boundary condition might affect the climate system. Model output indicates that one boundary condition of particular importance today, CO_2, has a much greater impact when atmospheric concentration is declining, as opposed to increasing. In addition, his model output suggests that 6 ka orbital insolation variations are capable of increasing summer temperature in North America by 3-4°C.

S. Hostetler (U.S. Geological Survey) presented both **J. Kutzbach's (University of Wisconsin)** latest CCM1 GCM output, as well as his own western North America regional or mesoscale climate model experiments. The CCM1 simulations indicate drier conditions over much of western North America at 18 ka, and at 6 ka significant July warming through western Canada, as well as an enhanced monsoon in the American southwest (both produced by a 1.5-2.5% enhancement of summer insolation). The 6 ka regional model output indicated wetter conditions in northwestern North America, accompanied by slightly warmer conditions that seem most pronounced in southern Alberta and British Columbia. Hostetler emphasized the great sensitivity of the regional model to changes in vegetation cover and surface hydrology, as well as the great interannual variability inherent to both models, underscoring the need to extend model runs for several simulated years to attain statistically significant results. **A. Weaver (University of Victoria)** discussed results of experiments with an idealized global ocean model with reference to recent ice-core and pollen data that suggest Eemian climate was much more unstable than that of the Holocene. The model simulation suggests that the most likely source for the observed, but controversial, Eemian climate variability may well lie in the dynamics of the ocean's thermohaline circulation which

responds to an enhanced hydrological cycle that characterizes warmer climatic regimes. This result leads to the disconcerting proposition that the warmer climate of a 2 X CO_2 world may lead to much greater climatic variability than has been experienced in the last 10,000 years.

A focus on the ocean continued with a summary by **C. Sancetta (National Science Foundation)** of the rather sparse but informative diatom database in the northeastern Pacific. Because of low sedimentation rates, the 6 ka interval is invisible, except in the Gulf of California where strong southwesterly winds are inferred, a marked contrast to prevailing winds today. Diatom records from 18 ka indicate that distinctly different ocean conditions prevailed; in fact, the data suggests that there was no upwelling off the Oregon coast. Other 18 ka features include significant differences in wind directions through all seasons, extremely cold (-10°C) sea-surface temperature in the Gulf of Alaska, and reduced productivity, compared to today, off the coast of Oregon. In contrast, productivity was higher than present in the Gulf of Alaska 18,000 years ago. **D.W. MacDonald (University of British Columbia)** discussed analyses of a 12 m long, 170 ka sedimentary record from the Gulf of Alaska, focusing on a 1.5 m thick layer of diatom ooze that was deposited between 10 and 12 ka. This significant stratigraphic marker indicates a productivity maximum in the north Pacific, likely related to temperature and salinity changes. **B.L. Sherrod (University of Washington)** ended the morning presentations with a summary of diatom and plant macrofossil evidence of sea level changes in central Puget Sound, focusing on an event (estimated to involve 7 m of uplift) that occurred some 1100 years ago, which is most likely the result of an earthquake.

Following lunch, the focus shifted to terrestrial records of climate change. **R. Spear (State University of New York at Geneseo)** discussed pollen evidence of vegetation and climatic change in northern Yukon. A sparse herb tundra prevailed at 18 ka, indicating cold, dry conditions. The 6 ka palaeoecological record features the expansion of black spruce (*Picea mariana*) and alder (*Alnus*) populations in south and central Yukon, suggesting decreased temperatures and/or increased precipitation. **R. Hebda (Royal British Columbia Museum)** summarized Holocene palaeoecological investigations in British Columbia, emphasizing that the 6 ka time slice is best viewed as a 'time of transition' from warm, dry conditions in the early Holocene to cooler and moister climate; much like today's, but slightly warmer. Lake-levels were rising from early Holocene lows, high elevation treeline remained higher-than-present, and western hemlock (*Thuja plicata*) was expanding along the coast. On southern Vancouver Island, Garry oak (*Quercus garryana*) was more abundant at 6 ka than it is today, suggesting that at least in this area of the province dry conditions persisted. **R.W. Mathewes (Simon Fraser University)** summarized 18 ka conditions in British Columbia, pointing out that the widely used date of 18 ka for maximum ice-sheet expansion is at variance with data from southwestern British Columbia that suggest interstadial conditions at this time. Rather than the cold and dry conditions outlined by CLIMAP, Mathewes reviewed palaeobotanical data indicating more humid and temperate conditions in the Pacific Northwest. **R.E. Vance (Geological Survey of Canada)** reviewed the existing palaeoecological data base of the Canadian prairie provinces. Most, if not all of the region was covered by the Laurentide glacier at 18 ka, although somewhat controversial radiocarbon dates on lake cores in western Alberta (within the so-called 'ice-free corridor'), suggest that ice free areas existed at 18 ka. Sparse shrub tundra prevailed, suggesting cold and dry conditions. In contrast, the rich and varied 6 ka database outlines significant vegetation, geomorphic, and lake-level responses to warmer and drier climatic conditions. Major

vegetation zone boundaries (i.e., grassland and boreal forest) were located farther north than today, treelines were situated upslope of current positions, forest fires more frequent and lake-levels lower than today. **P.E. Wigand (University and Community College System of Nevada)** rounded out the regional palaeoecological syntheses by summarizing pollen and woodrat midden records from the northern intermontane west of the United States. Records west of the Cascades indicate cold and moist conditions at 18 ka, whereas cold and dry conditions prevailed in the northern interior and southern intermountain regions. In northern Nevada, an 1100 m depression in the limit of pine (*Pinus*) growth suggests a drop in temperature of at least 8.5°C. Like British Columbia, 6 ka conditions in the northern intermontane west were on the downhill side of peak postglacial aridity, and a synchronous (from Oregon to southern Nevada), dramatic increase in precipitation at 5500 BP marks the onset of conditions similar to the present.

Following the afternoon coffee break, attention shifted to 'alternative' proxy indicators of climate change; that is, indicators that have not been as extensively used as palaeobotanical data to reconstruct past climate. **M. Hickman (Devonian Botanic Garden and University of Alberta)** opened with a discussion of diatom evidence of salinity, lake-level, and climatic change, focusing on records from central Alberta. The diatom stratigraphy of Goldeye Lake, a possible 18 ka record from western Alberta, outlines an interval of high salinity, supporting pollen evidence of pronounced aridity. Diatom data from central Alberta suggest that significant swings in salinity and lake-level occurred during the mid-Holocene, underlining the potential these sensitive indicators of the hydrologic budget have to document rapid environmental changes that may not be recorded by palaeobotanical markers. **S.A. Elias (University of Colorado)** followed with a summary of insect evidence of palaeoenvironmental conditions in Alaska. At 18 ka, insect remains indicate that, in contrast to dry, continental climatic conditions in interior Alaska, southwestern Alaska and at least central regions of the Bering Land Bridge were subject to more mesic conditions, supporting shrub-tundra communities. By 6 ka, essentially modern environmental conditions were established throughout Alaska. However, spruce (*Picea*) forests did not arrive in lowland sites until 4200 BP, some 8000 years after the time that insect evidence suggests that conditions were warm enough to support spruce forest. **I.R. Walker (Okanagan University College)** ended the session with a review of the potential chironomid remains have for reconstructing past climate. Results from low elevation coastal sites tend to support palaeobotanical inferences of a warm, dry early Holocene followed by the onset of conditions similar to the present by 6 ka. Current research foci include analyses of sedimentary records from climatically-sensitive saline lakes and high elevation tarns, as well as development of quantitative models for palaeoclimatic inferences.

Formal presentations were followed by a lively 30 minute discussion period that touched on a variety of topics, including discrepancies between model output and the palaeoecological record, the need for fully coupled ocean-atmosphere climate models, the gap in outlook between palaeoecologists (who generally produce time-series of environmental change) and climate modellers (who until now have requested 'snapshot' proxy data for a particular time slice), to speculation on the driving forces behind a major climatic change event that affected a large area of northwestern North America at 7000 BP. In retrospect, I feel other topics that emerged from the session that were not discussed at the meeting include the need for; 1) more data from the North Pacific Ocean, in particular for the Holocene, 2) extension of the boundaries in regional climate models to include data from sites north

of the Canada-United States border, 3) a better understanding of the driving forces behind El Niño, a source of globally significant environmental impacts and climatic anomalies that are particularly evident in North America, 4) more better-dated, multiproxy palaeoenvironmental study records from climatically-sensitive regions, and 5) greater effort on the behalf of climate modellers to identify specific proxy data needs and by palaeoecologists to convert proxy data output to parameters directly comparable with model output.

Those who wish for more information on the session (including abstracts and addresses for all contributors) are encouraged to contact either Robert Vance, Geological Survey of Canada, 3303-33rd St. NW, Calgary, Alberta, T2L 2A7, Canada (vance@gsc.emr.ca) or Ian Walker, Okanagan University College, 3333 College Way, Kelowna, B.C., V1V 1V7, Canada (iwalker@NKC1.OUC.bc.ca).

R.E. Vance
August 1995

HOLOCENE VEGETATION DYNAMICS IN THE KOOTENAY VALLEY, BRITISH COLUMBIA: Report of work-in-progress for a Master's Degree Project

Two montane lakes in Kootenay National Park (southeastern British Columbia) were cored in February 1995 using a Reasoner percussion corer in order to investigate vegetation dynamics in the Kootenay Valley throughout the late Holocene. The 2.54 m core from Dog Lake (15.1 ha) shows good chronologic control (regular laminations and at least two tephra layers currently being identified at University of Calgary) and has been intensively sampled for fossil pollen at 1-2 cm intervals. Pollen counts are currently underway in the palynology lab of Dr. L.V. Hills (Department of Geology and Geophysics). Both microscopic and macroscopic charcoal in the Dog Lake core will be analyzed along with other macrofossils in the coming months. This lake core is being used to investigate vegetation dynamics in the montane ecoregion with emphasis on climate changes interacting with disturbance events such as fire and insect and pathogen outbreaks.

The 4.57 m Cobb Lake (2.5 ha) core will be selectively sampled for fossil pollen around five distinct sediment influx events noted in the core that are presumed to be slope wash caused by fire events. Dating for both cores will be by AMS (e.g., charred wood and plant macrofossils). The Cobb Lake core will be used to investigate any vegetation changes before and after these major influx events.

Moss polsters and surface sediments (using a frozen finger corer) will be collected to compare the modern pollen rain in the Kootenay Valley with the fossil pollen record.

Funding for this project is from Kootenay National Park and an NSERC operating grant to Dr. L.V. Hills. Committee members for this Master's Degree Project include Dr. E.A. Johnson (Department of Biological Sciences, University of Calgary) and Dr. Alwynne Beaudoin (Provincial Museum of Alberta). Questions regarding this work should be addressed to Douglas Hallett at djhallet@acs.ucalgary.ca.

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HISTORY OF THE TEMPERATE RAINFOREST (HOTTR)

Paleoecological studies have shown that Vancouver Island ecosystems have been dramatically altered by climate change and other factors since the last glaciation (Hebda 1995, Nagorsen *et al.* 1995). To enhance understanding of the impacts these processes exert on temperate rainforest ecosystem dynamics, HOTTR project members, funded by Forest Renewal British Columbia, aim to map the distribution of Vancouver Island's biogeoclimatic zones and their variants through the Holocene. In addition to climate change, the impacts that fire, landslides, and altered competitive relationships exert on forest productivity will be assessed in order to assist forest managers planning for the impacts of future disturbance regimes. Forest dynamics in the early Holocene warm, dry interval are of particular interest, given current global warming scenarios.

The five-year long (1995-2000) HOTTR project is structured around a partnership of scientists from industry (G. Dunsworth, MacMillan Bloedel), government (R. Hebda, Royal British Columbia Museum and R. Vance, Geological Survey of Canada) and university (C. Larsen and C. Olney of State University of New York, as well University of Victoria graduate students). Sediment cores will be obtained from a number of lake study sites, selected to form two transects spanning ecological and elevational gradients across central and southern reaches of Vancouver Island. Pollen, plant macrofossil, and sedimentary records will provide information on long-term vegetation change, landslide periodicity and lake-level dynamics. High resolution studies of biotic, sedimentary and geochemical characteristics of deposits spanning the last 2000 years will relate limnological records to in-stand forest histories reconstructed from tree-ring studies as well as pollen and charcoal analyses of forest humus. Combined with ongoing studies in south Vancouver Island by R. Hebda (1995) and University of Victoria students G. Allen, K. Brown and Q. Zhang (supported by NSERC and the Atmospheric Environment Service), HOTTR will provide the forest industry with a comprehensive picture of major changes in ecosystem composition and structure, the location of ecotones, as well as altered fire regimes and landslide dynamics driven by climate change over the last 10,000 years on Vancouver Island.

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AN INTEGRATED APPROACH TO HOLOCENE PALAEOENVIRONMENTAL RECONSTRUCTION IN NORTH-WESTERN BRITISH COLUMBIA: APPLICATIONS OF PALYNOLOGY, SEDIMENTOLOGY, AND RESIDENT ORAL HISTORY

Susie Lake is an alpine cirque lake situated near tree line on the eastern slope of the northern Coast Mountains. Palynomorph assemblages recovered from cores were interpreted as proxy indicators of Holocene climate change. The post-glacial colonizing vegetation appeared before 7990 $\pm$ 80 ^{14}C yr B.P. and consisted of a shrub herb community dominated by *Alnus* (alder), *Betula* (birch), *Artemisia* (sage) and Gramineae (Grasses). Macrofossil and palynomorph data suggest that between about 7700 ^{14}C yr B.P. and 2000 ^{14}C yr B.P. timberline remained above present levels in response to warmer climatic conditions and was dominated by *Picea* (spruce) and *Abies* (fir). A return to wetter, perhaps colder conditions after 2000 ^{14}C yr B.P. is indicated by an increase in *Tsuga* (hemlock) and an absence of tree macrofossils. A decrease in the frequency of occurrence of turbidity current deposits in the core generated by a bordering alluvial fan coincides with an elevated treeline and warmer, drier conditions. The palaeo-vegetational record for Susie Lake is unique when compared to the previously obtained coastal and interior records and indicates that there are significant differences in meso-scale climate trends in western Canada.

Information on Late-Holocene environmental change was obtained from resident oral histories. Landslide activity was associated with concentrated spring runoff during high-snowpack years. A large rock avalanche was caused by activity along the Queen Charlotte transform. Both legends and resident histories indicate that volcanic activity on Mt. Edziza should be re-evaluated, especially in light of proposed economic development of the region.

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PALYNOLOGY AND PALAEOENVIRONMENTAL WORK AT THE PROVINCIAL MUSEUM OF ALBERTA

Palynology and palaeoenvironmental work at the Provincial Museum of Alberta is mainly directed towards the investigation of the postglacial landscapes and environments of Alberta, particularly as they relate to the Province's human history, which extends back over 10,000 years. In the last nine years, I have worked closely with colleagues from the Archaeological Survey on a number of joint projects. A particular focus has been the landscapes associated with some ancient archaeological sites, such as Saskatoon Mountain (*ca.* 9500 years old), Fletcher (*ca.* 9300 years old), and James Pass (*ca.* 10,000 years old).

The Palynology Laboratory houses collections and facilities for sample processing and

analysis. The Laboratory moved recently into new quarters in the basement of the Provincial Museum. This now includes work space for students and visiting scholars wishing to use the comparative collections. There are two Reference Collections (Pollen and Seeds) for identification and confirmation of material from lakes, peatlands, and archaeological sites. The Pollen Reference Collection comprises about 780 samples, mounted in silicone oil, and represents 86 plant families, mainly from native Alberta plants. The collection has good representation of plant taxa commonly encountered in Late Quaternary records from Alberta.

The Seed Reference Collection is small but growing rapidly! It consists of 220 catalogued samples, with about 100 other samples undergoing processing, and so far represents 47 plant families. Because there is no published reference manual for seeds of western Canadian plants, one recent focus of curatorial activity has been documenting the collection (photographs, drawings, size measurements etc.) and compiling a database which can be used to develop an identification manual. Each reference sample consists of a minimum of thirty seeds, thus allowing generation of size statistics for comparative purposes. The collection includes seeds from many plants known from ethnobotanical studies to have been used by Aboriginal people in Alberta.

The Working Collections consist of samples mainly from Alberta archaeological sites, lakes and peatlands. At least seven records are in various stages of processing. I am especially interested in landscape history following deglaciation. Current projects focus on macrofossils from 9300-year-old sediment at the Fletcher Site in Southern Alberta (which is now the subject of a diorama being constructed for exhibit in the new Aboriginal Peoples Gallery at the Provincial Museum) and analysis of *ca.* 10,000-year-old plant remains from several dugouts in southeastern Alberta (Vickers and Beaudoin 1989, Beaudoin 1995). These remains are highly significant because they provide a "snapshot" view of southern Alberta landscapes at a time that is poorly documented in the Plains (see Vance's article, pp. 6-7) but is important for human history because it coincides with some of the oldest known archaeological sites in the Province.

Seeds recovered from a *ca.* 9300-year-old hearth at the Saskatoon Mountain Site, west of Grande Prairie, included raspberry (*Rubus* sp.), cherry (*Prunus* sp.), bearberry (*Arctostaphylos uva-ursi*), and strawberry (*Fragaria* sp.). These plants were all used by Aboriginal people in the recent past and people at Saskatoon Mountain over 9000 years ago were presumably gathering and using them also (Beaudoin *et al.*, in press). Published Holocene pollen records are available from the area north and west of Grande Prairie but there is comparatively little information available from the region immediately to the south. In consequence, three lakes (Hilltop, Pierre and Nose Lakes) have been cored in the Grande Prairie area (Figure 1) and the pollen record from Pierre Lake is under investigation.

A recent project looked at a 9300-year-old record from "Wood Bog", just east of Grande Prairie. Fifty samples were processed for macrofossils (seeds, mollusc shells, ostracodes, insects, wood). The samples comprised over 21,000 seeds from about forty plant types and 12,000 shells from ten different mollusc taxa. This project provided new information about the early Holocene landscapes inhabited by the people who occupied the Saskatoon Mountain Site (Beaudoin 1993b). Pollen samples from this site should provide an interesting regional contrast to the predominantly local record given by the seeds.

Before joining the Archaeological Survey, I worked primarily in the Canadian Rockies. I have continued to analyse the data from this work (Beaudoin and King 1990, 1994). As an extension of this interest, I have recently completed an investigation, with Mel Reasoner, of

pollen focussing and differential pollen deposition in the sediments of Lake O'Hara (Beaudoin and Reasoner 1992, and my presentation at this conference).

Further afield, I have been involved in a project based in Heilongjiang Province, northeast China (Ives *et al.* 1994, Beaudoin and Reintjes 1994). Samples from sites in southern Heilongjiang have yielded abundant Late Pleistocene remains of large animals and tantalizing suggestions of human activity. At Xue Tian, near the Jilin border, for instance, remains of mammoth, woolly rhinoceros, bison, and horse have been recovered and are bracketted by dates of around 35,000 - 40,000 yr BP. Organic-rich sediments from this level are expected to produce details of Late Pleistocene environments.

Figure 1: Coring at Pierre Lake, March 1990. L-R Alwynne Beaudoin, Karie Hardie, and Milt Wright. Photo: George Chalut.

Colleagues and students are welcome to visit the Palynology Laboratory. For more details or to arrange access to the Reference Collections, please contact me at the address below.

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PALYNOLOGY IN THE GEOLOGY DEPARTMENT AT THE UNIVERSITY OF TORONTO

GEOFF NORRIS is Director of the Palynology Laboratory and a professor in the Department of Geology. Geoff is broadly interested in all aspects of palynology, particularly as it relates to solution of stratigraphic problems. He has a particular interest in Mesozoic-Cenozoic palynology and the integration of information from all available taxa — marine and terrestrial. He has published extensively on embryophyte spores and pollen, dinoflagellates, and fungal palynomorphs, and believes that the successful application of palynology to stratigraphy must rest on a firm, high resolution, taxonomic base.

Geoff has recently completed a monograph on spores, pollen, and dinoflagellates from Paleocene-Pliocene deltaic and inner shelf sequences in the Beaufort-Mackenzie Basin, NWT. This has allowed integration of sedimentological and faunal data into a robust chronostratigraphic framework capable of extension across major facies boundaries, and capable of rigorous application to sequence stratigraphic models. He has extended this to other Cenozoic basins in the eastern and western Canadian Arctic and is hoping to contribute to the puzzling diversity changes and evolution-extinction patterns — and lack thereof — of high latitude floras.

His long-term interest in high-level taxonomy and phylogenetic relationships of dinoflagellates cysts — initially started with W.A.S. Sarjeant in the early 1960's — has culminated in a joint publication with several co-authors of a classification which appears to satisfactorily integrate existing knowledge of the cysts and thecae of living and fossil dinoflagellates. Much of the credit for bringing this work to completion rests with Rob Fensome who actively pursued this research while a post-doctoral fellow in the Toronto Palynology Laboratory and formerly with Bill

Sarjeant, University of Saskatchewan. Rob Fensome and Geoff Norris were also invited to prepare summary of Cretaceous dinoflagellates and spores and pollen for the DNAG volume on the Canadian craton which appeared recently.

Geoff's earlier interests in the non-marine Cretaceous of the Moose River Basin, James Bay Lowland, Ontario was recently augmented by the completion of a doctoral thesis by Pierre Zippi. He proved that spores and pollen could be used to accurately date the main phase of sedimentation which occupied a relatively brief period of time in the mid-Cretaceous. Further, Pierre showed that the lacustrine environments were populated by distinctive non-marine dinoflagellates and zygnematacean cysts, representing some of the earliest records of these freshwater algae. Comparable cysts in recent and sub-recent lake sediments appear to offer the potential for tracking pH and Eh changes associated with global change phenomena.

He has just completed a paper with Oyuang Shu (a Visiting Scientist from the Nanjing Institute of Palaeontology, PRC) on Early Triassic spore-pollen assemblages from northwest China. This is important because the Dalongkou site in the Junggar Basin, Xinjiang is a potential candidate for a global continental Permian-Triassic boundary reference section.

Although most of the work done in our laboratory is focussed on projects for which funding has been procured from national and international sources, we do take the opportunity to welcome undergraduates to investigate projects of their choosing which can be researched using facilities in the Palynology Laboratory. In this way, Lee Fortner wrote a B.Sc. thesis a couple of years ago on Silurian acritarchs of the Rochester Shale of the Niagara Escarpment. Lee has recently been revising for publication the taxonomy and biostratigraphy of this work and has been collaborating with Prof. H. Brett to place it in a sequence stratigraphic framework.

MARTIN J. HEAD is an independent consulting palynologist as well as a research associate, sessional lecturer, and graduate faculty member in the Department of Geology. His current research interests are in the biostratigraphy, paleoecology, and taxonomy of Upper Cretaceous and Cenozoic dinoflagellates. He is a veteran of two ODP cruises (Legs 105 and 144) and is developing a magnetostratigraphically-constrained Neogene dinoflagellate biostratigraphy for the North Atlantic based on DSDP and ODP cores. This work has been supported by the Palynology Industrial Consortium comprising Amoco, Phillips, Unocal, Elf-Aquitaine, Norsk Hydro, and Statoil. Research has shown that many dinoflagellate and acritarch events are synchronous over large areas of the North Atlantic. This suggests exciting possibilities for refining the biostratigraphy of shelf and deltaic sequences where mineralized microfossil zonations are sometimes difficult to apply, and for the precise dating of high-latitude sites where other microfossils are sparse or absent.

Along with his work on deep-sea deposits, Martin has been examining neritic assemblages from classic Pliocene onshore sections in northwestern Europe including the Royal Society borehole at Ludham, the Chillesford Church beds, the Coralline Crag (all eastern England), the St. Erth Beds (southwestern England), and the Bosc d'Aubigny deposits (France). These studies are helping to establish the superiority of dinoflagellates for Plio-Pleistocene paleoclimatic reconstruction in Northwestern Europe — a field traditionally dominated by spore-pollen and foraminiferal studies.

Martin is also studying the taxonomy and morphology of Cenozoic dinoflagellates, with emphasis on cyst wall ultrastructure. This character is best explored with a finely-tuned SEM and so is often neglected in dinoflagellate taxonomy. The payoff is not entirely esoteric. Recent taxonomic work has enhanced the paleo-

ecological and biostratigraphic utility of several frequently confused species of the important Cenozoic genera *Habibacysta*, *Tectatodinium*, *Bitectatodinium*, and *Filisphaera*.

When Martin is not doing palynology or teaching, he can be found at his computer working on the CAP finances and membership files, editing the *AASP Newsletter*, or updating the AASP Web site.

LAURENT DE VERTEUIL is a post-doctoral fellow in the Department, having recently gained his PhD from the University Toronto. As an undergraduate he visited the Calvert Cliffs in Maryland and became fascinated with the exquisitely preserved dinocysts he found there. The Chesapeake material provided the basis for his dissertation, fieldwork for which was partially funded by an AASP Student Scholarship. Laurent's research tries to balance his theoretical interest in dinocyst morphology and taxonomy, with a pragmatic approach to allostratigraphic basin analysis. For example, he completed an original evaluation and synthesis of published cyst terminology and applied the results in describing stratigraphically useful new taxa. He developed a ten part Miocene zonation for the coastal plain formations and used it to delineate the subsurface allostratigraphy in Virginia, Delaware and New Jersey. His dinocyst stratigraphy of the Salisbury Embayment and adjacent Baltimore Canyon Trough represents the state-of-the-art in Miocene chronostratigraphic correlation for these basins. These taxonomic and stratigraphic studies formed the core of his thesis, which he defended in January. The results are presented in two papers that will appear together next year in a Micropaleontology Special Publication.

Following a summer stint at Exxon Production Research Company, where he demonstrated that the zonation developed onshore in Maryland could be applied to industry and COST wells off New Jersey, Laurent was accepted to sail as palynologist on the ODP New Jersey Sea Level cruise (Leg 150, summer 1993). With calcareous dissolution affecting most of the Neogene sections recovered from the New Jersey continental slope, the shipboard dinocyst stratigraphy provided a solid correlation framework between all the Leg 150 sites. These data, plus later shore-based work, still provide the only sure Neogene correlations between the continental slope and complimentary drilling in the New Jersey Coastal Plain (ODP Leg 150X).

Three onshore boreholes in New Jersey (at Cape May, Atlantic City and Island Beach), plus the Leg 150 sites on the continental slope and rise, form part of the ongoing New Jersey Transect Project, whose aim is to document the Oligocene to Recent record of sea-level change and sequence architecture on this margin. A dip-parallel series of shelf sites, that will be drilled in 1997, will complete the transect. Laurent is the dinocyst stratigrapher for the New Jersey Transect Project and in addition to his key responsibility for erecting the Neogene chronostratigraphic framework for the project, he is actively helping to delineate and interpret stratigraphic sequences (see his talk at this meeting).

Samples from New Jersey Transect sites provide some material for a related project that is being funded by a consortium of five oil industry majors. The Integrated Neogene Geochronology And Sequence Stratigraphy Project is coordinated from Woods Hole Oceanographic Institution by William Berggren, and is beginning work on integrating the next generation Neogene timescale with well-constrained sequence records from basins with high-resolution seismic and biostratigraphic data sets, and well-studied continuous cores. As a post-doc with this project, Laurent is responsible for the dinocyst horizons and palynofacies, and is working with Marie-Pierre Aubry (calc. nannos.), William Berggren (planktonic forams.), Anne Boersma and Mimi Katz (benthic forams.), and Kenneth Miller (strontium isotopes).

In August, at the SEPM Congress in Florida, Laurent summarized his results from the middle Atlantic Coastal Plain to an audience composed mostly of Atlantic and Gulf coastal plain stratigraphers. In the Neogene of Florida, where shallow water carbonate systems are difficult to correlate, dinocysts have the potential to impact the resolution of some long-standing basic questions in the regional stratigraphy, including the timing of major oceanographic and tectonic events in the history of the Florida Platform. Combining dinocyst and strontium stratigraphy, and calcareous biostratigraphy wherever available, is providing the key to inter-regional chronostratigraphic correlation on the U.S. Atlantic margin.

Most recently, Laurent has begun to explore opportunities in low latitude palynology, particularly in hydrocarbon-producing areas such as Venezuela, and his native Trinidad. In July he attended the joint Caribbean Geological Conference/Geological Society of Trinidad and Tobago meeting in Port of Spain, and was encouraged by the extent of biostratigraphic input into local exploration and production. When asked to comment on future directions in his career, Laurent managed only "Have scope, will travel."

FLORIN NEUMANN is a PhD candidate with interests mainly in dinocyst taxonomy, biostratigraphy, and palaeoecology. He worked initially on Late Cretaceous cysts, but for his Ph.D. project, which is supervised by M.J. Head and G. Norris, he has switched to Cenozoic material. Florin earned the degree of Master of Palynology from the University of Liège (Belgium), with a thesis on the taxonomy of Campanian dinocysts from the Nevele borehole (Western Flanders).

At the University of Toronto he studied dinocysts and pollen from the Kanguk Formation on Banks Island (NWT). Preliminary fission-track data from a tephra bed within Kanguk suggested a latest Maastrichtian age for this formation, which was usually considered to span the Campanian-Maastrichtian interval. Florin proved conclusively that samples from below and above the tephra bed were Late Campanian, and it was recognized that the fission-track dating method used in this instance was in need of further refinement.

Florin is now working on a Ph.D. thesis on the distribution of dinocysts in Pliocene deposits in areas adjacent to the Panama isthmus, based chiefly on DSDP/ODP samples. He is developing a dinocyst biostratigraphy for the area, and testing whether the palaeobiogeography of Pliocene cyst-producing dinoflagellates reflects the impact of a classical vicariant event, namely the emergence of the Panama isthmus at approximately 3.5 Ma. Part of this work was included in a presentation at the Fourth Canadian Palaeontology Conference (1994), which received the best student paper award.

Florin has been recently selected as shipboard palynologist for ODP Leg 165 (Caribbean Ocean History and K/T Boundary Event). Drilling at the five sites proposed for this leg will address two major themes, the nature of the K/T boundary, and the influence of tropical seas on global ocean history and climate evolution. Objectives range from the study of ejecta mechanisms of the Chicxulub impact event to the examination of effects of the late Neogene closing of low-latitude oceanic gateways.

Florin has been a recipient of the prestigious University of Toronto Connaught Research Fund Scholarship; in 1995 he was awarded the American Association of Stratigraphic Palynologists Student Scholarship.

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POSTGLACIAL PALEOHYDROLOGY AT CRAWFORD LAKE, ONTARIO: DRY CLIMATE TRIGGERED MID-HOLOCENE HEMLOCK DECLINE?

Lithology, geochemistry, ^{14}C, pollen, and/or plant-macrofossil data of five cores from the Crawford Lake basin (Figure 1) were used to reconstruct postglacial lake history. The lake basin was probably formed by hydraulic mining of the dolomite bedrock during a catastrophic glacier meltwater rush (McAndrews and Boyko-Diakonow 1989). The lake was formed shortly after the retreat of glacial ice around 13 ka, suggested by absence of till or other glacial deposits in this small, deep bedrock basin. The earliest sediments were minerogenic allochthonous silty/sandy clay which were likely eroded from treeless tundra upland or derived from glacial Lake Whittlesey (cf. Karrow 1987). From ~13-12 ka, lake level was at least 1.5 m

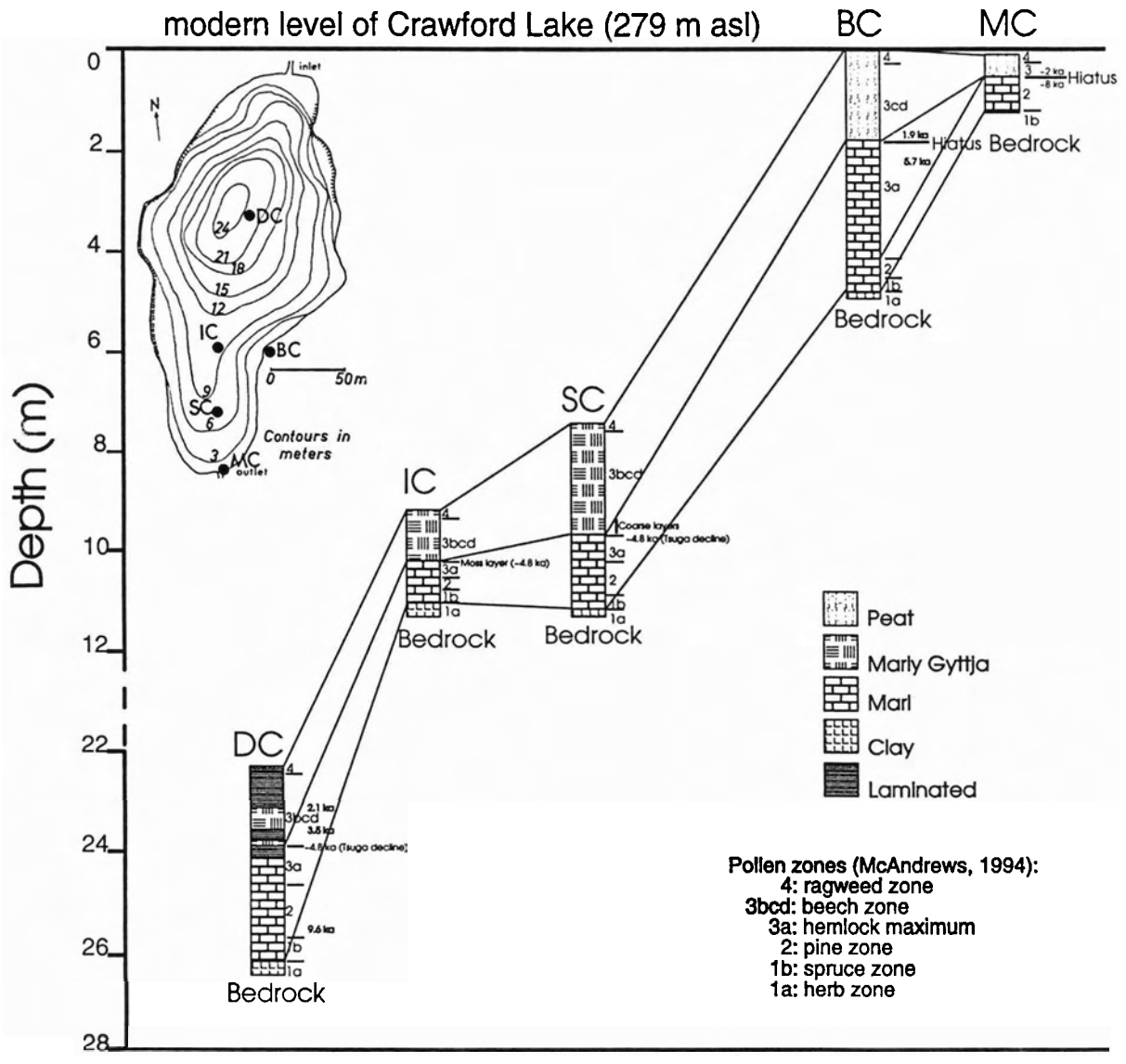

Figure 1. Sediment stratigraphy diagram of cores DC, IC, SC, BC, and MC from Crawford Lake (43°28'N; 79°57'W) showing lithology, ^{14}C ages, and regional pollen assemblage zones. Insert shows the bathymetry and locations of coring sites.

lower than today, as suggested by the missing basal tundra pollen zone (1a) and a very brief spruce zone (1b) in core MC, and an elevation constraint of the bedrock outlet sill at 1.5 m below the present lake level. Following afforestation of the watershed, autochthonous marl replaced clay throughout the basin. During the spruce pollen zone (1b; ~12-10 ka), reduced upland erosion is indicated by increased organic matter and carbonate and by decreased erosion-indicator elements (Ti, Al, K, Na, V, Mg), due to denser vegetation and slope stabilisation. During the following pine and early mixed forest zones (2, 3a), marl continued to be deposited

while lake level rose. In the middle of zone 3a (hemlock maximum; at ~6 ka) laminated sediments started to form in the deep basin.

The upland hemlock population decline at ~4.8 ka parallels basin-wide lithologic changes: 1) laminations disappeared from deep basin (core DC) along with a lithologic change from marl to marly gyttja, 2) two cores (SC, IC) from shallow south basin contain a moss layer up to 10-cm thick (inwashed terrestrial mosses *Fissidens grandifrons* and *Fontinalis* sp., N.G. Miller, 1995, personal communication), also with a shift from marl to more organic-rich sediments, and 3) the wetland cores (BC, MC) show sediment hiatuses from ~5 and ~8 to 2 ka, indicating non-deposition and/or erosion due to lowered lake levels of at least 2 m (core BC). From ~4.8 to ~2 ka detritus layers (inwashed) were deposited in core SC, also indicating lowered and fluctuating levels. The laminations in core DC disappeared from 3.5 to 2.1 ka. An underwater bedrock platform at 5 m depth probably formed during the lower lake levels by annual freeze-thaw cycle (cf. Shakesby and Matthews 1987). Rising lake level in the past 2,000 years due to a cool/moist climate renewed lamina sedimentation (core DC), homogeneous marl deposition (cores SC, IC), and peat accumulation (cores BC, MC).

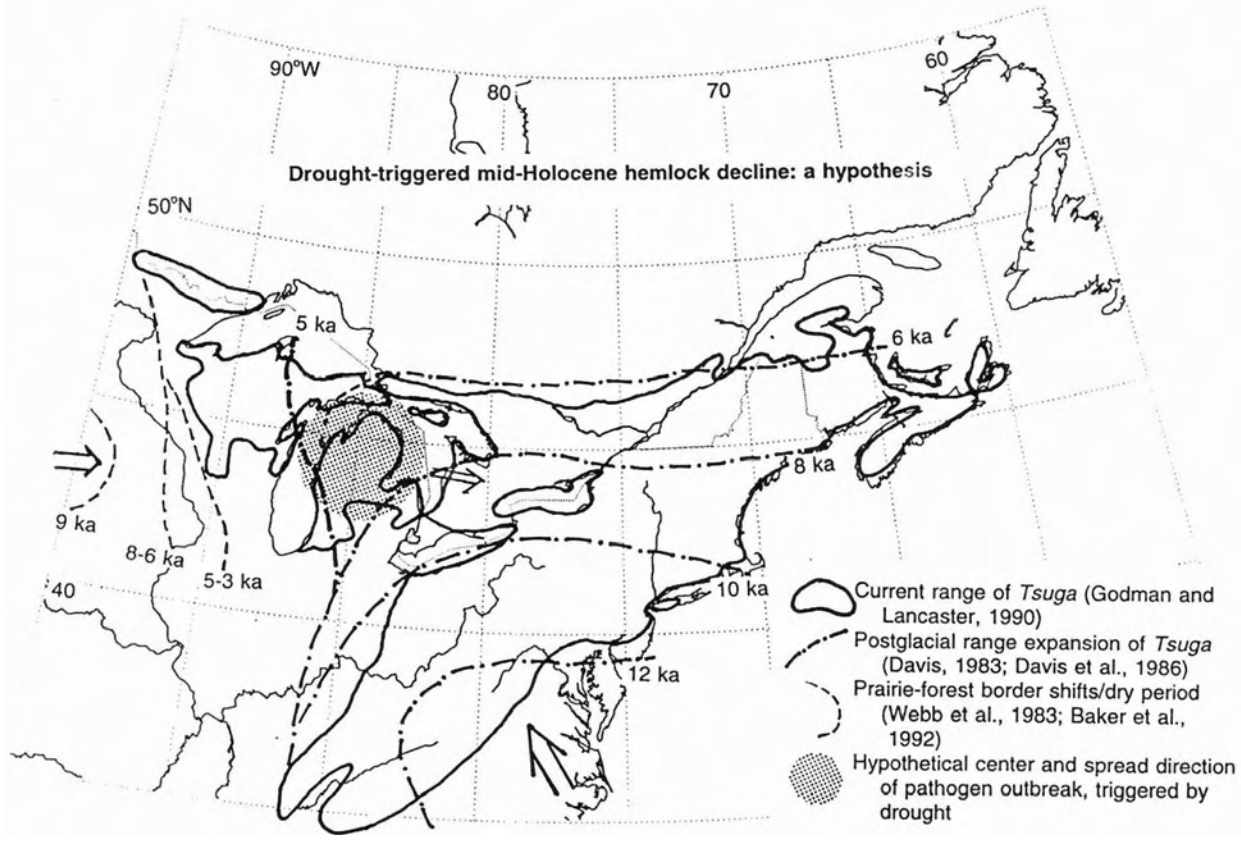

Figure 2. Map illustrating the drought-triggered pathogen hypothesis for the mid-Holocene hemlock decline. The hemlock expansion to the westmost limit of its range at 5 ka (Davis *et al.* 1986) corresponds with dry-period starting at ~ 5 ka in Wisconsin and Michigan (e.g., Baker *et al.* 1992); the drought might seriously damage the newly arrived small hemlock population and hypothetical pathogen (e.g., Allison *et al.* 1986) may attack the weakened hemlock and spread to its whole range.

Lower and fluctuating lake levels during the mid-Holocene (5-2 ka) reflect a dry/warm climate. This dry period in the late mid-Holocene appears at other sites in southern Ontario (cf. Yu 1995), e.g. Rice Lake (Yu and McAndrews 1994), Decoy Lake (Szeicz and MacDonald 1991), and Sunfish Lake (Sreenivasa and Duthie 1973). It correlates in time with the dry period in the midwestern United States (e.g., Webb *et al.* 1983; Baker *et al.* 1992), which shows a time-transgressive trend from 8-5 ka in northwestern Minnesota to 5-3 ka in southeastern Wisconsin and southern Michigan. This regional dry/warm climate starting at ~5 ka might have triggered the hemlock decline because: 1) drought is the most serious damaging agent to this species, especially for seedlings in winter (Godman and Lancaster 1990), 2) newly-immigrated hemlock in its westmost range at ~5 ka (Davis *et al.* 1986) was likely established in unfavourable habitats due to competition from other species, and 3) a reduced hemlock population persisted after the decline, probably in protected moist habitat. A drought-weakened hemlock population would be vulnerable to attack by a possible pathogen (cf. Clancy *et al.* 1995), which may have subsequently spread through the range of hemlock. This hypothesis might be tested by examining the trend in ages (^{14}C or varves) for the decline from Michigan to southern Appalachians or Nova Scotia, which may even provide evidence for the origin and path of the pathogen outbreak (see Figure 2).

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LATE GLACIAL AND EARLY HOLOCENE VEGETATION AND CLIMATE AT CRAWFORD LAKE, ONTARIO: A STUDY OF WITHIN-BASIN VARIATIONS OF SEDIMENT, POLLEN AND ISOTOPE RECORDS

The late glacial vegetation and climate changes since ice retreat (~13 ka) in southern Ontario have been poorly documented due to delayed development of lake basins at some sites (e.g., Warner *et al.* 1991), brevity of the early treeless stage, and contamination by reworked pollen from glacial deposits or ice (e.g., McAndrews 1984). In the paleoecological literature, there are a few studies on within-basin variations of sediment and pollen deposition (e.g., Davis *et al.* 1984), but few studies have been carried out to evaluate the within-basin variations of stable-isotope records along with pollen and sediment. Here we present detailed lithologic, pollen, geochemical, and oxygen-isotope records of three cores from a small, deep bedrock basin to reconstruct the late glacial vegetation and climate, and to evaluate intra-basin variations of pollen, sediment, and isotope records in terms of their sensitivity to environmental changes.

The summary diagram from the deep core (DC; Figure 1) will be used as a master sequence for vegetational and environmental reconstruction. Fossil pollen shows a vegetation succession from *Alnus-Picea-Pinus*-Cyperaceae zone (sparse tundra; CL1a), through *Salix*-Cyperaceae zone (dense tundra; CL1b) and *Picea* zone (open forest/woodland; CL2 and CL3), to *Pinus* zone (closed forest; CL4). The unstable landscape with severe slope erosion during the tundra zone (CL1) produced lacustrine clay sediment with high silicate and a high concentration of erosion-derived elements Ti, K, Mg, Al, and V. The decrease of these elements and increased organic matter and autochthonous carbonate corresponded

with slope stabilisation after spruce forest establishment (CL2) in the watershed. In the upper *Picea* zone (CL3) a climatic reversal at the estimated Younger Dryas-age (~11-10 ka) is indicated by a negative excursion (0.5‰) of oxygen isotope and peaks of erosion elements derived from soil erosion under cold climate. This interval is shown more clearly in the other two cores, 1.5‰ shift of $\delta^{18}O$ and increased silicate of the shallow core (SC; Figure 2a) and 1‰ shift of $\delta^{18}O$ and decreased carbonate of the lakeside bog core (BC; Figure 2b). Isotopes show climate warming during the *Picea-Pinus* (late glacial-Holocene) transition (2-3 ‰ positive shift of $\delta^{18}O$), along with increased carbonate and decreased erosion elements. The *Picea* recurrence at 9.6 ka corresponds with a peak of erosion elements, which suggests a brief climate oscillation.

The deep basin (DC) started accumulating clay on bare bedrock earlier and/or faster than the other two cores (SC and BC), perhaps because of greater depth. Pollen concentrations are similar at 15-20x10^3 grains/mL for tundra zone (CL1) in the three cores. The very high values (~-6‰) of $\delta^{18}O$ was caused by detrital dolomite derived from bedrock and thus have no climatic significance. Higher percentages (>80%) of autochthonous marl in cores SC

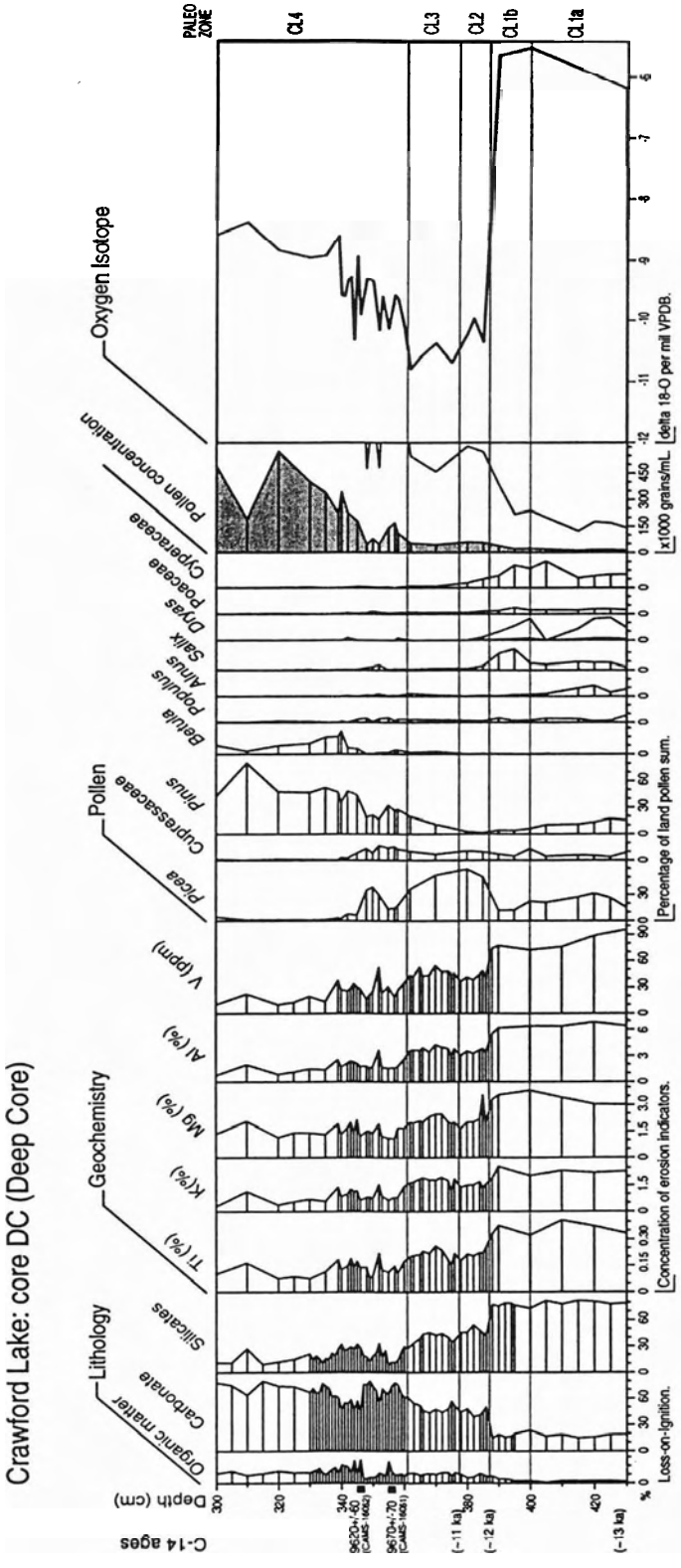

Fig. 1. Summary diagram of lithology, geochemistry, pollen, and oxygen isotope records from Crawford Lake core DC. Open curves for *Dryas* and pollen concentration are 10x exaggeration. The ages for CL1b/CL2 and CL2/CL3 boundaries are estimated but will be dated from Marl Pond. Isotope values in zone CL1 have no climatic significance due to detrital dolomite contamination.

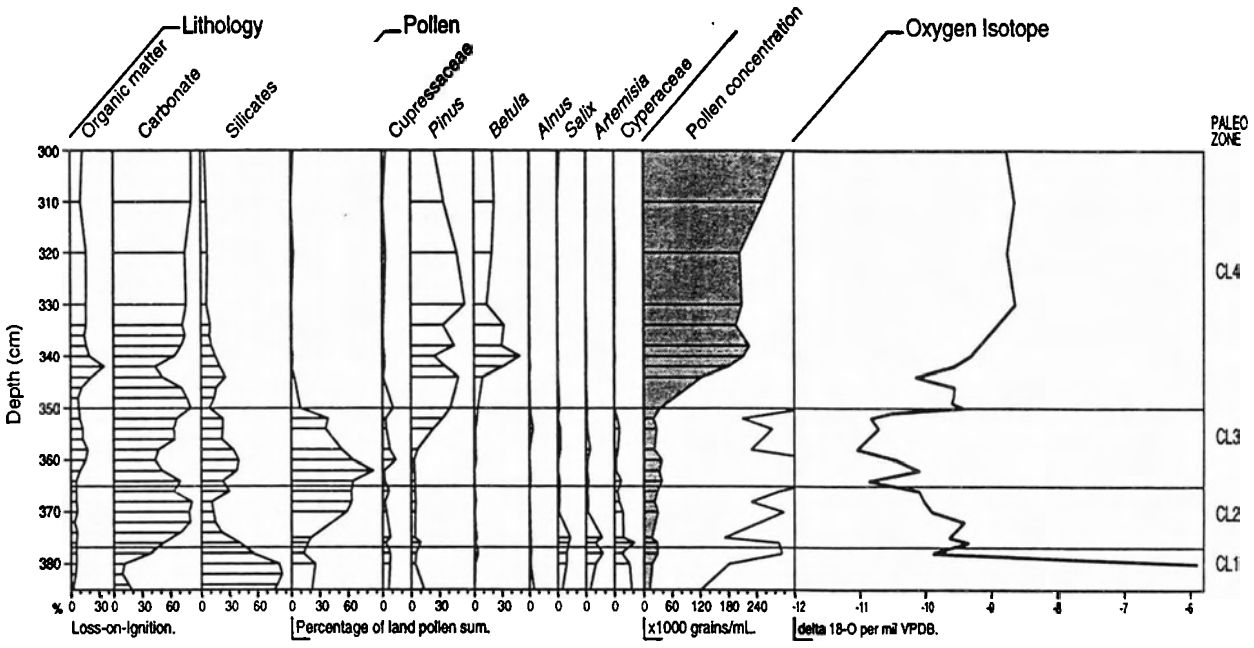

Fig. 2a. Summary diagram of lithology, pollen, and oxygen istope records from Crawford Lake core SC.

and BC than core DC (~50%) during the low *Picea* zone (CL2) might result from higher lake productivity in shallow water. Pollen concentration in *Picea* zone shows significant increase in core DC ($50x10^3$ grains/mL), perhaps caused by pollen focusing to the deeper part of the basin. The $\delta^{18}O$ values are about 0.5‰ more positive in core SC than the other two cores. In the zone CL3, more dramatic increase in silicate in core SC corresponds with more negative excursion of $\delta^{18}O$. The onset of Holocene is marked by renewed deposition of marl from all three cores, sharp increase in pollen concentration to $500x10^3$ for DC, $220x10^3$ for SC and $80x10^3$ grains/mL for BC, and abrupt positive shifts of $\delta^{18}O$ from 2‰ for DC to 3‰ for BC. Core SC may record environmental changes more sensitively during the YD interval than other two cores suggested by lithologic and isotope changes, whereas core BC shows isotopes to be more sensitive to Holocene climate warming. Core DC registers a more detailed pollen signature, probably due to lack of bioturbation and rapid sediment accumulation.

Our multi-proxy data from pollen, isotope and geochemical analyses provide a comprehensive reconstruction of vegetation and climate around the Pleistocene-Holocene transition in southern Ontario. The Younger Dryas-age climate oscillation was indicated by lithologic and stable isotope at this site and also at a nearby site (Z. Yu and U. Eicher, unpublished data). This event has been recently documented in southern Great Lakes region by isotope as well as pollen (e.g., Shane *et al.* 1994). The lack of pollen evidence for YD in southern Ontario was

Crawford Lake: core BC (Bog Core)

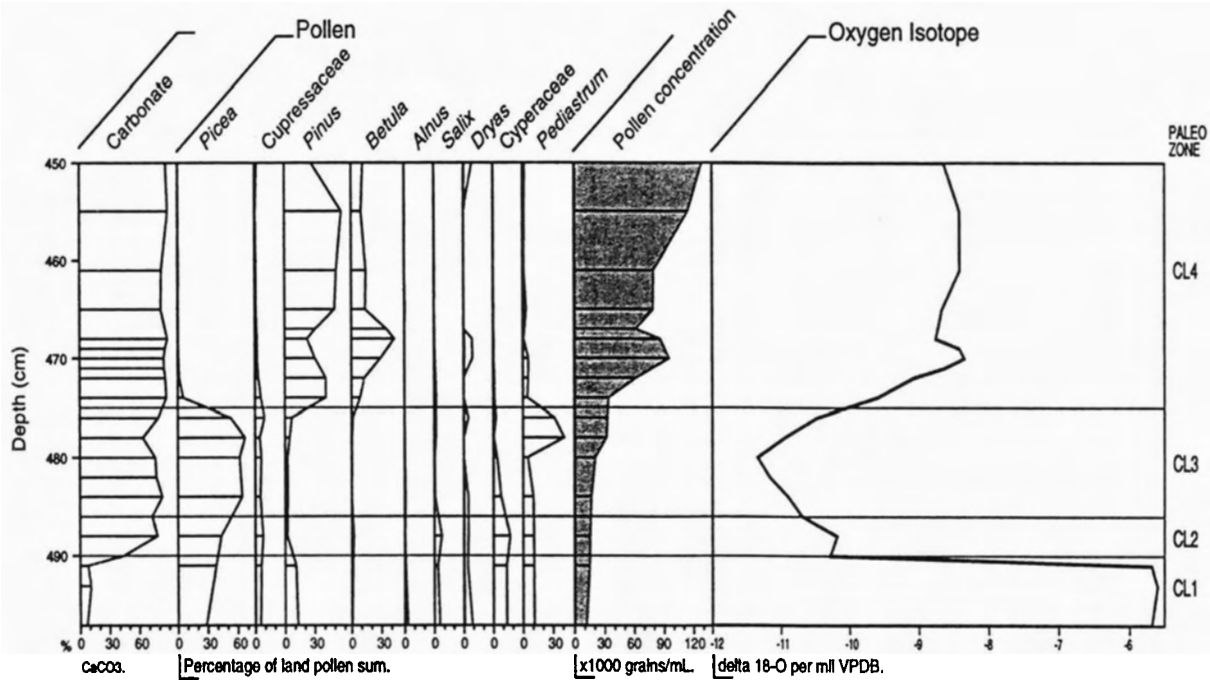

Fig. 2b. Summary diagram of lithology, pollen, and oxygen isotope records from Crawford Lake core BC.

presumably due to no response by insensitive non-ecotonal vegetation to climate change. The climatic significance of the Pleistocene-Holocene transition has been clearly shown from Crawford Lake, which is in contrast to Fritz *et al.* (1987) but is similar to records from European lake sediments (e.g., Eicher and Siegenthaler 1976; Lotter *et al.* 1992) and from Greenland ice cores (e.g., Johnsen *et al.* 1992). The well-dated early Holocene event indicated by *Picea* recurrence also has regional significance, which has been documented at other sites in southern Ontario (e.g., Anderson and Lewis 1992) and may correlate with European Preboreal oscillation (e.g., Lotter *et al.* 1992) or early Mattawa highstand of the Huron basin (Rea *et al.* 1994). The pattern of within-basin variations of sediment, pollen and isotope records from this study may provide useful information for site selection in paleoecological studies.

Acknowledgments

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LATE GLACIAL AND EARLY HOLOCENE VEGETATION AND CLIMATE AT MARL POND, SOUTHERN ONTARIO

In southern Ontario, the late glacial vegetation and climate changes since ice retreat (~13 ka) have been poorly documented due to delayed development of lake basins at some sites (e.g., Karrow and Warner 1988; Warner *et al.*, 1991), brief nature of the early treeless vegetation (see discussion in Cushing and Wright 1967), and contamination by reworked pollen from glacial deposits or ice (e.g., McAndrews 1984). Pollen and plant-macrofossil studies show the existence of tundra flora prior to the spruce zone, likely representing forest tundra (e.g., Anderson 1982), however, the contamination of organic debris and also macrofossils may cause the unreliable chronology and representation of macrofossil assem-

blages. A detailed multi-disciplinary investigation using pollen, insect, and stable isotope data has failed to provide evidence for climate changes during the late glacial, even no climatic signal for the Pleistocene-Holocene transition (Fritz *et al.* 1987). In this study, we present a detailed pollen, plant-macrofossil, and stable-isotope record for the late glacial and early Holocene from a southern Ontario site, and discuss the flora and vegetation after ice retreat as recorded by macrofossils and pollen and late glacial climatic oscillations as recorded by isotope and lithology.

The summary diagram (Figure 1) shows pollen, plant-macrofossil, and oxygen and carbon isotope data. The pollen record shows a vegetation succession from *Alnus-Pinus*-Cyperaceae zone (sparse tundra; MP1a), through *Salix-Juniperus*-Cyperaceae-*Artemisia* zone (dense tundra; MP1b) and *Picea* zone (open forest/woodland; MP2 and MP3), to *Pinus* zone (forest; MP4). Preliminary plant-macrofossil analysis provides a record of tundra plants that grew at or around the site immediately after the retreat of glacial ice, which include abundant *Dryas integrifolia* leaves and seeds, *Salix herbacea* leaves and seeds, and *Silene acaulis* seed(s). These plants grew in a treeless landscape, which is supported by absence of tree macrofossils which are abundant in upper forest zones. Zone MP3 shows an increased erosion episode indicated by increased silicate and a peak of *Pediastrum*, a planktonic green algae of silty water (Lotter

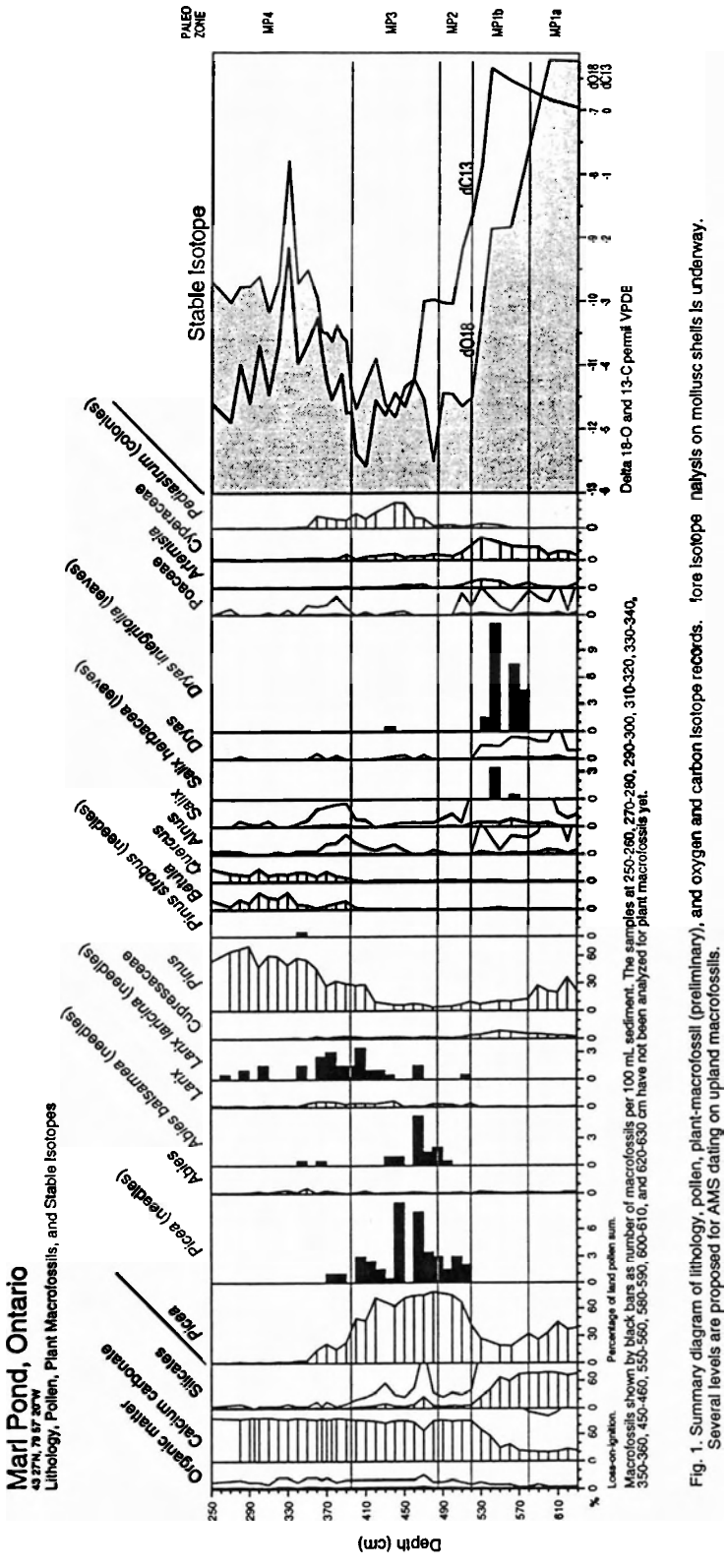

Fig. 1. Summary diagram of lithology, pollen, plant-macrofossil (preliminary), and oxygen and carbon isotope records. fore isotope nalysis on mollusc shells is underway. Several levels are proposed for AMS dating on upland macrofossils.

and Holzer 1994), along with a *Dryas* leaf. That interval also contains a negative excursion of oxygen isotope from Crawford Lake (Z. Yu and U. Eicher, unpublished data). The isotope record from Marl Pond has no clear negative excursion at this interval (except at 480 cm), which was probably caused by contaminant detrital dolomite at 470-440 cm as shown by an increase in dolomite and a significant drop of calcite to dolomite ratio (R. Farvacque, personal communication). The additional isotope analysis on mollusc (*Valvata* and *Pisidium*) shells is being carried out to test this possibility. The MP3 interval suggests a climatic reversal at ~11-10 ka, correlative with Younger Dryas event. The AMS dating on upland macrofossils will be carried out soon. Isotope data show clear climatic significance of the *Picea-Pinus* (late glacial- Holocene) transition with at least 2‰ positive shift of $\delta^{18}O$, which are similar to isotope records from European lake sediments (e.g., Lotter *et al.* 1992) and from Greenland ice cores (e.g., Johnsen *et al.* 1992). The *Picea* pollen recurrence in early Holocene has been AMS-dated at 9.6 ka from Crawford Lake, which suggests a brief climate oscillation, correlative with European Preboreal oscillation (e.g., Lotter *et al.* 1992) or early Mattawa highstand of the Huron basin (Rea *et al.* 1994).

Pollen and macrofossil data indicate a treeless landscape immediately followed the retreating glacial ice and the stage may last for several hundred years. The Younger Drays-age climate oscillation might exist in southern Ontario, even without pollen evidence; this event was indicated by lithologic, plant-macrofossil, algal records and likely also stable isotope. The climatic significance of the Pleistocene-Holocene transition has been shown from this site and also from Crawford Lake (Z. Yu and U. Eicher, unpublished data). The early Holocene event indicated by *Picea* recurrence also has regional significance, which has been documented at several sites in southern Ontario (e.g., Anderson and Lewis 1992).

Acknowledgments

We thank J. McAndrews for introducing the site, J. Denhart for field assistance, R. Farvacque for carbonate determination, J. Yang for *Pisidium* identification, D. Siddiqi for help with macrofossil analysis, and J. McAndrews for discussion and comments. This work was supported by a University of Toronto Fellowship to Yu and an NSERC grant to J. McAndrews. The isotope measurements were performed in the Institute of Climate and Environmental Physics of the University of Bern.

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LATE QUATERNARY PALEOECOLOGY OF *THUJA* AND *JUNIPERUS* (CUPRESSACEAE) AT CRAWFORD LAKE, ONTARIO: POLLEN, STOMATA AND MACROFOSSILS

In northeastern North America, paleoecological records of *Thuja* and *Juniperus* are problematic due to their indistinguishable and poor-preserved fossil pollen grains (e.g., McAndrews *et al.* 1973). They cannot be separated with confidence by palynologists in routine pollen analysis although Parent and Richard (1990) recently provide an identification key to separate *Thuja* and *Juniperus* among other taxa. The poor preservation seems to be responsible for its low abundance in lake sediments and peat because Cupressaceae has relatively high percentage (9%) in modern pollen rain in southern Ontario (Cambon 1994). Their separation, however, could provide valuable information in paleoecological and paleoclimatic interpretation of pollen data due to their different ecology and habitats. *Thuja occidentalis* is a northern temperate tree on organic soils in lowlands and calcareous mineral soils on uplands; whereas *Juniperus*, most commonly cf. *J. communis*, is a heliophytic shrub of open ground, especially on dry rocky soils in subarctic and arctic. Plant macrofossils are distinctive, but due to the highly time-consuming nature of macrofossil analysis and scarcity of macrofossils in pollen cores, only a few pollen investigations have accompanied by macrofossil studies. In this study, I use stomata as a proxy of macrofossils (Hansen 1995) to investigate this problem. Lignified conifer stomata are usually well-preserved, and *Thuja* and *Juniperus* stomata have distinctive and identifiable features. For stomatal analysis, pollen slides are used and thus it requires little extra time in a paleoecological study. Also stomata have better chance to be found in pollen cores due to their higher concentration ($x10^3$/mL) than macrofossils ($x10^0$/mL).

Pollen size was also measured because *Thuja* pollen tends to be larger than *Juniperus* although an individual grain cannot be separated by its size (Parent and Richard 1990). Macrofossil analysis was carried out to verify the pollen and stomatal results.

Crawford Lake has high percentages (5-15%) of Cupressaceae pollen through most of the past 13,000 years except for a dearth during the *Pinus* zone at ~10-8 ka (Figure 1). Macrofossil and stomatal results together with pollen size measurements indicated that the late glacial Cupressaceae pollen mostly derived from *Juniperus* cf. *communis* (smaller pollen, a few stomata, and absence of *Thuja* stomata/macrofossils), whereas pollen during the past 8,000 years was from *Thuja* (larger pollen, abundant stomata, and abundant leaves and seeds). This bi-modal pattern of *Thuja-Juniperus* pollen appears at other sites in southern Ontario, especially along the Niagara Escarpment, despite variable abundance of this pollen type. The same pattern warrants the separation of *Thuja* and *Juniperus* at other sites with more confidence based on the pollen, stomatal, and macrofossil results from this study. The reciprocal relation between *Thuja-Juniperus* and *Pinus* pollen suggests an exclusion interaction between *Thuja-Juniperus* plants and *Pinus* trees. The late glacial occurrence of *Thuja* macrofossils in southern Ontario reported by Warner (1982) and Anderson (1982) may indicate early immigration of a small population via the favourable habitats along the Escarpment or alternatively recycled/contaminated *Thuja* macro-

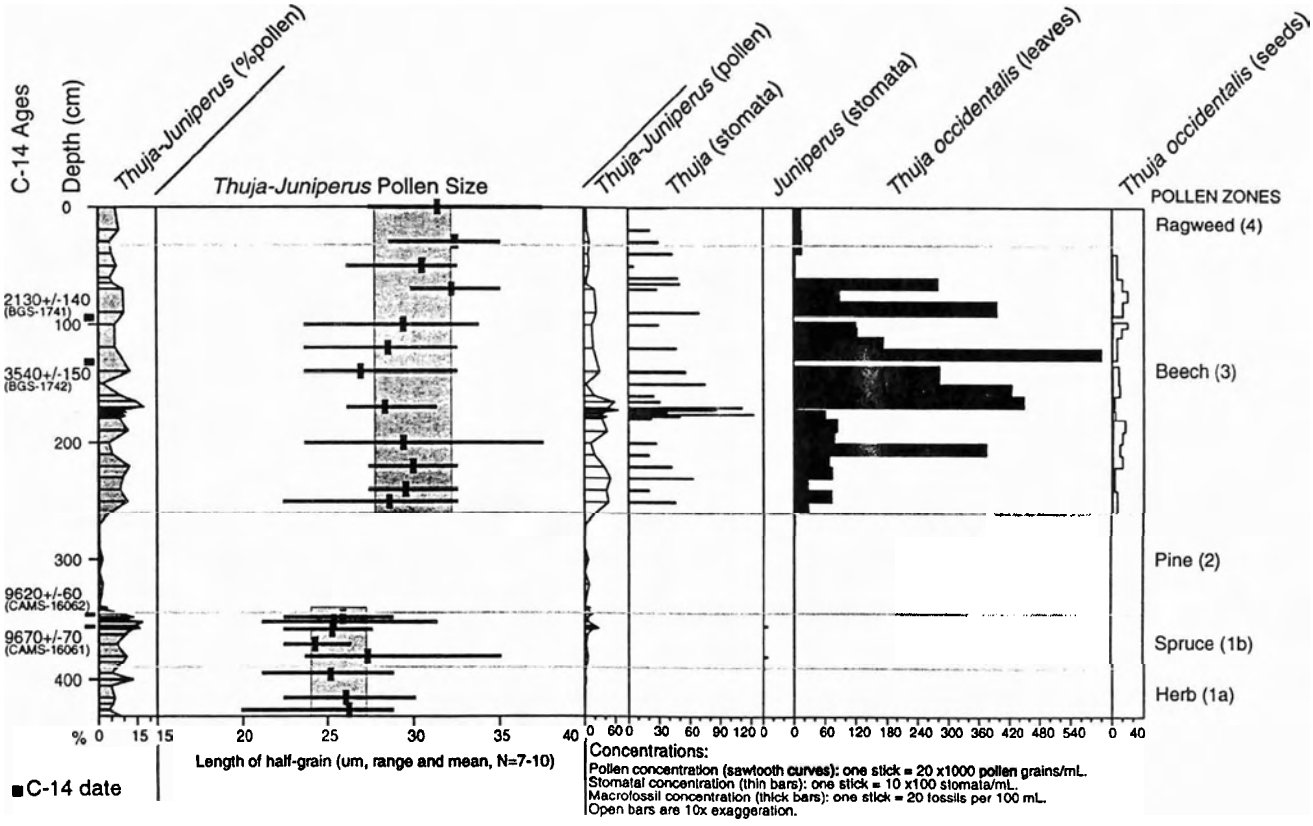

Fig. 1. Summary diagram of *Thuja* and *Juniperus* pollen, stomata and macrofossils from Crawford Lake (43 28'N; 79 57'W).

fossils, as suggested by the questionable stratigraphy and the puzzling ^{14}C dates at those sites.

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Canadian Museum of Nature

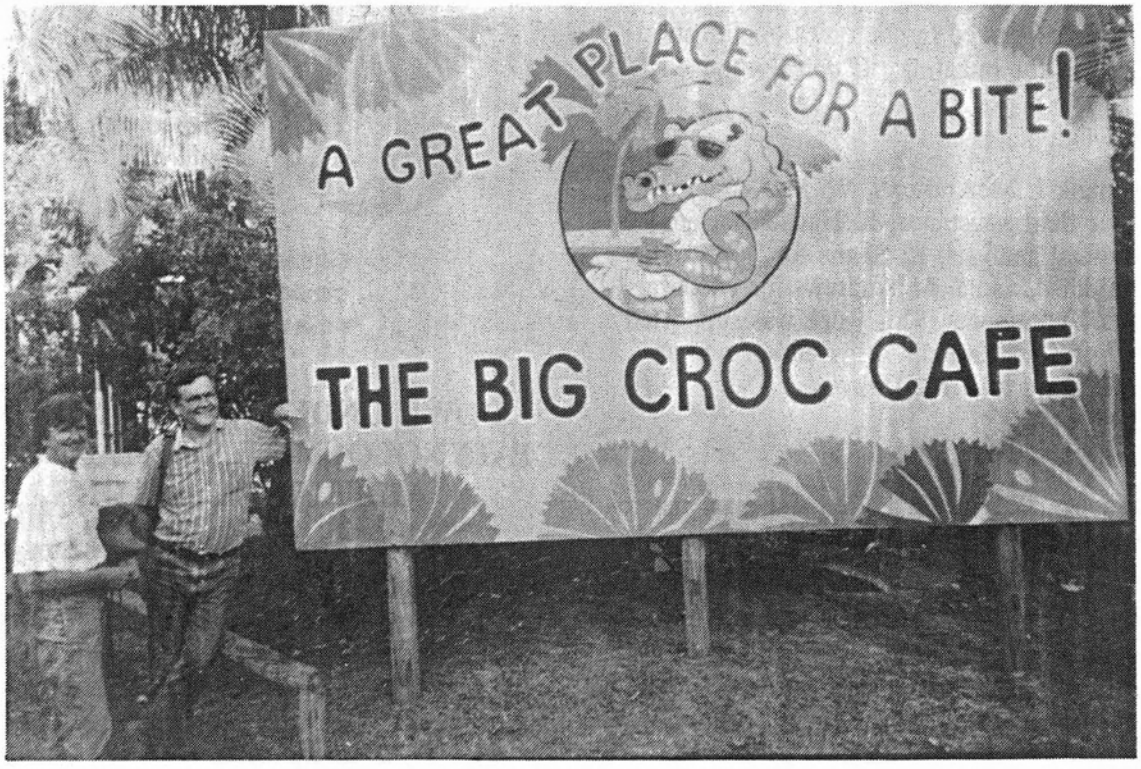
Musée canadien de la nature

DOWN UNDER AND UP NORTH: PALYNOLOGY AT THE CANADIAN MUSEUM OF NATURE

Palynology at the **Canadian Museum of Nature** (Ottawa) is part of the Planetary Evolution Centre of Knowledge, and, as such, falls under the responsibility of the Museum's Origins Programme. The mission of the Origins Programme is to "*increase understanding of the biological and geological processes and patterns that have formed the natural world in which we live, and to promote interest in and respect for those complex systems that control our well-being and future...*"

Research at the **Canadian Museum of Nature** must be societally relevant and when possible be based on interdisciplinary studies. It has also become apparent in recent years that research funding must be generated within our Museum as government cutbacks have reduced funding to cultural institutions.

Of major concern in Palynology at the CMN over the next few years will be an understanding of Late Cretaceous and earliest Tertiary environments of Gondwana. This is a continuation of collaborative work begun in 1987 with Dr. Mary Dettmann. Mary and I are expanding the work already completed on the Otway Basin (southeast Australia) to include several other localities of Late Cretaceous and earliest Tertiary sediments shown or expected to contain diverse and well-



Mary Dettman and David Jarzen at the Daintree Rainforest, Far North Queensland, Australia. The Daintree forests contain rare and endangered endemic proteaceous taxa. (Photo: S.A. Jarzen, October 1994).

preserved palynomorphs. Primary among these are 25 cored sections of the Kings Park Formation (Perth Basin, Western Australia) which were collected in 1991. The Kings Park Formation pollen assemblage is younger (?Paleocene-Eocene) than those of the Gippsland and Otway Basins (Jarzen 1992; Dettmann and Jarzen 1988), but contains numerous pollen species of proteaceous affinity which can be correlated with the southeastern palynofloras.

Today, these two floristic regions (i.e., southeastern cool temperate to subtropical environments and the southwestern wet temperate region) are separated by a broad expanse of dry, open, flat outback, populated by its own unique flora. Our research, coupled with published data, will attempt to illustrate the physical continuity of Late Cretaceous-Early Tertiary floras across southern Australia (Stover and Partridge 1982; Milne 1988; Dettmann and Jarzen 1991; Specht *et al.* 1992) as well as provide evidence that the source (cradle of evolution) of many Australian plant taxa, including several genera of the Proteaceae, Winteraceae, Trimeniaceae, Gunneraceae, and others, is within the Antarctic region with migration northward into and throughout Australia and later into New Caledonia and New Zealand (Jarzen and Pocknall 1993).

Detailed examination of pollen-bearing sediments from a broad geographical distribution is necessary to support such a broad-based hypothesis. Our work on Otway Basin and Antarctic pollen floras has already illustrated a direct route of dispersal between southern Gondwana (Antarctica) and northern Gondwanic lands (southeastern Australia, South America (Dettmann and

Jarzen 1988, 1990, 1991). Additional studies are necessary to expand our hypothesis to include southwestern Australia.

Samples have been collected and preliminary study of the Kings Park Formation palynofloras has been underway since 1992. Our work over the duration of this project will be to refine the pollen/spore sequences as observed in 25 borehole sections and to correlate our results with previously observed sequences elsewhere in Gondwanic lands, via light, scanning (SEM) and transmission (TEM) electron microscopy.

It is hoped that during the second year of this project, Dr. Dettmann will be able to visit the CMN for a period of 3-4 months as a Research Associate in order to complete the final phases of this proposal.

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LABORATOIRE DE PALÉOPHYTOGÉOGRAPHIE ET DE PALYNOLOGIE

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1. Le Laboratoire Jacques-Rousseau

Regular staff members at the Laboratoire Jacques-Rousseau include Alayn C. **Larouche**, biologist and palæobotanist (macrofossil analysis), and Nicole **Morasse**, geographer and pollen analyst. With Pierre J.H. **Richard**, the staff is responsible for all the activities, including stud-

ent training. The lab occupies two rooms in a 80 years old off-campus building, formerly an english elementary school where early in his carreer, Scoggan tought Natural Sciences. H.J. Scoggan is the author of "The Flora of Bic and the Gaspé Peninsula, Québec" (*Nat. Mus. Can. Bull.* 115, 1950). The "Laboratoire de paléophytogéographie et de palynologie" has been named after Jacques Rousseau, an eminent ethnobotanist, student then colleague of Frère Marie-Victorin, the author-manager of "Flore laurentienne". Jacques Rousseau was responsible for the artificial key to the plants in this flora, and for most of the ethnobotanic comments that enrich each taxonomic entry of this superb document.

The laboratory holds a collection of 2,329 pollen and spores reference slides covering 1,480 species, a reference collection of various organs (fruits, seeds, leaves, etc.) of 1,493 slides for 970 species of vascular plants, essentially. The library includes *ca.* 5,500 reprints and 500 books. Well over 12,300 titles pertaining mainly to palæopalynology and related topics are computerized in a bibliographical database allowing easy access to literature, thanks to the contribution of Mrs. **Dominique** Richard.

2. BDPMQ / Québec pollen and macrofossil database

Over the years, the lab has accumulated over 200 pollen and macrofossil diagrams from sediments of lakes and bogs from all over Québec. The records are all computerized using Paradox as the database software. The published information is integrated into the Canadian Palæoecological Database (Hélène Jetté, Geological Survey of Canada), as well as into the North American Pollen Database (Eric Grimm) with the National Geophysical Data Center of Boulder, Colorado. Unpublished data may be consulted in the lab, or released for specific projects after mutual agreement. BDPMQ stands for «Base de données polliniques et macrofossiles du Québec». Alayn Larouche is our computer wizard.

3. Recherches en cours / Current research

The overall objectives of the research programme in the laboratory are: 1) to reconstruct the gradients of abiotic conditions in Québec since the last glaciation, hopefully with methods independant of pollen or macrofossil analyses; 2) to identify the nature and kind of the responses of plant populations to these conditions that vary in space and time; and, 3) to identify the regional palaeoclimatic events that are correlative with the more global ones, as revealed by the palaeoclimatic study of the marine sediments in the North Atlantic and from the Greenland ice cores. Emphasis is placed on the reconstruction of the palæohydrological conditions through studies of peatland development and lake-level changes in southern Québec.

Gaspé Peninsula is the principal area we elected for investigating Late-glacial and Early postglacial environmental changes. In Gaspé Peninsula, the diversity of the landscape units found over short distances (summit tundras, plateaus at 1000, 700 and 300 m, enclosed coastal valleys with sea spray) offers ideal conditions for ecological and climatic reconstructions. Besides, the existence of varied palæogeographic (proglacial seas and lakes, ice sheet and glaciers) and physiographic conditions throughout southern Québec allow the study of vegetational and climatic gradients in a periglacial setting during almost 5000 years, and the reconstruction of Holocene climatic changes in both continental and maritime environments.

The laboratory is involved in the international **BIOME 6000** project: "Towards a global palaeovegetation data set", led by Colin Prentice (Plant Ecology, Lund University). It is also contributing to the **North Atlantic Seaboard Programme** (NASP) of the IGCP-253 project (Termination of the Pleistocene), Les Cwynar (Biology, University of New-Brunswick) being the leader for this side of the Atlantic.

Recent research by Nancy Marcoux (M.Sc.) in northern Gaspé Peninsula led to the discovery of a proglacial expression of the **Younger Dryas oscill-**

ation. The oscillation occurs entirely with the initial herb tundra phase of the postglacial vegetational development. Pierre J.H. Richard and Alayn Larouche recently contributed to the palæoecological reconstructions of the **oldest Palæo Indian** site in Québec (8,200 BP), a Plano site near Rimouski in the Lower St. Lawrence region.

Much effort is devoted to the characterization, dating, and understanding of a widespread Early Holocene **reversal in the postglacial afforestation** process in Eastern Québec.

Chercheurs et étudiants gradués / Researchers and graduate students

Alexander **Wolfe** (Ph.D., 1994 at Queen's University; NSERC postdoctoral fellow) has recently joined the lab. His ability as palæolimnologist using mainly diatom analysis is invaluable in adding an independent method in the reconstruction of palæoenvironmental conditions.

Hélène **Jetté** (Ph.D. candidate) is pursuing an independent research project in the Mackenzie River Delta and surrounding areas, using a variety of methods to decipher the postglacial palæoclimatic signal.

Martin **Lavoie** (Ph.D. candidate) is centrally involved in the reconstruction of the palæohydrological conditions through studies of peatland development and lake-level changes in southern Québec. He uses pollen, macrofossil and thecamoebians analyses in these reconstructions.

Autres projets en cours / Other on-going projects

Holocene vegetational reconstructions and fire history in the LG-4 area of the Open Boreal Forest, Central Québec (P.J.H. Richard)

Climatic interpretation of the subalpine postglacial vegetational history in the McGerrigle Mountains, Gaspésie, Québec, with P. Gangloff and F. M'Pindy.

Postglacial vegetational history in the Nunavik Crater area, Arctic Québec, with B. Fréchette, P. Gangloff, A. Larouche and M. Bouchard.

Holocene history of a permafrost outlier in an *Empetrum* heath at Ile Nue de Mingan, Côte Nord du Saint-Laurent, Québec, with J.M. Dubois, B. Landry and A. Larouche.

Pollen fluxes over southern Québec, with L. Durand and P. Comtois.

4. Mémoires récents / Recent M.Sc. theses

Fréchette, Bianca, 1994. Le till pollinifère de la région du cratère du Nouveau-Québec, Ungava, Québec. Mémoire de M.Sc., géologie, Université de Montréal, 209 pp. + 52 pp. d'annexes. Co-direction avec Michel Bouchard.

Lacroix, Jacques, 1993. Étude paléoécologique d'un marécage riverain au lac Saint-François, Québec. Mémoire de M.Sc., géographie, Université de Montréal, 147 pp.

Marcoux, Nancy, 1993. Histoire tardiglaciaire et postglaciaire de la végétation près de Madeleine-Centre en Gaspésie, Québec. Mémoire de M.Sc., géographie, Université de Montréal, 131 pp. + 34 pp. d'annexes.

5. Publications récentes / Recent publications

Gangloff, P., B. Hétu, F. Courchesne et P.J.H. Richard, 1994. Gélistructures d'un pergélisol würmien sur le piémont des Pyrénées atlantiques. *Géographie physique et Quaternaire* 48(2): 169-178.

Marcoux, N., et P.J.H. Richard, 1995. Végétation et fluctuations climatiques postglaciaires sur la côte septentrionale gaspésienne, Québec. *Canadian Journal of Earth Sciences* 32:79-96.

Richard, P.J.H., 1995. Le couvert végétal du Québec-Labrador il y a 6000 ans BP: un essai. *Géographie physique et Quaternaire* 49 (1):117-140.

Richard, P.J.H., 1994. Wisconsinan Late-glacial environmental change in Québec: a regional synthesis. *Journal of Quaternary Science* 9(2): 165-170.

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Richard, P.J.H., 1993. Palynological assessment of organic materials. Chapter 46, pp. 487-497, *In* M.R. Carter, (ed.), *Soil sampling and methods of analysis*, Canadian Society of Soil Science, Lewis Publishers, 823 pp.

Richard, P.J.H., et A.C. Larouche, 1994. Histoire postglaciaire de la végétation et du climat dans la région de Rimouski, Québec. pp. 49-89, *in*: Il y a 8000 ans à Rimouski... Paléoécologie et archéologie d'un site de la culture plano. Chapdelaine, C., édit., *Collection Paléo-Québec,* no 22, Recherches amérindiennes au Québec et ministère des Transports du Québec, 314 pp.

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Hétu B., S. Occhietti, P.J.H. Richard, et A. Larouche, 1995. Dépots de versants pléistocènes associés aux sédiments de Saint-Pierre et aux rythmites du Saint-Maurice, vallée moyenne du Saint-Laurent, Québec. *Géographie physique et Quaternaire* 49 (2), in press.

Lavoie, M., A.C. Larouche, et P.J.H. Richard, 1995. Conditions du développement de la tourbière de Farnham, Québec. *Géographie physique et Quaternaire*, in press.

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PALYNOLOGY AT MEMORIAL

With the retirement of Joyce Macpherson in 1994 palynological research in the Department of Geography, Memorial University of Newfoundland is winding down. This reconnaissance work was begun twenty years ago with the objective of tracing the margin of the retreating Late Wisconsinan ice cap, faltered with recognition of the unreliability of basal bulk-sediment radiocarbon dates, was side-tracked into a search for the not entirely elusive Younger Dryas, came closer to the present with a survey of the mid-Holocene, and has considered the palynological record as evidence for environmental influence on prehistoric occupance and for the influence of European occupance on the environment. The action now is focussed in the Department of Earth Sciences, where Elliott Burden and his students know what they are doing.

Recent publication:

Macpherson, J.B., 1995. A 6 ka BP reconstruction for the island of Newfoundland from a synthesis of Holocene lake-sediment pollen records. *Géographie physique et Quaternaire* 49:163-182.

More publications are planned.

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EPHEMERAL PALYNOLOGY

When I took early retirement in 1993 , the University of Toronto decided that my replacement should be in neo-plant ecology rather than paleoecology, for the sound reasons that two active labs in palynology-palaeoecology exist elsewhere at the university. So when the final graduate student, Chris Rogers, completes her doctoral thesis in aeropalynology at the end of this calendar year, a short two decades of activity in research, using palynology as only one of several tools, terminates on the Scarborough Campus of the University of Toronto.

The emphasis in the laboratory at Scarborough College has been on maintaining a small team of highly selected graduate students, postdoctoral fellows, and visitors, and the scope and quality of the investigations into Canadian problems of Late-Quaternary palaeoecology and aeropalynology are reflected in the festschrift volume that was published as Volume 79 Nos. 1/2 of *Review of Palaeobotany and Palynology* in 1993, presented to me as a total surprise ending at a gathering in Toronto that year.

The other focus in the lab has been research into the Late-Quaternary vegetation and environment of North Africa. Since the early eighties, this has centred on the work of a research team directed by Professor Vance Haynes (University of Arizona) into the Holocene environment of the Eastern Sahara, with fieldwork based in southern Egypt and northern Sudan. Much of the laboratory palynology was done at the Palynology Laboratory of CNRS, Montpellier, France, where I held an adjunct position for many years under the terms of an accord between CNRS and the University of Toronto. The paper in *The Holocene*, Volume 4, pp. 9-15, 1994, might be my final contribution as the political situation in Sudan has prevented further fieldwork there since 1992 - another aspect of ephemeral palynology.

Continued connection with the University of Toronto, and also with the Institute of Earth Studies, University of Wales, Aberystwyth (hence the e-mail address: jcr@aber.ac.uk), enables me to remain semi-retired, and the latest activity has been a commissioned review paper in *New Phytologist* 130, pp. 469-494, 1995.

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"Carol, I can decipher GSC, GSA, AAPG, AASP, CIMP, and CAP in this, but what do you think MSB stands for?"

"They're your initials, Sedley."

If you feel acronymically-challenged, see the CAP WWW page, at URL http://www.ualberta.ca/~abeaudoi/cap/cap.html

Cartoon from *CAP Newsletter* 1(2):4, 1978. Submitted by D.M. Jarzen.

palyno bytes

CAP WWW PAGE

The CAP World Wide Web (WWW) page has now been on-line for almost six months and, from all accounts, seems to be a big hit with users. The site consists of a Home Page which contains an introduction and an index to the other components. Among the items included in the CAP WWW presentation are: a membership form and membership details, a listing of the CAP executive, a directory of palynologists and palaeoecologists, a list of recent palynological publications, a calendar of relevant conferences, and information about laboratory and field equipment. The presentation also includes extensive links to other WWW sites that may be of interest to palynologists (including herbaria, geology departments, libraries, journals on-line, services, statistical resources, societies on-line, and specific project sites), links to sites of interest to archaeologists (including many museums and exhibits), and a listing of Internet discussion lists (by Florin Neumann). A recent addition to the site is "A Dictionary of Quaternary Acronyms and Abbreviations", which now contains over 400 entries, and is designed to help others, like me, that find themselves drowning in a sea of letters. I welcome comments on this presentation and suggestions for additional material.

The CAP WWW page can be accessed using the following URL:

http://www.ualberta.ca/~abeaudoi/cap/cap.html

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Announcements

VEGETATION HISTORY AND ARCHAEOBOTANY, SPRINGER-VERLAG

At the request of Prof. Dr. Karl-Ernst Behre, Editor-in-Chief, Pierre J.H. Richard has agreed to act as associate editor of VHA. The aim is to encourage North American contribution to the journal, whose "scope includes pollen analysis as clue for vegetation history, history of habitation and climate as well as papers dealing with botanical macro-remains. The time span covered is Pleistocene and Holocene. Particularly welcome are review articles."

Because of differing human impact on vegetation, and due to historical development of the use of pollen analysis, methodology for the reconstruction of vegetation is often different on both sides of the North Atlantic. For instance, pollen zonation *vs.* chronology, sediment type *vs.* pollen concentration, pollen accumulation rates, and minor pollen taxa are used differently or to differing extent by most palynologists in Europe and in North America. It would be of great value to see those different approaches published side by side in the same journal. Thus, CAP members and North American palynologists should take the occasion to publish their vegetation reconstructions in VHA.

This will ultimately favour methodological improvements of pollen-based vegetation reconstruction and will enhance mutual understanding of Pleistocene and Holocene evolution of vegetation at the plant, the community, and the landscape levels.

You are invited to submit papers either to the Editor-in-Chief or to the Associate Editor for North America at the addresses given below:

K.-E. Behre
Niedersachsisches Institut
für historiches Kustenforschung
Postfach 944
D-26357 Wilhelmshaven
Germany

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or

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CAP ANNUAL GENERAL MEETING 1995

The 1995 CAP Annual General Meeting will be held in Ottawa, Ontario, during the AASP 28th Annual Meeting. The AGM will be held in the Palladian Room of the Chateau Laurier, on Thursday, October 12, 1995, from 6-9 p.m. The Agenda will be distributed to attendees at the AGM. If you have items you wish to place on the Agenda for discussion, please see Martin Head (CAP Secretary/Treasurer), preferably before the AGM. All CAP members and correspondents are invited to attend. Other interested palynologists and earth scientists are also welcome to attend the CAP Annual General Meeting.

CAP NEWSLETTER DEADLINES

CAP members and other palynologists are warmly invited to submit items for inclusion in the *CAP Newsletter*. Among the items that would be relevant are: conference announcements, abstracts from recently-completed theses, computer-related items, requests for information, conference reports, field-work reports, and lists of recent publications. Longer items, such as accounts of research in progress, book reviews, technical notes, or essays on palynological topics, are also welcome. Humorous items (cartoons, photos etc.) illustrating the lighter side of palynology would be appreciated.

Please submit items for the next *CAP Newsletter* (Volume 18, Number 3, December 1995) by November 15 1995. I prefer to receive material on disk using MS-DOS WordPerfect 5.1 or 6.0; MS-DOS or Macintosh text files or Word files are also fine. Either 5.25" or 3.5" disks (low or high density) are acceptable. Each item should also be submitted as hardcopy. Articles may include diagrams and photos; for photographs, please provide a glossy black-and-white print (3" x 5" or 6" x 4") from a picture with good contrast. Illustrations may be submitted on disk in CorelDraw 4.0 format. Text and illustrations may also be submitted by e-mail.

Please note my new telephone and FAX numbers below. Please send material to:

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CAP MEMBERSHIP FORM

Canadian Association of Palynologists (CAP) membership is open to all members of the palynological community in Canada. The Association is devoted to promoting the exchange of information among palynologists in Canada. Palynologists from outside Canada may become corresponding members for the same dues, with no voting rights. Membership dues include two issues a year of the *CAP Newsletter*, to which all members are invited to contribute. CAP is also affiliated with the International Federation of Palynological Societies (IFPS) and CAP members receive two issues of the IFPS newsletter (*PALYNOS*) each year.

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CAP membership dues are $10 per year in Canadian funds payable at the beginning of the year. Lapsed members are removed from the mailing list after two years. Members may, if they wish, pay for up to three years in advance. Please send a cheque or money order payable to CAP to:

Martin J. Head, CAP Secretary/Treasurer, Department of Geology, Earth Sciences Centre, University of Toronto, 22 Russell Street, Toronto, Ontario, M5S 3B1, Canada.

Name and title:_____

Affiliation:_____

Address:_____

_____

_____

Tel:_____FAX:_____E-mail:_____

Research interests:_____

_____

_____

Indicate: Renewal:_____New membership:_____Amount enclosed:_____

May we include your name/address/research interests in the on-line "Directory of Palynologists" in the CAP World Wide Web page? Yes:_____ No:_____