Canadian Association of Palynologists
Association Canadienne des Palynologues

NEWSLETTER

Volume 43 Number 2 December 2020

President's Message

As 2020 comes to a close, there is considerable hope that life will return to 'normal' or at least something close to it, next year. As I write this message, Health Canada has approved a COVID-19 vaccine and will start immunizing the general population shortly. It is to be seen how quickly academic life will revert to what we were used to prior to the pandemic. At present, many conferences and meetings, both nationally and internationally, have been scheduled to take place virtually in 2021. CAP also opted for a virtual format for its 2020 AGM this past October, about which you can read on p. 3 of this newsletter. Although not a direct replacement for face-to-face meetings, the virtual AGM worked very well, perhaps most importantly enabling the participation of members who may not have planned to attend an in-person meeting.

During the 2020 AGM we filled several important positions for the Association. I would like to extend a warm welcome to Terri Lacourse, our new CAP Councilor to IFPS (International Federation of Palynological Societies), and to Estelle Allan, CAP Newsletter Editor. Francine McCarthy has kindly agreed to be CAP's Secretary-Treasurer. Last but not least, I would like to welcome Florin Pendea as our new President-elect; Florin will step down as Newsletter Editor in the new year. I would like to sincerely thank the executive committee for their continued work for the association, in particular Francine McCarthy (former CAP Councilor to IFPS, now Secretary-Treasurer), Florin Pendea (President-Elect), and Manuel Bringué (Website editor). Your dedication and commitment to CAP is very much appreciated!

As in previous years, CAP will celebrate the achievements of students focusing on palynology with the CAP Student Award. Applications will be accepted from CAP student members of all levels (undergraduate and graduate) until March 1st, 2021. For more information please consult p. 24 of this issue. You can find details of the award and access the profiles of our previous awardees on our website: https://capacp.wordpress.com/student-award/. We also encourage all CAP members to use our website, bi-annual newsletter and twitter account to share content and opportunities across the field of palynology.

We wish you happy holidays!
Bon temps des fêtes à tous!

Sincerely,
Anna Pieńkowski
Norwegian Polar Institute

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Editor's Notes

For over eight years I had the pleasure to work as CAP Newsletter editor, but the time has come to pass on the baton to a new generation of palynologists. I am pleased to welcome Estelle Allan from McGill University, who will take the helm of the newsletter beginning May 2021. Estelle will bring in bright, bold ideas as she will continue the mission to make our newsletter a great "meeting place" for all Canadian palynologists. I am particularly pleased that Estelle will be able to work to increase the francophone content of the newsletter to better reflect the amazing diversity of our palynological community.

Thank you all who have contributed to the newsletter over the years and special thanks to those who have contributed to this edition: E. Allan, M. Bringué, K. Gajewski, T. Lacourse, F. McCarthy, Peta Mudie, V. Pospelova, P. Richard, S. Stolze, A. de Vernal.

Kindest regards,
Florin Pendea
Lakehead University

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Deadline for Next CAP Newsletter

Please submit items for the next issue of the *CAP Newsletter* (Volume 43, Number 1, May 2020) by April 15, 2020. Conference reports, announcements, field trip reports, notices of new books, dissertation abstracts, book reviews, news, and essays on topics relevant to Canadian palynology are all welcome. Please send contributions to:

Estelle Allan
***CAP Newsletter* Editor**
estelle.allan56@gmail.com

Membership Consultation: Location of the CAP AGM in 2021

At our last Annual General Meeting in October 29 (2020), we discussed potential venues for our next AGM. The 2021 CANQUA, AASP, and DINO 12 meetings were some of the options preferred by the members present, but we would like to hear from all members about their preference. Further to this, we discussed the format of the venue given the numerous uncertainties related to the pandemic. A virtual meeting (e.g., Zoom) or a hybrid model are the main options but any other ideas are welcome.

A formal survey will be sent to the membership at the beginning of the year, once we have a better idea of how the pandemic may influence various venues considered. In the meantime, I would love to hear from you regarding these matters at ifpendea@lakeheadu.ca

Florin Pendea
Lakehead University

2020 CAP Annual General Meeting Agenda and Minutes

Zoom Meeting
Thursday, October 29, 2020

AGENDA

1. **Acceptance of agenda**
2. **Reading of the minutes of the 2019 Annual General Meeting, Québec, QC**
3. **Business arising from Minutes**
4. **President's report, Anna Pieńkowski**
5. **Secretary/Treasurer's report, Francine McCarthy**
6. **Auditor's Statement, Sarah Finkelstein**
7. **Newsletter Editor's report, Florin Pendea**
8. **Website Editor's report, Manuel Bringué**
9. **CAP Councillor to IFPS's report, Francine McCarthy**
10. **Appointment of auditor**
11. **Location for 2021 AGM**
12. **Vacant positions, CAP Executive**
13. **International Palynological Congress – response to IFPS**
14. **Priorities and Goals**
15. **Other Business**
16. **Adjournment**

MINUTES

Members present: Florin Pendea (Newsletter Editor), Manuel Bringué (Website Editor), Francine McCarthy (Secretary-Treasurer and Councillor to IFPS), Terri Lacourse, Diana Tirlea, Vera Pospelova, Sandy McLachlan, Cale Gushulak, Zhen Li, Roslin Chen, Anne de Vernal, Peta Mudie, Anna Pieńkowski (President – joined late due to scheduling conflict). Quorum reached.

Meeting called to order by Francine M., 3:30 pm EST

1. Acceptance of agenda
Peta M. moved to accept the agenda, seconded by Manuel B. Motion carried, agenda accepted.

2. Reading of the minutes of the 2019 Annual General Meeting, Québec, QC
Manuel B. read the highlights of the 2019 CAP Annual General Meeting.

3. Business arising from Minutes
No business arose.

4. President's report, Anna Pieńkowski
Florin P. read the President's Report for Anna Pieńkowski in absentia.

5&6. Secretary/Treasurer's report, Francine McCarthy, and Auditor's statement, Sarah Finkelstein
Francine M. read a summary of the Secretary Treasurer's Report and Auditor's Report, thanking Sarah Finkelstein for auditing the CAP accounts.

This was not a normal year for membership, with only 31 members in good standing (38 needed for balanced books). Terri L. inquired about the decline in membership – it was gradual and has been an on-going challenge for years. Francine M. will send out reminders for membership renewal, and every effort should be made from all members to encourage new palynologists to join. See further discussion under item 14.

Sizable donations were made, which helped balance the books and for which Francine – and the whole association – were very grateful.

7. Newsletter Editor's report, Florin Pendea
Florin P. read a summary of the Newsletter Editor's Report

8. Website Editor's report, Manuel Bringué
Manuel B. read a summary of the Website Editor's report.

9. CAP Councillor to IFPS' report, Francine McCarthy
Francine M. read a summary of the report of the CAP Councillor to IFPS.

Peta M. moved to accept all reports from the Executive, seconded by Vera P. Motion carried, all reports accepted.

10. Appointment of auditor
Diana T. kindly offered to audit CAP accounts for the next AGM.

11. Location of 2021 AGM
CANQUA, AASP and DINO12 were suggested as possible venues, with a strong preference for the first two. A hybrid (online) format is to be adopted no matter where the meeting is physically held. Florin P. proposed to ask membership in the Newsletter.

12. Vacancies on Executive – President-Elect, Newsletter Editor, Councillor to IFPS
Florin P. reiterated his willingness to stand for the position of President-Elect (Motion to vote by Anna P., seconded by Vera P.; motion carried). Everyone was in favor, and Florin P. elected to the position of President-Elect, effective immediately.
Anne de V. offered to encourage some of her students to take on the role of apprentice to the Newsletter Editor position.
Terri L. offered to stand for the position of IFPS Councillor (Motion to vote, Manuel B., seconded by Vera P.; motion carried). Everyone is in favor, Terri L. relieved Francine M. and became CAP's new Councillor to IFPS, effective immediately.

13. Discussion of timing and location/ format of next International Palynological Congress (at request of IFPS President Jean Nicolas Haas)
Agreement for virtual IPC 2021; CAP to continue preparing a bid for 2024 or (more likely) 2025 in Toronto, in a hybrid format (Motion to approve, Manuel B., seconded Terri L.; motion carried).

14. Priorities and Goals
Priorities and goals leaned heavily on boosting membership:
Diana T. offered to step in as membership promoter and to take charge of CAP's Twitter account. With the help of others (e.g., Cale G., Roslin C.), she will "beat bushes", send reminder emails to renew membership and contribute to association, urge heads of labs to encourage grad student membership (Motion to approve, Anna P., seconded by Vera P.; motion carried).

Vera P. suggested making renewal emails more personal (make sure to include the member's name), and to add a note suggesting that if money is an issue, CAP can be flexible on membership cost.

Terri L. suggested CAP sponsored sessions at meetings, to promote Canadian palynology and get exposure for CAP. Cale G. suggested promoting CAP on Paleoforum.

Peta M. highlighted that declining membership might be linked to dwindling enrollment in palynology at Canadian universities.

Terri L. suggested to make the application process smoother on the website. Manuel B. will look into creating an online form.
Cale G. suggested looking into PayPal, but e-transfers work well and without any fee.

Vera P. informally challenged every member in attendance to bring someone new at the next AGM.

15. Other Business
Florin P. discussed how hard it is to get enough material for the Newsletter (which everyone agreed was the main benefit of membership – praise was expressed for the

quality of the newsletter and Florin was thanked for his ongoing service as a replacement is sought). Ideally, the new Newsletter Editor would be bilingual.

Anne de V. agreed that an article in honour of Pierre Richard is overdue and will redouble efforts to get his former students and collaborators to write this.

16. Adjournment
Vera P. moved to adjourn the AGM, seconded by Anna P. Meeting adjourned at ~ 5:15 pm EST.

EXECUTIVE REPORTS

President's Report

Dr. Anna Pieńkowski
Nansen Legacy Postdoctoral Fellow
Norwegian Polar Institute Longyearbyen
Anna.Pienkowski@npolar.no

The following consists of a brief report on CAP activities since the last AGM on May 14, 2019 in Québec City, QC.

This year's CAP Student Research Award only attracted three applications, similarly to previous years. Although all three applications were of very high quality, attracting new CAP members and retaining existing members is still a priority for the association. In that regard, the CAP website in tandem with the CAP Twitter account may be valuable tools to achieve a higher level of visibility for the association, as is the option of paying membership for three years at a discounted rate. Another avenue which may increase the visibility of CAP both nationally and internationally is the preparation of a bid to host the 2024 International Palynological Congress (IPC) in Toronto. This bid is being prepared under the leadership of CAP's Councillor to IFPS, Francine McCarthy.

I would like to thank all members of the executive committee for their continued hard work for the organization: Francine McCarthy (CAP Councillor to IFPS & Secretary-Treasurer), Florin Pendea (Newsletter Editor), and Manuel Bringué (Website Editor). I would also like to sincerely thank members of the executive who have recently stepped down: Audrey Limoges (former President) and Jessie Holst Vincent (former Secretary Treasurer).

Respectfully submitted,

Dr. Anna Pieńkowski
CAP President
Oct 27, 2020

Secretary-Treasurer's Report

Dr. Francine McCarthy
Professor, Brock University
fmccarthy@brocku.ca

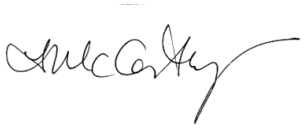
I took over as Secretary-Treasurer this winter, taking the books (and excellent tips and advice) from Jessie Holst Vincent as Ontario went into COVID lock-down in mid-March.

It took a long time to open the CAP account under the circumstances, but the account had been established in Vancouver in 2005 and the manager at BMO in Stoney Creek insisted that the account be transferred, cementing my decision to remain in the position for the foreseeable future, unless another CAP member wants to take over – but since we have several positions to fill, this is probably one that will be left to me. In the interim, things like sending the cheque to the recipient of the CAP Award (congratulations Cale Gushulak!) were delayed, and one of our member's cheques was more than 6 months old when I tried unsuccessfully to cash it, but ??fortunately?? few other transactions were required …. I say '??fortunately??' be-

cause very few dues were received from members. I did, however, go down to the mailroom at Brock (no mail is being delivered to departments, which remain all but shut down) upon receiving notice from Pierre Richard that he had mailed a donation to the association – *merci infiniment pour votre généreux don, Pierre – c'est grâce à celui-ci que le prix APC n'a pas épuisé nos fonds cette année!* Donations exceeded dues revenue this year, with the generous gifts by several members, notably by Pierre Richard and Mike Pisaric. As a result, we realized a net revenue of $711.00 since the last AGM (see summary of transactions attached).

Despite the relatively healthy financial status, the number of members in good standing is only 31, down from 40 at the last AGM. This undoubtedly in part reflects the turmoil of the past year. I will be sending out reminders to CAP members whose membership expired in the past few years (unless we have received word of formal withdrawal) to jog everyone's memory – I am never sure which of my memberships are current, so it is not surprising to have to send out reminders. I have not received a request for transfer of fees to IFPS for 2022, but we will be forwarding these after the meeting, based on 31 members in good standing, following the AGM.

Sincerely,



Francine M.G. McCarthy
October 27, 2020

Summary of Financial Transactions Since Last AGM, as at midnight October 27, 2020

Account Balance May 15, 2019: $6232.70

Revenue:
Membership dues 11* $40 (3-yr): $440.00
Membership dues 5*$15 (1-yr): $75.00
Membership dues $80 (-'catch up thru 2021): $80.00
Donations: $648.00

TOTAL REVENUE: $1243.00

Expenditures:
Corporations Canada Filing (2019 & 2020): ($32.00)
CAP Award: ($500.00)

TOTAL EXPENDITURES: ($532.00)

NET REVENUE: $711.00

Account Balance: $6943.70 (Oct 27,2020)

Website Editor's Report

Dr. Manuel Bringué
Research Scientist,
Geological Survey of Canada—Calgary
manuel.bringue@canada.ca

The association's website has been hosted by WordPress (capacp.wordpress.com) since January 2017, and through it, CAP has maintained a healthy online presence. I am reporting on the period from May 2019 until October 20, 2020, as shown by the red rectangle in Fig. 1.

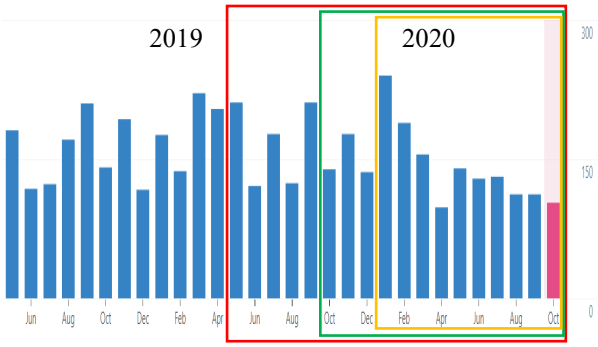


Fig. 1. Total monthly views (all pages combined) from May 2018 to October 20, 2020. Current reporting period indicated with red rectangle; data included in Fig. 2 indicated with green rectangle; and statistics for 2020 cover the period shown by the orange rectangle.

During the reporting period, the website was accessed 2705 times, with an average of ~ 150 monthly views. Monthly views have decreased by almost 10% compared to the previous reporting period, which is possibly an effect of the pandemic (at least in part), since March-October views in 2020 were 30% lower than the same period in 2019. As usual, over the last year (green rectangle in Fig. 1), most viewers accessed the site

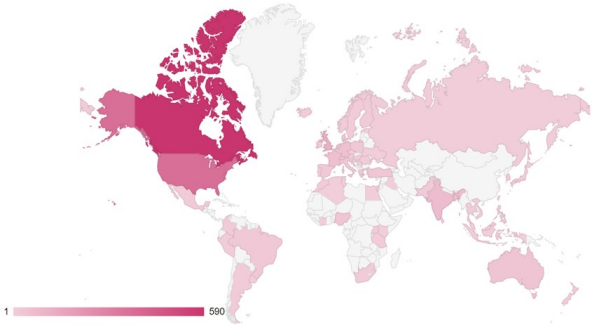


Fig. 2. CAP website views per country over the last 365 days (ending on Oct. 20, 2020). Out of a total of 1731 views, Canada had 590, the US 368, the UK 108, India 69, France had 54 and all other countries identified on the map had less than 49 views.

Interestingly, most downloaded files in 2020 (orange rectangle in Fig. 1) were the *Lycopodium* batch 3862 information (221 downloads), CAP newsletters (multiple issues, up to 184 downloads per file) and opportunities announcements. The latter is also reflected in the number of "clicks", with most links accessed through the website leading to pages advertising opportunities. Overall, the most viewed pages in 2020 so far are the Home page (244 views), Equipment and Laboratory Supplies (231 views), and Opportunities page (103 views). This confirms that CAP serves the palynological community in Canada and beyond, and we should strive to continue providing relevant information on our website.

In this spirit, I invite the membership to contact me for postings, especially to populate the Opportunities page, and for anything else relevant to our palynological community. As always, new pictures of beautiful and/or interesting palynomorphs would help making the website more visually appealing. I am happy to continue serving the association and to help promote Canadian palynology to the world.

Respectfully submitted,
Manuel Bringué
CAP Website Editor
October 20, 2020

Newsletter Editor's Report

Dr. Florin Pendea
Associate Professor, Lakehead University
ifpendea@lakeheadu.ca

Since my last report, three issue of the CAP Newsletter were produced. The May 2019 Newsletter (Vol. 42, No. 1) had 16 pages and was distributed to CAP members on Thursday, June 6th, 2019. Most notably, the May 2019 newsletter included an editorial on the extraordinary efforts of a group of Canadian scientists, led by Francine McCarthy (Brock), who are working to define a new geological epoch – the Anthropocene – at Crawford Lake, under the auspices of the Global Stratotype Section and Point.

The December 2019 Newsletter (Vol. 42, No. 2) had 8 pages and was distributed to CAP members on Thursday, December 26th, 2019. This issue included a series of short announcements regarding upcoming scientific meetings relevant to Canadian palynologists, a call for applications for the CAP Student Award, and a call to fill out the position of CAP Secretary-Treasurer currently open.

The May 2020 Newsletter (Vol. 43, No. 1) had 17 pages and was distributed to the CAP membership on Friday, May 29th, 2020. Among the most notable newsletter items were a featured article on Crawford Lake, titled "Crawford Lake – not anoxic???" by Francine McCarthy (Brock) and a very interesting letter from Vaughn Bryant (Texas A&M) discussing important questions relevant to beekeepers and the spectre of "mad honey". This issue also featured updates on scientific meetings and pandemic-related cancelations as well as short announcements on new dissertations and a call for research collaboration.

I would like to remind our members that our past Newsletters are available in electronic format on the CAP website. Contributions for the next issue of the Newsletter will be accepted until December 10, 2020.

Respectfully submitted,

Florin Pendea
Orillia, October 21, 2020

Report of the Councillor to the *International Federation of Palynological Societies*

Dr. Francine McCarthy
Professor, Brock University
fmccarthy@brocku.ca

I took over as Councillor to the International Federation of Palynological Societies at the Calgary AGM, and in addition to light duties of paying the "head-count" dues to IFPS and passing the link to PALYNOS to our membership, I have spearheaded the potential bid to host the 2024 International Palynological Congress in the Toronto area, at the invitation of long-time CAP member Jean Nicolas Haas, current president of IFPS. I surveyed the membership and traveled to Toronto twice to meet with members of the convention board to prepare a bud to present in Prague– but that was before COVID turned the world of conference travel upside-down. The organizers in Prague postponed the congress from September 2020 to May 2021. They now have to make a decision about the fate of this revised date for the IPC/IOPC since things have not markedly improved. I received a few responses to my blast email in late August, seeking input on this issue, in which the initial email to Jean Nicolas from the Prague Organizing Committee included, but would like input from each member society about the options summarized below:

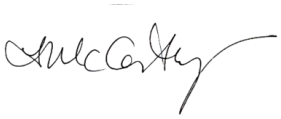
A) **IPC/IOPC held in Prague in May 2021**, even if only a relatively small number of people are able / feel comfortable enough to attend
B) **IPC/IOPC cancelled indefinitely**
C) **IPC/IOPC postponed to 2022 in Prague** (although some issues with availability of venue suited to large numbers; MAX would be 400-500 attendees); also European Paleobotany and Palynology Conference is scheduled in Stockholm in 2022

D) **Virtual IPC/IOPC anytime** (IOPC has already proposed this option); Prague conference agency would face severe financial penalties if the congress cannot be rescheduled
E) **IPC/IOPC held in Prague in 2024** (this would mean that CAP's bid would be potentially postponed to 2028 – although we are not committed to a bid)

To summarize email responses, while virtual meetings are not nearly as satisfying as in-person meetings, they do have the advantage of greater accessibility, since attendees to not face the cost of travel & accommodation – and fees are inevitably lower, in part reflecting the less satisfying experience for attendees. A blended model would probably be the best option, however international (and even national) conference travel is prohibited by government agencies and academic institutions, so the prospects for an in-person congress in May 2021 are not good.

There seems to be support for hosting a congress in Toronto at some point, and I would be willing to continue to lead that bid even though I will have been retired several years by then – a good retirement project! I would like to step down as IFPS councillor, now that I have agreed to take on the more onerous position of Secretary-Treasurer for the foreseeable future, so I am hoping that a CAP member interested in contributing to the association will step forward.

Sincerely,



Francine M.G. McCarthy

CAP Financial Audit

25 October 2020
Re: Auditor's Report, Fall 2020

To the Board and Membership of the Canadian Association of Palynologists,

Thank you for the opportunity to review the financial statements of the Canadian Association of Palynologists (CAP). I received a spreadsheet listing all transactions, as well as a facsimile of the bank statement corroborating the amounts.

CAP is in a good financial position with a healthy balance relative to annual net expenses. Revenues from membership dues totalled $190 (the majority of which were dues payments for 3 years). CAP also received donations from generous members. These revenues exceeded the expenditures this year, which included the CAP award, and a filing charge with Corporations Canada.

IPFS dues are presumably another regular expense but these are manageable given the available balance.

I consider the statements to be a fair statement of CAP's financial affairs, and I consider them to be in good order.

Sincerely yours,

Dr. Sarah A Finkelstein
Associate Professor
University of Toronto
sarah.finkelstein@utoronto.ca

Celebrating our distinguished members

Prix Marie-Victorin/ The Marie-Victorin Award

This year's coveted **Marie-Victorin Award** in the Science category was given to **Anne de Vernal** for her word class contributions to paleoceanography. The award is one of the highest honours bestowed by the Québec Government to distinguished personalities in the world of Arts, Sciences, and Culture.

Anne de Vernal's contributions to paleoceanography and climate change represents extraordinary breakthroughs in the field of palynology.

For over 40 years, Anne and her team have roamed the vast oceanic expanses of the Arctic and Atlantic Oceans collecting sediments for complex paleoecological and geochemical analyses. These analyses allowed her to reconstruct in great detail sea-surface parameters and other oceanic processes during the late Quaternary period.

Please join me in congratulating Anne for this great honour!

Doctor Honoris Causa l'Université du Québec en Abitibi-Témiscamingue

Few scientists have had a bigger impact on Canadian palynology than **Pierre J. H. Richard.** His seminal work on Postglacial evolution of the vegetation in Eastern Canada has influenced the way we understand North American Holocene climates and landscapes.

Pierre Richard's landmark work was recognized early on through his induction into The Royal Society of Canada in 1993. Yet, his impressive contributions continued to influence Canadian paleoecology for decades and shaped the careers of generations of palynologists.

The latest honour awarded to *Professeur* Richard for his extraordinary achievements in the field of Holocene vegetation history of northern Canada was the ***doctor honoris causa*** title conferred by the **University of Quebec at Abitibi-Témiscamingue.**

Please join me in congratulating Pierre for this great honour!

Dissertations

Thèse de doctorat/Doctoral thesis:

Joindre le passé et le présent par les études paléoécologiques dans un contexte d'aménagement écosystémique de la forêt boréale du Québec.
«Joining the past to the present through palaeoecological studies in an ecosystem-based management context of Québec boreal forest».

Hennebelle Andy
Département de géographie, Faculté des Arts et des Sciences, Université de Montréal.

Le jury était composé des personnes suivantes: Olivier Blarquez (directeur), Pierre Grondin (codirecteur), Jeannine-Marie St-Jacques (membre du jury), Kendrick Brown (examinateur externe), sous la présidence de Julie Talbot et en présence de Jacques Brisson (représentant les Études supérieures et postdoctorales de l'Université de Montréal).

Résumé

L'objectif de ce doctorat est de réconcilier les échelles, temporelle et spatiale, dans les études paléoécologiques et écologiques récentes avec pour territoire d'étude les écosystèmes forestiers boréaux du sous domaine de la pessière à mousses de l'Ouest du Québec (PMO). Dans un premier temps une étude de la diversité écosystémique actuellement présente et de son histoire plurimillénaire permet d'appuyer la mise en place de cibles d'aménagement écosystémique à plus petite échelle. Les reconstructions holocènes de la végétation et des feux utilisées dans un premier chapitre ont mis en évidence des difficultés dans l'analyse conjointe de plusieurs bio-indicateurs. Ces difficultés sont principalement liées au manque de connaissances du rôle des processus taphonomiques dans les enregistrements de bio-indicateurs retrouvés dans les archives sédimentaires. Les deux autres chapitres de ce doctorat ont permis de mieux comprendre ces liens qui existent entre les écosystèmes et certains des bio-indicateurs qu'ils génèrent. Il a ainsi été possible de développer des outils méthodologiques pour faciliter l'interprétation des bio-indicateurs. À terme, ces outils permettront de mieux comprendre les dynamiques à long-terme des écosystèmes forestiers boréaux de la PMO.

Abstract

The objective of this thesis is to reconcile the two scales, temporal scale and spatial scale, in paleoecological studies and contemporary ecological studies with the Quebec western spruce-feathermoss subdomain (SMW) as study area. First, the current ecosystem diversity and its pluri-millennial history have been studied and support the establishment of low scale ecosystemic management targets. The Holocene reconstructions of vegetation and fire from the first chapter highlighted the challenges of multi-proxy analyses. These difficulties are mostly due to the lack of knowledge concerning the influence of taphonomic processes in the recording of bio-proxies in a sedimentary archive. The two other chapters composing this thesis helped to understand the links existing between the ecosystems and the bio-proxy signals they generate in order to develop methodological tools to facilitate their interpretation. Overall, these tools will allow us to better understand long-term dynamics of boreal forest ecosystems in the SMW.

Featured Article:

Commentary and Viewpoint on Neglected Arctic NPP

Peta Mudie
NRCan
Geological Survey Canada Atlantic

The Arctic Ocean is one of the fastest changing regions in the world and the climate is warming two to three times faster than the rest of the Earth. Time-lapse NASA satellite imagery captures well the magnitude of the changes in time and space from 1981 to 2020: you can check this out online at https://svs.gsfc.nasa.gov/4860. Oceanographers show that the Arctic Ocean ecosystems may soon reach a tipping point for which we have no ability to forecast the directions of further change using historical records that cover only the past 30 years. Thus, projections for the future need be made from paleoclimate records of times warmer than now, as explained by de Vernal et al. (2020). These projections usually rely heavily on use of dinoflagellate cysts (dinocysts) in sediment cores as phytoplanktonic proxies for reconstruction of paleo-sea ice extent. Palynological data from new cores in eastern Arctic Ocean areas of thick multi-year pack ice or ridged first-year ice therefore have led to a proposed new paleo-sea ice model (Fig. 4 of de Vernal et al., 2020). This model portrays areas of multi-year sea ice as lacking in phytoplankton proxies, with calcareous microfossils being the only source of paleoenvironmental information.

This new model for perennial sea ice proxies reminded me of some overlooked palynological data collected from the Canadian Ice Island located between 81° to 82° N, and 94° to 100° W during 1985 to 1989. The Ice Island expedition was one of the most extraordinary Arctic endeavours in Canadian history. The unconventional arctic study used a 44 m-thick chunk of floating shelf ice broken off from the Ward Hunt Ice Shelf, Ellesmere Island, as a platform for a science camp (Mudie and Jackson, 2014). A team of geologists and oceanographers built a laboratory on the island to map, photograph and sample the sea floor below the 7 m-thick permanent pack-ice offshore of the Canadian Polar Margin north of Ellesmere, Axel Heiberg and Meighan Islands, in one of the coldest parts of the Arctic Ocean. The geology team also collaborated with oceanographers from Bedford Institute of Oceanography to suspend sediment traps and make plankton tows below the pack-ice, by lowering the nets down a meter-wide hole painstakingly melted through the ice island over a period of two weeks (Fig. 2 Left). This unique study provided the first knowledge of the seabed on the coldest part of the Canadian Polar Margin northwest of Ellesmere Island. The expedition was a 20th century pioneer exploration, describing uncharted territory never before seen by scientists because the permanent ice made it inaccessible by ships, and was not traversed by the Inuit who have never lived on Axel Heiberg and Meighen islands.

Remarkably, the past two years of a 3°C Arctic warming have led to large areas of open water over the Axel Heiberg Shelf, as shown in Fig. 1 (compare with Fig. 2 Right). Therefore, it seems timely to provide more details of the 1980's Ice Island palynology before the polar shelf environment

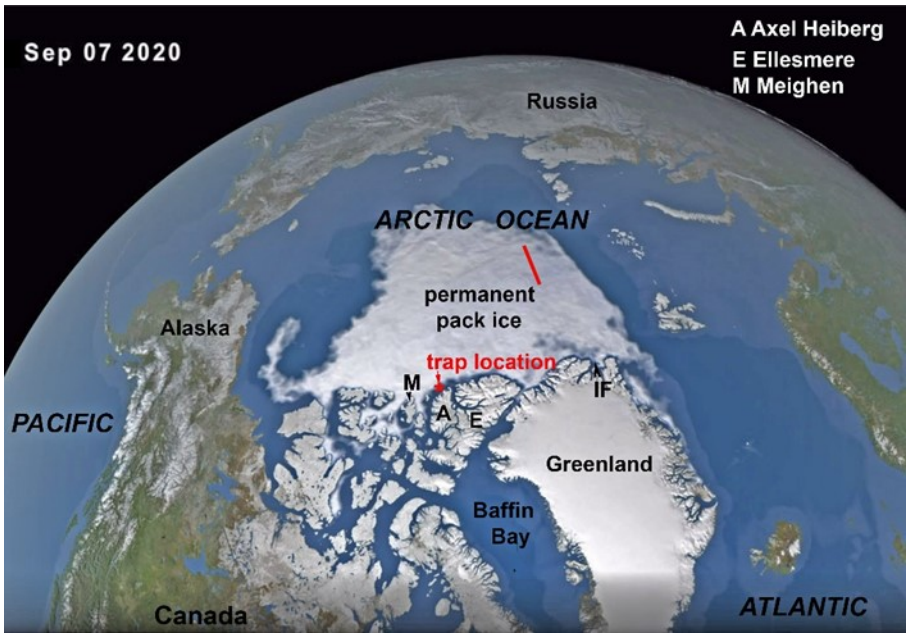


Fig. 1. NASA image of sea ice in the Canadian Arctic, late summer 2020, showing the Canadian Ice Island trap location in 1986 and de Vernal's core transect (red line). At that time and until 2018, there was only solid pack ice from Independence Fiord (IF) in Greenland to Meighen Island (M). This year, however, there was a 50 km wide area of open water from Ellesmere to Meighen Island.

Fig. 2. Left - The Ice Island sampling hydrohole, with palynology lab-tech Jean Dabros cleaning mud left by the piston core barrel so that the plankton net sampling can start. Right – view of the Ice Island from the corehut in early summer; pink and red-orange mark abundant red snow-algae; the insert is a SEM image of a Chlamydomonas nivalis cell.

changes irreversibly to a summer open-water condition.

The first Ice Island palynological data, collected in 1985, focused on the pollen (P) and terrestrial plant spores (S) in the seabed surface layer, comprising a sparse, low-diversity assemblage with *Alnus viridis, Ambrosia, Betula nana*-type*, Picea marina* (all 5%), Poaceae and *Pinus strobus*-type (both 14%), sporadic Ericales and *Salix*, and a dominance of *Polytrichum*-type moss spores (52% of total P+S). The Pollen+Spore concentrations ranged from 107 to 550/g sediment dry weight. No surprises there – the Polar Shelf pollen flora is consistent with the tundra vegetation on the adjacent islands, together with wind transported bisaccate grains, as previously recorded for the Meighen Icecap by Jocelyn Bourgeois et al. (2001). The big surprise was finding Maidenhair Tree (*Ginkgo biloba*) pollen in the Ice Island snow, suggesting an origin in dust blown from the relict forests in southwestern China, as also found for soot on Hudson Bay sea ice by "Buster" Welch et al. in 1991.

Contrary to the new model that characterizes permanent pack ice environments by absence of dinocysts and other phytoplankton proxies, the surface sediment data from the Ice Island show that several dinocyst taxa were widespread beneath the pack ice in the 1980's, together with low diversity of other non-pollen palynomorphs (NPP). In this area, sedimentation rate is estimated as ca. 1–3 cm ka^{-1}. Dinocyst abundances were low (27 to 225/g) but the various small archeomonads and chrysophytic acritarchs comprised an additional 41 – 106 resting spores/g of planktonic or ice algae. Dinocysts in the surface samples are mostly well-known marine heterotrophic taxa: *Brigantedinium* spp. (31%), *Brigantedinium simplex* (12%)*, Islandiella minuta* (8%), *Echinidinium* sp. and other spiny round brown cysts (10%), with fewer autotrophs: *Operculodinium centrocarpum*, *Spiniferites elongatus* Beaufort/*frigidus* morphotype (4% each), rare *Biecheleria* sp. and *Impagidinium pallidum* (2% each). In addition, numerous discoidal cysts of the enigmatic cladopyxiinean taxon *Peridiniella catenata* (30%) were present, and this was the most abundant thecate dinoflagellate recorded plankton tows in May 1986. In contrast, rare *P. catenata* cells were found in the sediment trap moored below the Ice Island from 1986-87, pointing to a possible avoidance strategy associated with narrow-opening sediment trap cups (Hargrave et al., 1989).

The arctic dinoflagellate *P. catenata* appears to be uniquely adapted to polar ice environments in multiple innovative ways. For example, the thecate stage of *P. catenata* (Fig. 3 top) forms colonial chains of 2 to 12 cells that are interconnected at their anterior sulcal and apical plates; here the cells are anchored by posterior horns and joined by cytoplasm strands that are shared by the entire catenate organism. Each thecate cell in the interconnected chain is propelled by two flagellae. It is likely that the enhanced motility provided by chain formation is advantageous in the oligotrophic Arctic Ocean waters where nitrogen is rapidly removed from the surface by diatoms. Motility and directionality towards light may be further aided by the unique peripheral location of chloroplasts in *P. catenata* (Hansen and Moestrup, 1998). The light sensitive chloroplasts that also emit luminescence provide another advantage in the dimly lighted sub-pack ice environment, particularly during the High Arctic spring season when low-incident sunrays provide weak sunlight. Another unique characteristic of *P. catenata* is the presence of two sizes of trichocysts (large vs. small). The trichocysts show that *P. catenata* is mixotrophic, not dependent on photosynthesis; two sizes of trichocysts could also double the chance of capturing prey in oligotrophic waters.

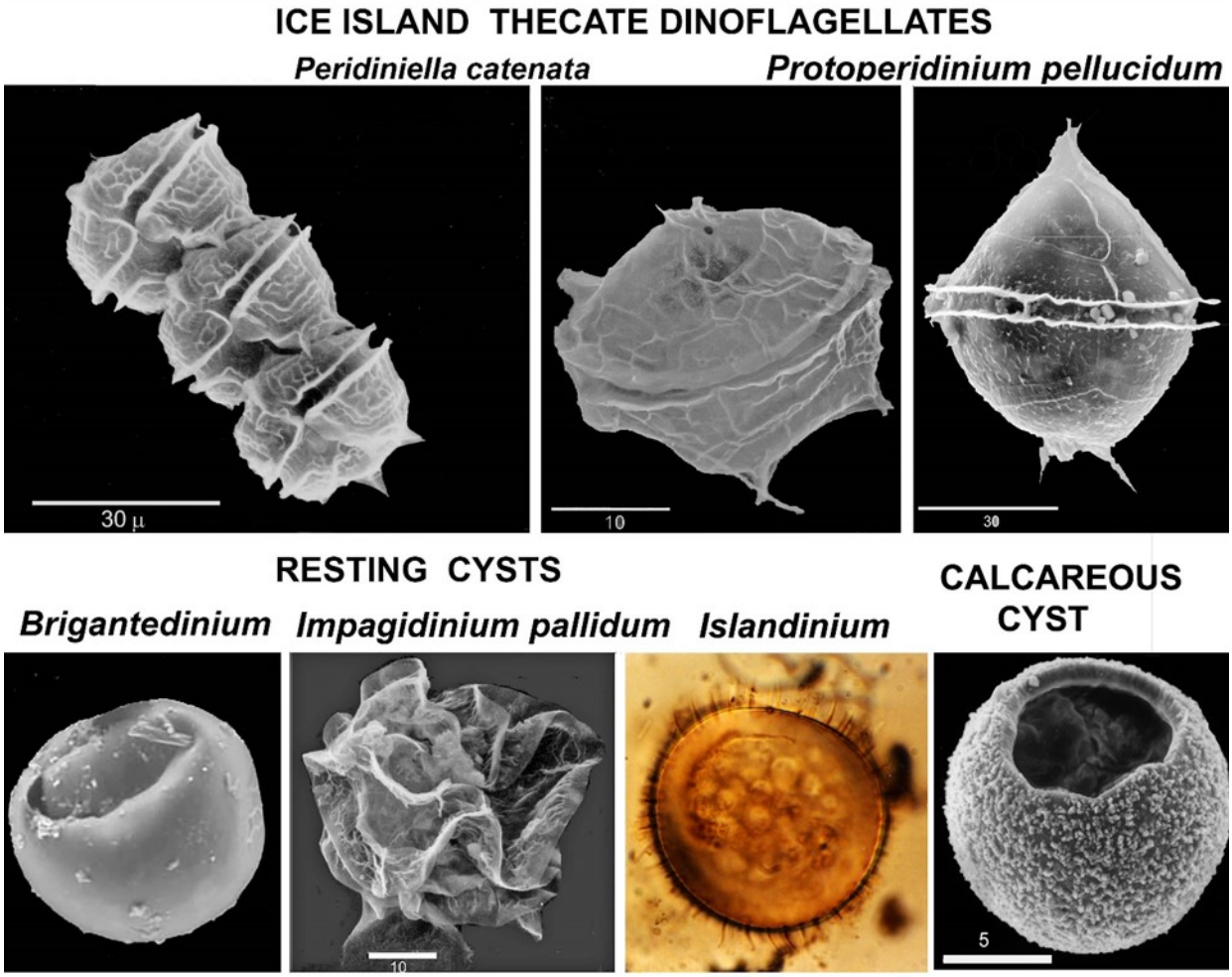


Fig. 3. Ice Island dinoflagellates: SEM images and a light microscope image of Islandinium minutum. Top row – SEM images of thecate stages from plankton tows. Bottom row shows three species of organic-walled cysts and a calcareous cyst (Thoracosphaera heimii) from surface sediments.

The other well-known sea-ice dinocysts *Biecheleria* and *Polarella glacialis* (Suessiaceae) in the Ice Island samples are also characterized by peripherally located chloroplasts and have a complex Type E eyespot comprising rows of brick-shaped blocks of material within cisternae (Moestrup et al., 2009). Stephens et al. (2020) find that the genome of *Polarella glacialis* includes transcripts that mostly encode functions critical for adaptation to cold and to low-light conditions. They conclude that "The independently evolved ice-binding domains and the lineage-specific dark genes in *P. glacialis* highlight functional innovation in dinoflagellate genomes relevant to environmental adaptation and niche specialization as successful psychrophiles in the extreme cold [polar] environment".

Less-well known dinocysts found under the Ice Island pack ice are the bizarre taxa *Actinocystis* cf, *A. pentasterias* (Fig. 4) and *Thoracasphaera* cf. *T. heimii* (Fig. 3). The genus *Actinocystis* has an internal siliceous skeleton and it displays mixed features of Dinoflagellata and Radiolaria, and some affinities with Silicoflagellata that form an internal skeleton (Bursa, 1969). The Ice Island sediment traps record the sub-ice co-occurrence of two of these phytoplanktonic phyla together with silicious spines of *Chaetoceros decipiens* diatoms (Fig. 4). *Actino-*

cystis cf. *A. pentasterias var. artica* is mixotrophic, containing green-brown dense protoplast while also feeding on *Cryptomonas*, *Glenodinium* and some chrysophytes, all of which were found in Ice Island samples (illustrated in Mudie et al., in press). It is not clear that *Actinocystis pentasterias* var. *arctica* produces resting cysts, but the characteristic pentaster skeletons (27 to 97/g) were recovered with sponge spicules and the sterrasters of the arctic demisponge *Geodia* cf. *G. phlegraei* that forms reefs on the Canadian Polar Margin (Mudie and Jackson, 2014).

Thoracasphaera cf. *T. heimii* (Fig. 3) is a calcareous dinoflagellate that appears to be the coccoid vegetative stage of a dinoflagellate with a spongy calcareous wall (Fig. 3). Tangen et al. (1982) report that in *T. heimii*, the calcitic wall grows on the outside of the organic wall of planozygotes released from a spherical, archeopyle-like aperture lacking discernable plate boundaries (Tangen et al, 1982). It is presently unclear that *T. heimii* produces a resting cyst or that the organic lining of the vegetative cell survives palynological processing.

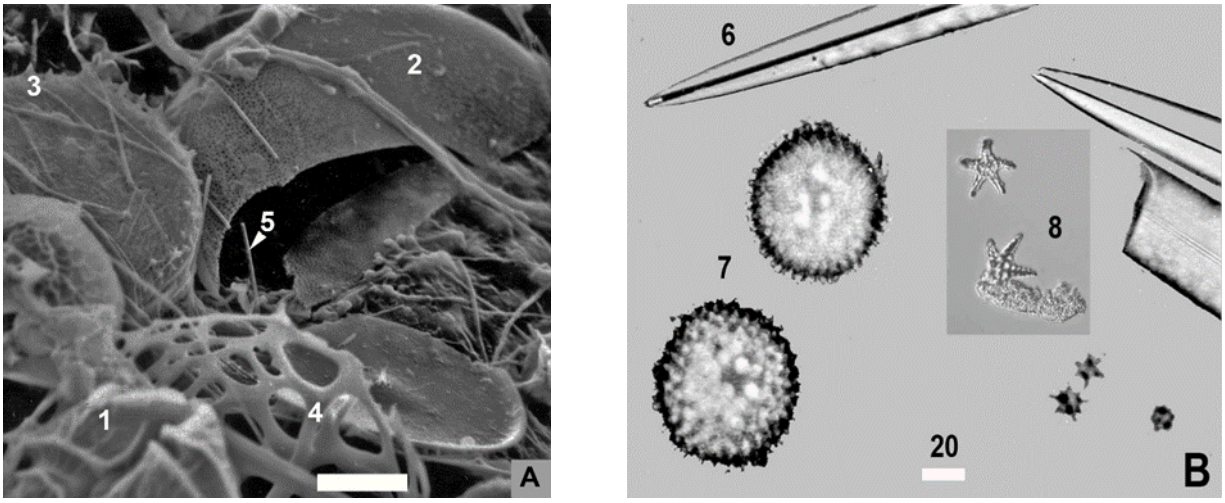


Fig. 4. A: suspended sediment from Ice Island trap, showing a mixture of thecate cells (1) and cysts (2) of Peridiniella catenata, Biecheleria (3), a silicoflagellate (4) and abundant fragments of Chaetoceros diatom spines (5). Scale bar = 10 µm. B: siliceous spicules in surface sediment below permanent pack ice: Geodia sponge spicules (6) and sterrasters (7), Actiniscus cf. A. pentaster "skeltons" (8); scale bar = 20 µm.

Other phytoplanktonic NPP commonly found in the surface sediments under the pack ice on the Canadian Polar Margin are *Halodinium minor* and *Halodinium major.* These taxa were previously thought to be thecamoebians but molecular evidence (from single specimen SSU and LSU rDNA sequencing) shows that *Halodinium verrucatum* is the resting stage of a prorodontid ciliate (Gurdebeke et al., 2018). It is therefore likely that the arctic taxa are also ciliates. Remarkably, although copepods were abundant in the Ice Island trap samples (Hargrave et al., 1989), the absence of their organic-walled resting stages in the Polar Margin sediments is a notable and a distinguishing characteristic of palynological assemblages beneath permanent pack ice. In contrast the organic-walled linings of benthic microforaminifera (130 to 1189/g) are very common in the seabed samples, as predicted by the de Vernal pack ice model. The counts of 2,301 – 14,183 benthic specimens/g (Shröder-Adams et al., 1990) in seabed sediments below the Ice Island are one to two orders of magnitude larger than the microforaminiferal lining counts and no linings of the planktonic taxa are preserved.

In conclusion, the new de Vernal model for multiyear and ridged paleo-sea ice may be valid for the deep-water areas over the

Lomonosov Ridge from 80° W to 140°E, and it is indeed true that numbers of benthic foraminifera far exceed the NPP abundances under the pack ice of the Canadian Polar margin. However, the Ice Island NPP data collected in the 1980's clearly establish that this model may not apply to more shelfal settings (ca. 80–200 m) where it is incorrect to forecast an absence of organic-walled palynomorphs, even in the coldest areas with the heaviest cover multiyear pack ice. The Ice Island data also point to the strong need for more morphological and biomolecular studies of other pack-ice dinoflagellates, small chrysophytes and archeomonads — these nano- and pico-plankton are major contributors to the Arctic Ocean carbon budget and are increasingly becoming the focus of phytoplankton research. The unique morphological adaptations of these single-cell micro-organisms combined with genetic studies are a fruitful area of study that may further elucidate how dinocysts and other ciliates are adapted to the most extreme arctic environments.

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Message to marine palynologists

In late Quaternary and recent marine sediments, we often observe weird and/or unknown palynomorphs. In the forthcoming months, I plan to collect information and to prepare an illustrated inventory of these microfossils, with special attention paid to recent sediments from the subarctic North Atlantic, including the epicontinental seas and coastal settings. If you are interested in participating in the exercise, you are very welcome to send material (residue or sample) containing such palynomorphs, together with the information on the location (latitude, longitude, water depth), age and sedimentary context.

You can email the information at devernal.anne@uqam.ca and send the material to :

Anne de Vernal
Geotop-UQAM, PO Box 8888,
Montréal, Qc H3C 3P8 Canada

Let me know if you have further questions.
Best wishes,
Anne

Message pour les palynologues marins

Dans les sédiments marins récents et quaternaires, nous observons souvent des palynomorphes bizarres ou inconnus. Dans les mois à venir, je prévois colliger des informations et préparer un inventaire illustré de ces microfossiles, en accordant une attention particulière aux sédiments récents de l'Atlantique Nord subarctique, y compris les mers épicontinentales et les zones côtières. Si vous souhaitez participer à l'exercice, n'hésitez pas à envoyer du matériel (résidu ou échantillon) contenant de tels palynomorphes, ainsi que des informations sur l'emplacement (latitude, longitude, profondeur de l'eau), l'âge et le contexte sédimentaire.

Vous pouvez envoyer les informations par courriel à devernal.anne@uqam.ca et envoyer le matériel à:

Anne de Vernal
Geotop-UQAM, PO Box 8888,
Montréal, Qc H3C 3P8 Canada

N'hésitez pas à me contacter si vous avez des questions.

Avec mes meilleurs vœux,
Anne

A great loss

The unexpected news of Eric Grimm's death recently made me think not only of his tremendous and lasting contributions to palynology – including the plotting program TILIA and the constrained cluster technique CONISS, and as one of the co-founders of the Neotoma Paleoecology Database – but also of the amazing contribution made by the Limnologic Research Centre at the University of Minnesota. Many palynologists were trained there since Herb Wright received funding from the Hill Foundation in 1959, including Ed Cushing (who was Eric Grimm's PhD supervisor) and Jock McAndrews (my MSc supervisor). I scheduled a zoom meeting with Jock (facilitated by his supportive wife Sharon) to discuss his memories of Eric Grimm, whose career somewhat shadowed Jock's, from dissertation research on the prairie-forest boundary and the ragweed problem in the Great Plains, to subsequent careers as Curators of Botany at their respective museums. Our conversation turned more broadly to palynological research that germinated at the University of Minnesota.

According to Jock, Herb Wright wanted to establish a facility in the 'Land of Lakes' that would allow him to conduct the type of paleolimnological research undertaken in several European countries, many of whom visited the LRC for extended collaborations (e.g., Bill Watts from Ireland, Magnus Fries from Sweden, Richard West and John and Hilary Birks from the UK). The Hill Foundation provided funds for the pollen laboratory and eventually for the LRC, that allowed a very special building to be constructed to house the facility – 7 stories beneath the ground. Many postdocs, including Ed Cushing and long-time CAP member Brian Cumming, spent time at LRC and subsequently passed on insights to generations of students.

Today, the LRC hosts LacCore, the National Lacustrine Core Facility, maintains close ties with the Large Lakes Observatory in Duluth and with the Institute for Rock Magnetism, the Minnesota Geological Survey, as well as the Departments of Ecology, Evolution, and Behavior and Geography in addition to the Newton Horace Winchell School of Earth and Environmental Sciences, where former CAP President Vera Pospelova and former CAP Award winner Kristin Michels currently work.

Francine McCarthy
Brock University
with contributions from **Jock McAndrews**
and **Sharon Hick**

Palynfo

This is to announce that I am currently recruiting graduate students for fall 2021. Multiple MSc and PhD positions are available in my Paleoenvironmental Laboratory at the Department of Earth and Environmental Sciences, the University of Minnesota. The research projects involve applications of marine palynology and geochemistry for environmental and paleoclimatic reconstructions. The Graduate Record Examination (GRE) is not required!!!

Interested students should contact Dr. Vera Pospelova by e-mail (https://www.esci.umn.edu/people/Vera-Pospelova).

Developments in palynological methodologies

A comparison of Holocene testate amoeba assemblages and paleohydrological records from pollen slides and wet-sieved peat

By Gabriel Magnan[1], Terri Lacourse[2] & Michelle Garneau[1]

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[2]Department of Biology and Centre for Forest Biology, University of Victoria, Victoria, British Columbia, Canada

Testate amoebae (unicellular protists) are commonly encountered on pollen slides prepared from peat samples and have often been used as additional indicators for past local hydrological conditions in peatlands. It is known that the palynological treatments (e.g. acetolysis and KOH) can damage and destroy testate amoeba shells and affect the composition of assemblages in peat samples. Consequently, most palynological studies have interpreted the remains of testate amoebae as indicator taxa for wet and dry surface conditions rather than as proxies for quantitative water table depth (WTD) reconstruction.

In this study, we compared new testate amoeba records produced by the conventional wet-sieving method to testate amoeba data from previous palynological studies on the same two Holocene peat profiles from British Columbia. We used 132 paired samples to compare the composition of testate amoeba assemblages between the two methods and explore the potential of palynological testate amoeba records as quantitative paleohydrological proxies in peatlands.

Our results suggest that the palynological treatments (acetolysis, 10% KOH and 150

Progrès dans les méthodes palynologiques

Comparaison des assemblages de thécamoebiens et des reconstitutions paléohydrologiques obtenus par les préparations polliniques et le tamisage humide sur deux profils de tourbe holocène

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Les thécamoebiens (protistes unicellulaires) sont couramment observés sur les lames polliniques préparées à partir d'échantillons de tourbe et ont souvent été utilisés comme indicateurs supplémentaires des conditions hydrologiques locales passées dans les tourbières. On sait que les traitements palynologiques (e.g. acétolyse et KOH) peuvent endommager et détruire les thèques et affecter la composition des assemblages de thécamoebiens dans les échantillons de tourbe. Ainsi, la plupart des études palynologiques ont interprété les restes de thécamoebiens comme taxons indicateurs de conditions de surface humides et sèches plutôt que comme indicateurs pour reconstituer quantitativement la profondeur de la nappe phréatique (PNP).

Dans cette étude, nous avons comparé de nouvelles séquences de thécamoebiens produits par la méthode conventionnelle de tamisage humide à des données de thécamoebiens provenant d'études palynologiques antérieures sur les deux mêmes profils de tourbe holocènes de la Colombie-Britannique. Nous avons utilisé 132 paires d'échantillons pour comparer la composition des assemblages de thécamoebiens entre les deux méthodes et évaluer si les assemblages

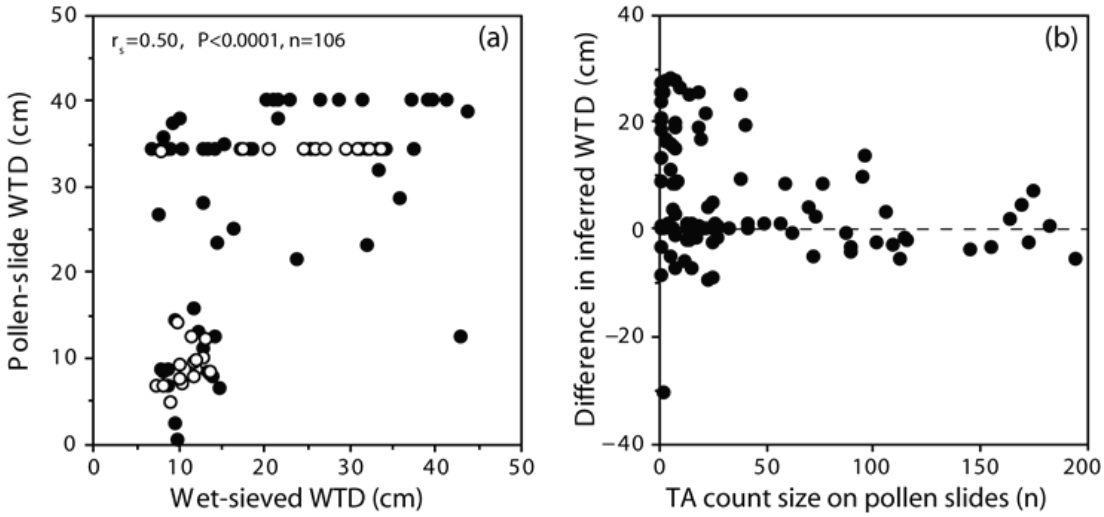

Figure 1. Comparison of water table depths (WTD) inferred from testate amoeba (TA) assemblages from the two methods with a transfer function. Open circles show WTD estimates based on counts >50 tests in both methods.

Comparaison des profondeurs de nappe phréatique (WTD) déduites des assemblages de thécamoebiens (TA) des deux méthodes avec une fonction de transfert. Les cercles blancs montrent les estimations de PNP basées sur des dénombrements de plus de 50 thèques pour les deux méthodes.

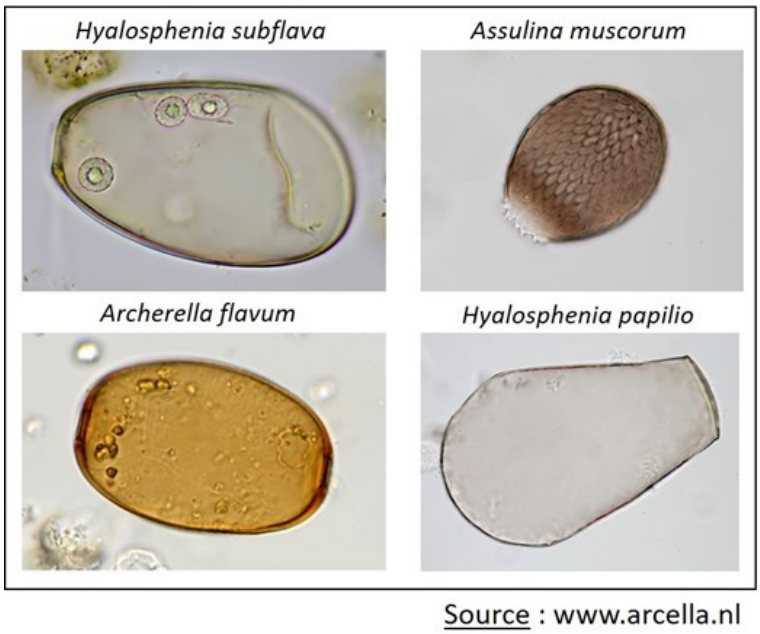

Figure 2. Photomicrographs of testate amoebae that can be preserved in pollen preparations as their tests are more resistant to chemical treatment. The xerophilous taxa *Hyalosphenia subflava* and *Assulina muscorum* and the hydrophilous taxa *Archerella flavum* and *Hyalosphenia papilio*.

Microphotographies de thécamoebiens pouvant être préservés dans les préparations polliniques car leurs thèques est plus résistante au traitement chimique. Les taxons xérophiles Hyalosphenia subflava et Assulina muscorum et les taxons hydrophiles Archerella flavum et Hyalosphenia papilio

μm sieving) substantially reduce test concentrations, diversity and richness in most pollen-slide samples. However, we were surprised by similarities in inferred WTD values between the two methods (Figure 1a). The major wet to dry shifts, as shown by the WTD reconstructions using wet-sieved samples, were relatively well captured by the palynological datasets in most instances. As is typical of this method, the number of tests counted on pollen slides was often too low to provide representative assemblages that can produce reliable paleohydrological reconstructions using a transfer function. However, the palynological assemblages with counts of >50 tests (n=30) provided WTD estimates similar to those inferred from the wet-sieved samples (Figure 1b) as the most dominant hydrophilous (e.g. *Archerella flavum*) and xerophilous (e.g. *Hyalosphenia subflava*) taxa were relatively well represented in the pollen-slide samples in the two studied peat cores (Figure 2).

This study shows that testate amoebae from pollen slides provide useful paleohydrological information particularly when combined with other paleoenvironmental proxies. Nonetheless, given that testate amoeba concentrations, diversity and richness are typically much lower on pollen slides, it is recommended that analyses be conducted using the wet-sieving method if the goal is to generate quantitative paleohydrological reconstructions using transfer functions.

Full citation

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de thécamoebiens des lames polliniques peuvent être utilisés comme indicateurs paléohydrologiques quantitatifs dans les tourbières.

Nos résultats suggèrent que les traitements palynologiques (acétolyse, 10% KOH et tamisage à 150 μm) réduisent considérablement les concentrations, la diversité et la richesse des thèques dans la plupart des échantillons polliniques. Cependant, nous avons été surpris par les similitudes dans les valeurs de PNP reconstituées entre les deux méthodes (Figure 1a). Les principales transitions des conditions humides à sèches, montrées par les reconstitutions de PNP basées sur les échantillons tamisés par voie humide, ont été relativement bien captées par les données palynologiques dans la plupart des cas. Comme c'est typique de cette méthode, le nombre de thèques comptées sur les lames polliniques était souvent trop faible pour fournir des assemblages représentatifs pouvant produire des reconstitutions paléohydrologiques fiables en utilisant une fonction de transfert. Cependant, les assemblages palynologiques avec des dénombrements supérieurs à 50 thèques (n=30) ont fourni des estimations de PNP similaires à celles déduites des échantillons tamisés par voie humide (Figure 1b) car les taxons hydrophiles (e.g. *Archerella flavum*) et xérophiles (e.g. *Hyalosphenia subflava*) les plus dominants étaient relativement bien représentés dans les échantillons polliniques dans les deux carottes de tourbe étudiées (Figure 2).

Cette étude montre que les thécamoebiens des lames polliniques fournissent des informations paléohydrologiques utiles, particulièrement lorsqu'elles sont combinées avec d'autres indicateurs paléoenvironnementaux. Néanmoins, comme les concentrations, la diversité et la richesse des thécamoebiens sont généralement beaucoup plus faibles sur lame pollinique, il est recommandé que les analyses soient effectuées en utilisant la méthode de tamisage humide si l'objectif est de générer des reconstitutions paléohydrologiques quantitatives à l'aide de fonctions de transfert.

Recent Publications

* denotes a CAP member

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A special issue of Marine Micropaleontology (vol. 159) featuring 11 articles on modern and fossil dinoflagellate cysts:

Taxonomy and distribution of modern organic-walled dinoflagellate cysts in surface sediments from the Northern Hemisphere: an update of Rochon et al., 1999

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CAP Student Award

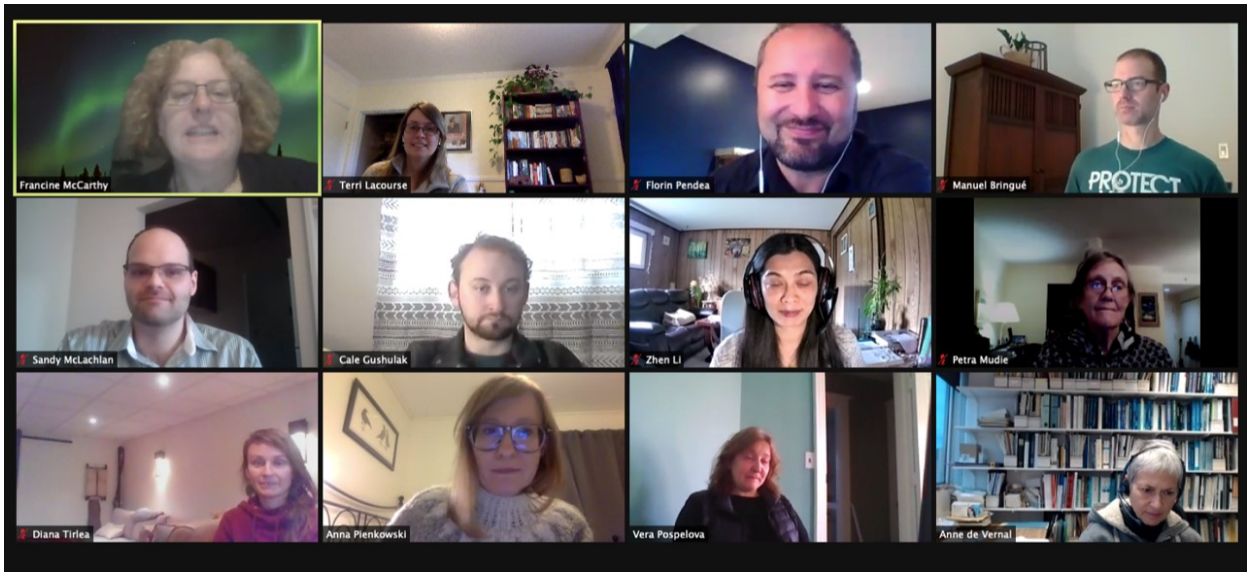
The CAP student research award recognizes student contributions to palynological research. The award consists of a three-year membership to the Association and between $200 and $500 CAD to be used to finance anything related to the student's research (ex. analyses, participation to conference, fieldwork, etc.). We encourage all undergraduate and graduate students to apply. Applicants must be members of the association.

Application deadline and details: the deadline for the application is March 1st, 2021. The application consists of: 1) a one-page statement outlining the nature of the research project, its scientific importance, the approximate timeline for completion of the project, and the research aspects toward which the funds would be directed; (2) a CV; and, (3) a letter of support from the student's supervisor.

More information can be found on the CAP website: https://capacp.wordpress.com/student-award/

Applications should be sent to Anna Anna Pieńkowski (CAP President) at Anna.Pienkowski@npolar.no

Coming together as a community



Even in the most difficult of times we find ways to come together as a community. From the Norwegian Arctic to the shores of the Great Lakes, from the Atlantic to the Pacific our members zoomed in to meet at our Annual General Meeting on October 29. From top to bottom and left to right Francine McCarthy, Terri Lacourse, Florin Pendea, Manuel Bringue, Sandy McLachlan, Cale Gushulak, Zhen Li, Peta Mudie, Diana Tirlea, Anna Pieńkowski, Vera Pospelova and Anne de Vernal.

Happy New Year!

Bonne Année !

CAP MEMBERSHIP FORM

Canadian Association of Palynologists / Association Canadienne des Palynologues (CAP) membership is open to all members of the palynological community in Canada and others with an interest in Canadian palynology. The Association is dedicated to the advancement and encouragement of all aspects of palynology in Canada and the promotion of co-operation between palynologists and those engaged in related fields of study. Membership dues include two issues a year of the *CAP Newsletter*, to which all members are invited to contribute. CAP is affiliated with the International Federation of Palynological Societies (IFPS) and members receive two issues of the IFPS newsletter (*PALYNOS*) each year.

CAP membership dues are $15 per year in Canadian or US funds payable at the beginning of the year. Lapsed members are removed from the mailing list after one year, following a reminder. Members may, if they wish, pay for up to three years in advance for a reduced amount of $40. To join or renew, please fill out this membership form (by hand or in Adobe Reader®) and send your payment *via* either: a) a cheque (Canadian bank only) or money order payable to CAP along with your form, or b) an Interac e-Transfer to:

Dr. Francine McCarthy, Interim CAP Secretary-Treasurer,
Dept. of Earth Sciences, Brock University, St Catharines, ON, L2S 3A1, CANADA

Name: _____

Affiliation: _____

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_____

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Research interests: _____

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Do you want to make a donation towards the Annual CAP Student Research Award?

Yes ☐ No ☐ Amount: _____

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If you are the head of a palynology laboratory in Canada, may we include your name/address/ research interests/webpage in the online "Directory of Canadian Palynology labs" on the CAP website? Yes ☐ No ☐

Lab page URL: _____

Do you permit your name/address/email address to be included in the printed "World Directory of Palynologists" being compiled by IFPS? Yes ☐ No ☐