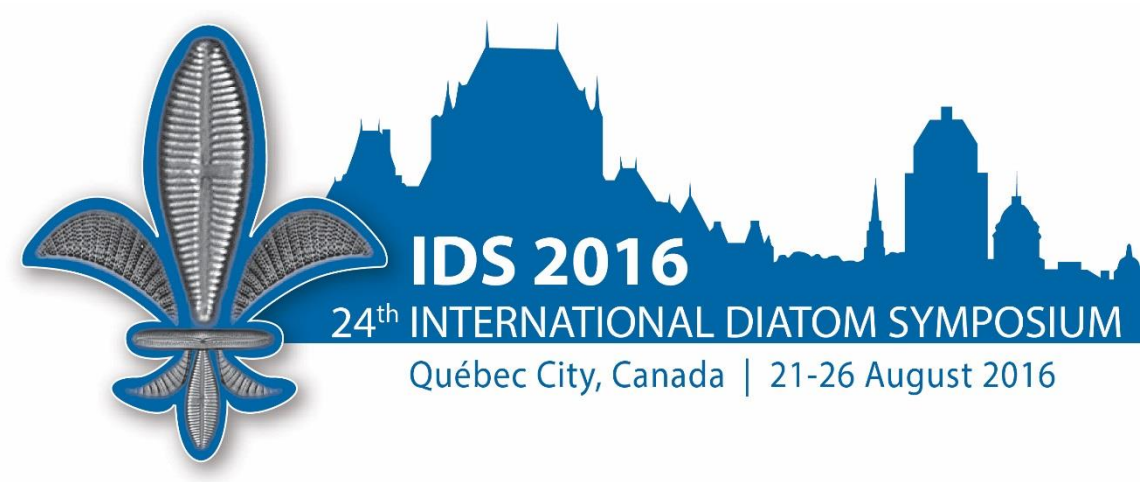


PROGRAM & ABSTRACTS

24th International Diatom Symposium

Québec, Canada

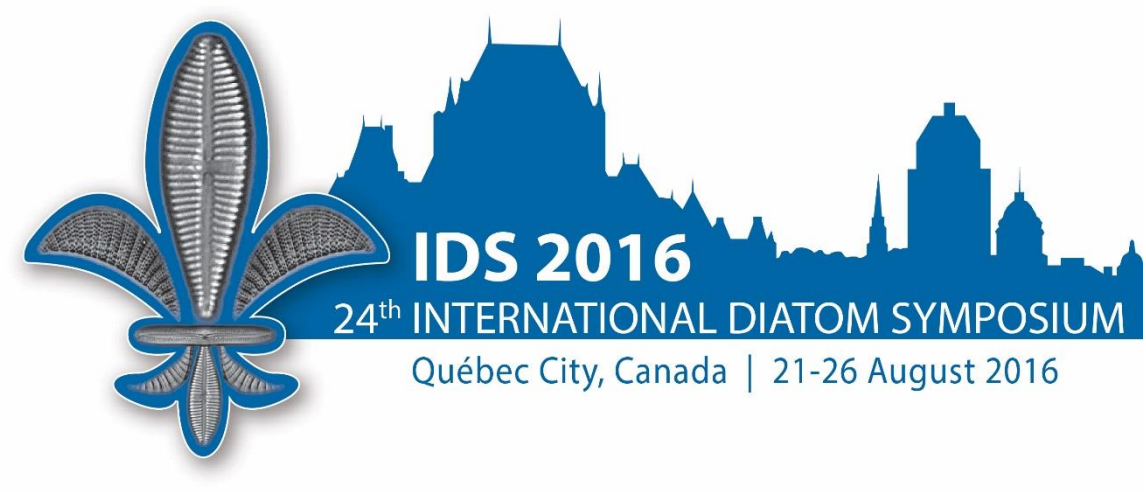
21-26 August 2016

IDS 2016 – GENERAL SCHEDULE

Timetable	August 21 Sunday	August 22 Monday		August 23 Tuesday		August 24 Wednesday		August 25 Thursday		August 26 Friday
8:00 - 8:15		Registration/ Poster set-up		Registration/ Poster set-up		Registration		Registration/ Poster set-up		**Tribute 4**
8:15 - 8:30						**Tribute 2**				**Tribute 5**
8:30 - 8:45		**Welcoming address**		**Tribute 1**				**Tribute 3**		**Plenary 7 Dr. D. Campbell**
8:45 - 9:30		**Plenary 1 Dr. W. Vyverman**		**Plenary 3 Dr. N. Kröger**		**W-3 Termi-nology**	**W-4 Web-based diatom reference sites**	**Plenary 5 Dr. N. Lundholm**		
9:30 - 10:30		**S-1A Systematics**	**S-1B Blooms**	**S-2A Molecular**	**S-2C Paleo**			**S-3A Monitoring**	**S-3B Marine**	**S-4A Ecophysiol**
10:30 - 10:50		Coffee break		Coffee break		Coffee break		Coffee break		Coffee break
10:50 - 12:10	DR Editorial Board Meeting (10:30 – ~13:30)	**S-1A Systematics**	**S-1C Biogeogr**	**S-2A Molecular**	**S-2C Paleo**	**Young Scientists Meeting** Lead: H. Vossel; O. Jacques		**S-3A Monitoring**	**S-3B Marine**	**S-4A Ecophysiol**
12:10 - 13:30		Lunch		Lunch		Lunch		Lunch		Lunch
13:30 - 14:15		**Plenary 2 Dr. C. Kilroy**		**Plenary 4 Dr. J. Saros**		Mid-week Excursion to Old Quebec City (13:30 – 17:30)		**Plenary 6 Dr. M. Kahlert**		ISDR General Meeting (13:30 – 14:55)
14:15 - 15:15	ISDR Council Meeting (14:15 – ~16:55)	**S-1A Systematics**	**S-1D Didymo**	**S-2A Molecular**	**S-2C Paleo**			**S-3A Monitoring**	**S-3B Marine**	
15:15 - 15:35		Coffee break		Coffee break				Coffee break		
15:35 - 16:55		**S-1A Systematics**	**S-1D Didymo**	**S-2B Databases**	**S-2C Paleo**			**S-3A Monitoring**		
16:55 - 17:00		**Photo session**								
17:00 - 18:30	Registration	**Poster session 1** (17:00 – 18:30)		**Poster session 2** (17:00 – 18:30)				**Poster session 3** (17:00 – 18:30)		
18:30 - 22:00	Icebreaker Reception (18:30 – 21:00)	Dinner on your own/ **W-1 Freshwater Monoraphids**		Dinner on your own/ **W-2 Gomphonemoids**		Banquet at Québec Aquarium (18:15 – 24:00)		Dinner on your own/ **W-5 Marine benthic diatoms**		

Timetable	August 26 Friday
8:00 - 8:15	**Tribute 4**
8:15 - 8:30	**Tribute 5**
8:30 - 9:15	**Plenary 7 Dr. D. Campbell**
9:15 - 10:35	**S-4A Ecophysiol**
10:35 - 10:50	Coffee break
10:50 - 12:10	**S-4A Ecophysiol**
12:10 - 13:30	Lunch
13:30 - 14:55	ISDR General Meeting (13:30 – 14:55)
14:55 - 15:15	
15:15	15:15 Departure for Post-Symposium Excursion to Charlevoix

(S = Session; W = Workshop)



PROGRAM & ABSTRACTS

24th International Diatom Symposium

Québec, Canada

21-26 August 2016

LOCAL ORGANIZING COMMITTEE

Dr. Reinhard Pienitz – Université Laval – Québec City (President IDS 2016)
Dr. Dermot Antoniades – Université Laval – Québec City
Mr. Paul B. Hamilton – Canadian Museum of Nature – Ottawa
Dr. Isabelle Lavoie – INRS-ETE – Québec City
Dr. Michel Poulin – Canadian Museum of Nature – Ottawa
Dr. Émilie Saulnier-Talbot – Université Laval – Québec City
Mrs. Claudia Zimmermann – Université Laval – Québec City

INTERNATIONAL SCIENTIFIC COMMITTEE

Dr. Marco Cantonati – Museo delle Scienze - MUSE – Italy & ANSP Drexel University – USA
Dr. Sarah Davies – Institute of Geography and Earth Sciences - Aberystwyth University – UK
Dr. Mark B. Edlund – St. Croix Watershed Research Station - Science Museum of Minnesota – USA
Dr. Regine Jahn – Botanischer Garten & Botanisches Museum – FU Berlin – Germany
Dr. Peter G. Kroth – Fachbereich Biologie - Universität Konstanz – Germany
Dr. Nora I. Maidana – Departamento de ciencias biologicas – Universidad de Buenos Aires – Argentina
Dr. Shigeki Mayama – Department of Biology - Tokyo Gakugei University – Japan
Dr. Marina Potapova – Academy of Natural Sciences - Drexel University - Philadelphia – USA
Dr. Michael Reid – School of Behavioural, Cognitive & Social Sci. - University of New England – Australia
Dr. Koen Sabbe – Department of Biology - Ghent University – Belgium
Dr. Jonathan C. Taylor – Environmental Sciences & Management - North-West University – South Africa
Dr. Xiangdong Yang – Nanjing Institute of Geography and Limnology – China

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ACKNOWLEDGMENTS

We would like to express our gratitude to the following people, without whom the organization of this symposium would have been impossible: Mr. Luc Cournoyer for website design, Ms. France Lévesque for financial administration, Mr. Guillaume Mallet for handling the IDS 2016 registration platform, Ms. Sylvie St-Jacques for help with the Symposium Program & Abstracts book, all special session chairs, all oral and poster presentation judges, voluntary helpers, and the International Society for Diatom Research (ISDR) for providing student travel awards.

This publication should be cited as follows:

Pienitz, Reinhard & Zimmermann, Claudia (Eds) 2016. Program & Abstracts, 24th International Diatom Symposium, Québec, Canada, 21-26 August 2016. Université Laval, 271 pp.

WELCOMING ADDRESS

Dear members of the International Diatom Society,

Bienvenue à Québec – Welcome to Québec City and Université Laval!

Four years have passed since our bid to host the 24th International Diatom Symposium in Québec City was submitted to ISDR. This time has passed like a whirlwind and we are honoured and delighted to welcome you to the oldest French-speaking university in North America, with more than 45,000 students enrolled.

From the very beginning, our aim has been to bring together experts from all fields of research on modern and fossil diatoms (both from marine and freshwater systems), including molecular, physiological, evolutionary, ecological, biogeographical, paleoecological, biomonitoring, systematic/taxonomic, and other aspects of research on diatoms. Today we are proud to announce a rich and diverse symposium program including several parallel oral sessions with a total of 84 talks, 101 poster presentations, 7 eminent plenary speakers, 5 workshops and 5 tributes and, last but not least, the first ever IDS Young Scientists Meeting! All together, we are pleased to welcome 189 participants from 6 continents and 28 countries.

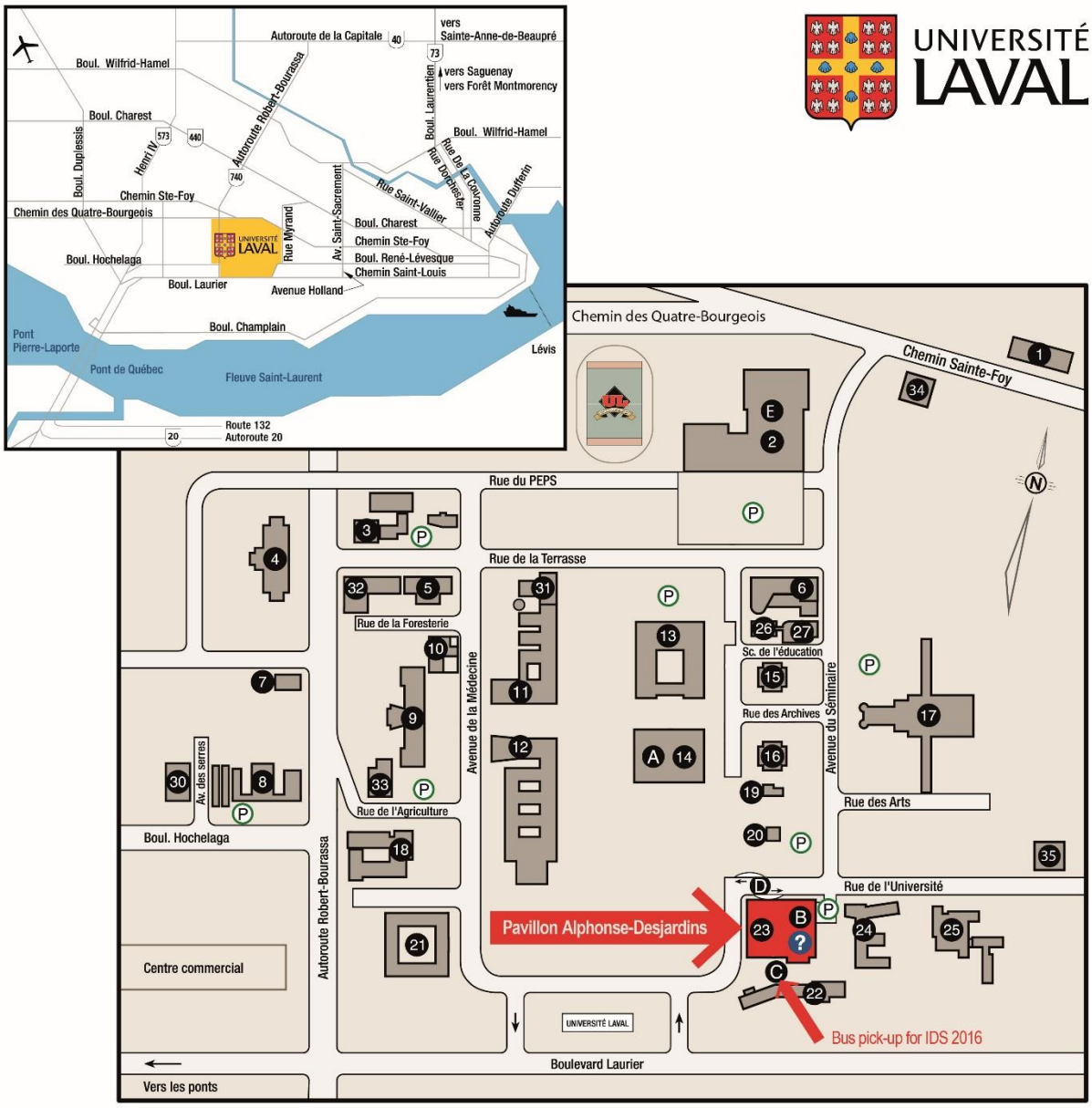
We hope that you will find the time to discover the major tourist attractions in Québec City with its numerous historic sites and its European flair, as well as the mighty St. Lawrence River, during or after the symposium. The mid-symposium excursion to Old Québec is meant to give you a taste of the beauty of the only walled city in North America, which is a UNESCO World Heritage site. Those who are going on the post-symposium excursion will be able to visit other tourist attractions in the Province of Québec. Please also join us in the evenings for fun “extracurricular” activities to experience Québec nightlife!

We wish you inspiring and interesting exchanges with old and new friends during the 24th IDS, as well as pleasant discoveries during your stay in Québec and Canada.

Enjoy the meeting!

Reinhard Pienitz & the IDS 2016 Local Organizing Committee

CAMPUS MAP



PAVILLONS

1 Pavillon de l'Est
2 Pavillon de l'Éducation physique et des sports (PEPS)
3 Pavillon de Médecine dentaire
4 Centre de foresterie des Laurentides
5 Pavillon Abitibi-Price
6 Pavillon Palasis-Prince
7 Maison Omer-Gingras
8 Pavillon des Services
9 Pavillon Ferdinand-Vandry
10 Pavillon Charles-Eugène-Marchand
11 Pavillon Alexandre-Vachon
12 Pavillon Adrien-Pouliot
13 Pavillon Charles-De Koninck
14 Pavillon Jean-Charles-Bonenfant
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16 Pavillon Félix-Antoine-Savard
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19 Maison Eugène-Roberge
20 Maison Marie-Sirois
23 Pavillon A.-Desjardins–M.-Pollack
26 Pavillon J.-A.-De Sève
27 Pavillon La Laurentienne
28 Édifice La Fabrique
29 Édifice du Vieux-Séminaire-de-Québec
30 Pavillon de l'Envirotron
31 Pavillon d'Optique-photonique
32 Pavillon Gene-H.-Kruger
33 Édifice logeant Héma-Québec
34 Maison Michael-John-Brophy
35 Pavillon Gérard-Bisaillon (centrale d'énergie)

SERVICES

A Library
B Bank
C Bus pick-up for IDS 2016
D Bus Stop (public transportation)
E Sport Center

ACCOMMODATIONS (RÉSIDENCES)

21 Pavillon Agathe-Lacerte
22 Pavillon Ernest-Lemieux
24 Pavillon H.-Biermans-L.-Moraud
25 Pavillon Alphonse-Marie-Parent

Ⓟ Parking meter
? Information

Locations in the Pavillon A.-Desjardins–M.-Pollack

Pavillon A.-Desjardins–M.-Pollack is a complex of two connected buildings. The first part with the main entrance is called Pavillon A.-Desjardins, the rear part Pavillon M.-Pollack.

To find the conference rooms, just follow the signs that will be set up for IDS 2016.

Amphithéâtre Hydro-Québec	2nd Floor, Room 2530
Atrium Jean-Guy Paquet	Central Hall on the Ground Floor
Grand Salon	2nd Floor, Room 2244
Le Cercle	4th Floor, Room 4512/4514 – take the elevator to the 4th Floor

ORAL & POSTER PROGRAM

Oral Program

****

Please note that Special Oral Sessions
on Monday, Tuesday and Thursday
as well as Workshop Sessions on Wednesday
*are **parallel sessions**!*

****

Sunday, August 21, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

10.30 - 13.30	Diatom Research Editorial Meeting	closed meeting
14.15 - 16.55	ISDR Council Meeting	closed meeting
17.00 - 18.30	**Registration**	**Grand Salon**
18.30 - 21.00	**Ice-breaker reception**	**Grand Salon**

Monday, August 22, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

08.00 - 08.30	Registration Poster set-up	Atrium Jean-Guy Paquet
08.30 - 08.45	Welcoming address by the conference organizers	Grand Salon
08.45 - 09.30	**Plenary 1** The evolution of polar diatom biomes **Wim Vyverman**	Grand Salon

Parallel Special Oral Sessions — Grand Salon

S-1A - Diatom Systematics into the next century

Chairs: **Marina Potapova** & **Paul B. Hamilton**

09.30 - 09.50	Morphology and ecology of a new centric diatom from Northeastern China, *Lindavia khinganensis* sp. nov. **Patrick Rioual**	
09.50 - 10.10	A new Paleocene centric diatom genus with a complex wall design from a freshwater locality in Northern Canada **Peter Siver**	
10.10 - 10.30	Variation in morphological characters of diatotepum in relation to valve ultrastructure **Noriaki Nakamura**	
10.30 - 10.50	*Coffee break*	*Atrium Jean-Guy Paquet*
10.50 - 11.10	Exploring generic relationships within the Cymbellales – a morphological analysis **Eileen J. Cox**	
11.10 - 11.30	*Ulnaria*: Synapomorphies and the Science of Systematics **David M. Williams**	
11.30 - 11.50	Diatom nomenclatural rules and best practices **Jana Veselá** & **Chelsea R. Smith**	
11.50 - 12.10	open discussion	
12.10 - 13.30	*Lunch*	*Le Cercle*

Monday, August 22, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

13.30 - 14.15	**Plenary 2** Non-native diatoms: the case of *Didymosphenia geminata* in New Zealand **Cathy Kilroy**	Grand Salon

Parallel Special Oral Sessions — Grand Salon

S-1A - Diatom Systematics into the next century

Chairs: **Marina Potapova** & **Paul B. Hamilton**

14.15 - 14.35	Genetic and morphological variation in *Gyrosigma acuminatum* across eastern North America **Paul B. Hamilton**	
14.35 - 14.55	Constructing a phylogenetic classification for the Eunotiophycidae: testing hypotheses for raphe evolution **Jennifer Beals**	
14.55 - 15.15	It's all in the timing: a densely calibrated molecular clock estimate of diatom divergence events **Matthew L. Julius**	
15.15 - 15.35	*Coffee break*	*Atrium Jean-Guy Paquet*
15.35 - 15.55	Seasonality and ontogeny in *Diatoma vulgaris* **David R.L. Burge**	
15.55 - 16.15	Using automated microscopy and image analyses in intrageneric morphometrics: a case study with Southern Ocean *Fragilariopsis* spp. **Bánk Beszteri**	
16.15 - 16.35	Seasonal changes in valve size distributions of the Southern Ocean diatom *Fragilariopsis kerguelensis*: a window on the species' life cycle **Michael Kloster**	
16.35 - 16.55	open discussion	

16.55 - 17.00	Photo session	Atrium Jean-Guy Paquet
17.00 - 18.30	**Poster session 1**	Atrium Jean-Guy Paquet
18.30 - 22.00	**Workshop 1** Freshwater monoraphids **Marina Potapova**	Grand Salon

Monday, August 22, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

08.00 - 08.30	Registration Poster set-up	Atrium Jean-Guy Paquet
08.30 - 08.45	Welcoming address by the conference organizers	Grand Salon
08.45 - 09.30	**Plenary 1** The evolution of polar diatom biomes **Wim Vyverman**	Grand Salon

Parallel Special Oral Sessions		**Amphithéâtre Hydro-Québec**
S-1B - Diatoms and Harmful Algal Blooms Chairs: **Koen Sabbe & Nina Lundholm**		
09.30 - 09.50	Hypoxia in Lake Erie is mostly driven by diatoms **Euan D. Reavie**	
09.50 - 10.10	The proliferation of lake snow in South Island lakes: a new case of diatoms as a nuisance in New Zealand freshwaters? **Émilie Saulnier-Talbot**	
10.10 - 10.30	Diatom-bacteria interactions in marine intertidal biofilms: nature, constraints and specificity **Koen Sabbe**	
10.30 - 10.50	*Coffee break*	*Atrium Jean-Guy Paquet*
S-1C - Diatom biogeography and species traits Chair: **Jacob John**		
10.50 - 11.10	Refugia as source of speciation in Diatoms - a perspective from flora studies in Australia **Jacob John**	
11.10 - 11.30	Genetic variation of *Nitzschia traheaformis* Li Ch., Witkowski & Yu Sh. and *N. dubiiformis* Hustedt (sect. Nitzschiae Dubiae) from various geographic regions based on molecular and morphologic data **Andrzej Witkowski (First author: M. Krzywda)**	
11.30 - 11.50	Opening Pandora's box: species diversity, evolutionary history and biogeography of the *Pinnularia borealis* species complex **Eveline Pinseel**	
11.50 - 12.10	Freshwater diatom biogeography and the genus *Luticola*: An extreme case of endemism in Antarctica **Bart Van de Vijver**	
12.10 - 13.30	*Lunch*	*Le Cercle*

Monday, August 22, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

13.30 - 14.15	**Plenary 2** Non-native diatoms: the case of *Didymosphenia geminata* in New Zealand **Cathy Kilroy**	Grand Salon

Parallel Special Oral Sessions	**Amphithéâtre Hydro-Québec**
S-1D - ***Didymosphenia geminata* as a nuisance species** Chair: **Carole-Anne Gillis**	
14.15 - 14.35	The apoplast of diatoms - important polysaccharides identified with glycomic approaches **Michael R. Gretz**
14.35 - 14.55	Structure of the *Didymosphenia geminata* stalks as a biomaterial **Izabela Zgłobicka**
14.55 - 15.15	Exploring the impact of *Didymosphenia geminata* nuisance growths on juvenile Atlantic salmon **Carole-Anne Gillis**
15.15 - 15.35	*Coffee break* — *Atrium Jean-Guy Paquet*
15.35 - 15.55	The history and current status of *Didymosphenia geminata* in Lake Superior **Robert Pillsbury**
15.55 - 16.15	DNA Barcoding as tool to identify *Didymosphenia* spp. in Chile: How many species are there? **Leyla Cárdenas**
16.15 - 16.35	eDNA detection versus microscopy observations for assessing presence-absence of *Didymosphenia geminata* in Quebec rivers (Canada) **Sandra Kim Tiam**
16.35 - 16.55	Spatio-temporal population dynamics of the invasive diatom *Didymosphenia geminata* in central-southern Chilean rivers **Max Bothwell (First author: V. Montecino)**

16.55 - 17.00	Photo session	Atrium Jean-Guy Paquet
17.00 - 18.30	**Poster session 1**	Atrium Jean-Guy Paquet
18.30 - 22.00	**Workshop 1** Freshwater monoraphids **Marina Potapova**	Grand Salon

Tuesday, August 23, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

08.00 - 08.30	Registration Poster set-up	Atrium Jean-Guy Paquet
08.30 - 08.45	**Tribute 1** "Remembering our Colleagues and Friends" **Marina Potapova** & **Paul B. Hamilton**	Grand Salon
08.45 - 09.30	**Plenary 3** Molecular "life" of diatoms **Nils Kröger**	Grand Salon

Parallel Special Oral Sessions — Grand Salon

S-2A - Molecular aspects of diatom biology

Chair: **Peter G. Kroth**

09.30 - 09.50	Secondary structure alignment and multiple outgroups confirm the monophyly of the diatom classes using SSU, LSU rRNA genes and plastid genes **Linda K. Medlin**	
09.50 - 10.10	Epilithic diatoms in streams from central Mexico: comparison between the morphological and metabarcoding identification approaches **Luis D. Mora Hernández**	
10.10 - 10.30	Molecular investigation of the diatom genus *Envekadea* with remarks on biogeography and new species **Maxim Kulikovskiy**	
10.30 - 10.50	*Coffee break*	*Atrium Jean-Guy Paquet*
10.50 - 11.10	Molecular and morphological investigations of the stauros-bearing, raphid pennate diatoms (Bacillariophyceae): *Craspedostauros* E.J. Cox and *Staurotropis* T.B.B. Paddock and their relationship to the rest of the Mastogloiales **Matt P. Ashworth**	
11.10 - 11.30	*Gomphonema acuminatum* species complex: Evaluation of morphological and molecular characters **Nélida Abarca**	
11.30 - 11.50	A comparison of molecular barcodes and morphology of *Neidium* (Bacillariophyta) of North America **Paul B. Hamilton (First author: K.E. Lefebvre)**	
11.50 - 12.10	Presence of the scattered dot-like chloroplast DNA was verified in large *Pinnularia* species **Shigeki Mayama**	
12.10 - 13.30	*Lunch*	*Le Cercle*

Tuesday, August 23, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

13.30 - 14.15	**Plenary 4** Integrating ecological and paleolimnological approaches to interpret diatom records of environmental change **Jasmine E. Saros**	Grand Salon

Parallel Special Oral Sessions — Grand Salon

S-2A - Molecular aspects of diatom biology

Chair: **Peter G. Kroth**

14.15 - 14.35	Exploring the biology of the freshwater diatom *Asterionella formosa* and its interactions with bacteria using a combination of physiological, cellular and genomic approaches **Mila Sirinelli-Kojadinovic**	
14.35 - 14.55	Changing gene expression linked to extracellular polymeric substance (EPS) production pathways in the diatom *Fragilariopsis cylindrus* during simulated sea ice formation **Graham J. C. Underwood**	
14.55 - 15.15	Deciphering the chrysolaminarin biosynthetic pathway in the diatom *Phaeodactylum tricornutum* using molecular tools **Peter G. Kroth**	
15.15 - 15.35	*Coffee break*	*Atrium Jean-Guy Paquet*

S-2B - Recent developments in diatom databases

Chair: **Émilie Saulnier-Talbot**

15.35 - 15.55	GBOL2 – "Environmental DNA in the water framework directive context (diatoms)" – **Jonas Zimmermann**
15.55 - 16.15	Indexing and registering scientific diatom names and nomenclatural types **Regine Jahn**
16.15 - 16.35	Advancement of phytoplankton research in the Philippines: the use of an auto-imaging device (FlowCAM) in the development of an image database of phytoplankton from two key sardine fishery areas in the country **Marianne G. Camoying**
16.35 - 16.55	Catalogue of Diatom Names Resurrected: DiatomBase will be the new authority resource for diatom names and more **J. Patrick Kociolek**

17.00 - 18.30	**Poster session 2**	Atrium Jean-Guy Paquet
18.30 - 22.00	**Workshop 2** Gomphonemoids **J. Patrick Kociolek**	Grand Salon

Tuesday, August 23, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

08.00 - 08.30	Registration Poster set-up	Atrium Jean-Guy Paquet
08.30 - 08.45	**Tribute 1** "Remembering our Colleagues and Friends" **Marina Potapova** & **Paul B. Hamilton**	Grand Salon
08.45 - 09.30	**Plenary 3** Molecular "life" of diatoms **Nils Kröger**	Grand Salon

Parallel Special Oral Sessions		**Amphithéâtre Hydro-Québec**
S-2C - Diatoms in the paleosciences Chairs: **Biljana Narancic** & **Kathryn Hargan**		
09.30 - 09.50	Reconstructing wetland dynamics in northeastern Iceland in response to climatic change and human impacts over the last 1000 years **Isabelle Cyr-Parent**	
09.50 - 10.10	Reconstructing the history of coastal eutrophication and quantifying total nitrogen reference conditions in Baltic Sea coastal waters **Elinor Andrén**	
10.10 - 10.30	Diatom responses to the construction of prehistoric and medieval wetland occupation sites around the Irish Sea **Thierry Fonville**	
10.30 - 10.50	*Coffee break*	*Atrium Jean-Guy Paquet*
10.50 - 11.10	Recent diatom assemblage changes in shallow lakes of the Selenga Delta, Siberia reveal drivers of environmental change **Jennifer K. Adams**	
11.10 - 11.30	Cliff-nesting seabirds influence productivity of lakes situated above their colony **Kathryn Hargan**	
11.30 - 11.50	Using diatom assemblages to assess the influence of nutrient loading and climate warming on lakes that sustain Lake Trout populations in Ontario, Canada **Clare Nelligan**	
11.50 - 12.10	Long-term lacustrine evolution of the high-altitude Lake Allos (Southern Alps, 2200 m a.s.l) during the Holocene revealed by diatom assemblages **Rosine Cartier**	
12.10 - 13.30	*Lunch*	*Le Cercle*

Tuesday, August 23, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

13.30 - 14.15	**Plenary 4** Integrating ecological and paleolimnological approaches to interpret diatom records of environmental change **Jasmine E. Saros**	Grand Salon

Parallel Special Oral Sessions	**Amphithéâtre Hydro-Québec**
S-2C - Diatoms in the paleosciences Chairs: **Biljana Narancic** & **Kathryn Hargan**	
14.15 - 14.35	Late-glacial and early-Holocene palaeoenvironments reconstructed from multi-proxy records, Loch of Sabiston, Orkney, UK **Melanie Kingsbury**
14.35 - 14.55	The diatom flora of Lake Kinneret (Israel) – New insights into Holocene climate change and human impact in the southeastern Mediterranean **Hannah Vossel**
14.55 - 15.15	Unravelling the drivers of diatom evolution in ancient Lake Ohrid: ecosystem resilience and species resistance; a link between geology and biology **Aleksandra Cvetkoska**
15.15 - 15.35	*Coffee break* — *Atrium Jean-Guy Paquet*
15.35 - 15.55	Pliocene diatom record of Baringo Basin, Kenya **Karlyn Westover**
15.55 - 16.15	Long-term diatom changes during the past 85 ka from tropical lowlands of Northern central America **Florence Sylvestre**
16.15 - 16.35	Preliminary diatom results from Chew Bahir, Ethiopia – a contribution to the Hominin Sites and Paleolakes Drilling Project **Sarah Davies**
16.35 - 16.55	Combined paleoenvironmental inference models from sediment diatom assemblages and δ18O analyses of biogenic silica in Nettilling Lake (Baffin Island, Canada) and reconstruction of summer water temperature **Biljana Narancic**

17.00 - 18.30	**Poster session 2**	**Atrium Jean-Guy Paquet**
18.30 - 22.00	**Workshop 2** Gomphonemoids **J. Patrick Kociolek**	Grand Salon

Wednesday, August 24, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

08.00 - 08.15	Registration	Atrium Jean-Guy Paquet
08.15 - 08.30	**Tribute 2** Grethe Hasle: diatomist, mentor, and friend **Linda K. Medlin**	Grand Salon

Parallel Workshop Sessions		
08.30 - 10.30	**Workshop 3** Terminology **Richard W. Jordan** & **Eileen J. Cox**	Grand Salon
08.30 - 10.30	**Workshop 4** Web-based diatom reference sites **Sarah A. Spaulding**	Amphithéâtre Hydro-Québec
10.30 - 10.50	*Coffee break*	*Grand Salon / Amphithéâtre Hydro-Québec*

10.50 - 12.10	**Young Scientists Meeting** **Hannah Vossel** & **Olivier Jacques**	Amphithéâtre Hydro-Québec
12.10 - 13.30	*Lunch*	*Le Cercle*
13.30 - 17.30	**Mid-week Excursion to Old Québec City**	Bus pick-up at the back entrance of Pavillon A.-Desjardins–M.-Pollack
18.15 - 24.00	**Banquet at Québec Aquarium**	Bus pick-up at the back entrance of Pavillon A.-Desjardins–M.-Pollack

Mid-week Excursion to Old Québec City

Yellow school busses will depart from the back entrance of Pavillon A.-Desjardins–M.-Pollack (**C** on the Campus Map) at **13.30** for a guided walking tour (in groups of about 20 persons) of the Old City of Québec. The tour will be held in English by professional tourist guides and will take about 2 hours. After the tour, the busses will bring you back to Université Laval.
There is no free time in Old Québec City!

Banquet at Québec Aquarium

For IDS 2016 participants who have registered for the banquet, yellow school busses will depart from the back entrance of Pavillon A.-Desjardins–M.-Pollack (**C** on the Campus Map) at **18.15** and bring you to the Québec Aquarium. Later in the evening a permanent service of shuttle busses will bring you back from the Aquarium to Université Laval at the time that suits you best.

Thursday, August 25, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

08.00 - 08.30	Registration Poster set-up	Atrium Jean-Guy Paquet
08.30 - 08.45	**Tribute 3** Tribute in honour of Françoise Gasse **Florence Sylvestre**	Grand Salon
08.45 - 09.30	**Plenary 5** Toxin-producing diatoms and zooplankton – a co-evolutionary interaction? **Nina Lundholm**	Grand Salon

Parallel Special Oral Sessions — Grand Salon

S-3A - Diatom-based assessments and monitoring of freshwater habitats

Chairs: **Marco Cantonati**, **Maria Kahlert** & **Kalina Manoylov**

Topic: **Plankton -** Chair: **Kalina Manoylov**		
09.30 - 09.50	A comparison of planktonic diatom communities from the summer epilimnia and deep chlorophyll layers in the Laurentian Great Lakes **Andrew J. Bramburger**	
09.50 - 10.10	Diatom dynamics in the phytoplankton of a small deep crater lake in East Africa **Christine Cocquyt**	
10.10 - 10.30	Contemporary limnology and phytoplankton communities of the Ugandan crater lakes **Keely Mills**	
10.30 - 10.50	*Coffee break*	*Atrium Jean-Guy Paquet*
Topic: **Environmental Assessments Streams -** Chair**: Maria Kahlert**		
10.50 - 11.10	Biotic condition of rivers in the southeast United States **Sarah A. Spaulding**	
11.10 - 11.30	Uses of fine level taxonomy in bioassessment and accuracy indicator power of diatom communities **Kalina Manoylov**	
11.30 - 11.50	Mediterranean-climate streams diatom biodiversity: indications from environmental-assessment studies in two geographically-distant areas **Marco Cantonati**	
11.50 - 12.10	Variable exposure: the ability for periphytic diatoms to track nutrient concentrations over both short and long time scales in tributaries of northern Lake Erie **Mark J. MacDougall**	
12.10 - 13.30	*Lunch*	*Le Cercle*

Thursday, August 25, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

13.30 - 14.15	**Plenary 6** Diatoms in monitoring and ecotoxicology - Valuable, useful, important, complicated, redundant and beautiful **Maria Kahlert**	Grand Salon

Parallel Special Oral Sessions — Grand Salon

S-3A - Diatom-based assessments and monitoring of freshwater habitats

Chairs: **Marco Cantonati**, **Maria Kahlert** & **Kalina Manoylov**

Topic: **Reaction to toxic substances -** Chair: **Marco Cantonati**		
14.15 - 14.35	Heritability of deformities in diatoms **Soizic Morin (First author: N. Coquillé)**	
14.35 - 14.55	Legacy effects of Arctic gold mining: Assessing the influence of past arsenic emissions on subarctic diatom assemblages **Branaavan Sivarajah**	
14.55 - 15.15	Diatom community response to accidental ammonium nitrate addition to the river Jagst, Germany **Lydia King**	
15.15 - 15.35	*Coffee break*	*Atrium Jean-Guy Paquet*
Chair: **Marco Cantonati**		
15.35 - 15.55	Ecological and taxonomic studies of terrestrial diatom communities and the search for linkages with river regimes **Carlos E. Wetzel**	
15.55 - 16.15	Impact of glyphosate on aquatic ecosystems: experimental analysis using periphytic diatoms (Laguna del Cisne, Uruguay) **Natalie Corrales-Martín**	
16.15 - 16.35	A diatom functional-based approach to assess changing environmental conditions in temporary depressional wetlands **Luisa Riato**	
16.35 - 16.55	open discussion	

17.00 - 18.30	**Poster session 3**	Atrium Jean-Guy Paquet
18.30 - 22.00	**Workshop 5** Marine benthic diatoms – internet data base on Atlantic Ocean benthic diatoms **Andrzej Witkowski** & **Matt P. Ashworth**	Grand Salon

Thursday, August 25, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

08.00 - 08.30	Registration Poster set-up	Atrium Jean-Guy Paquet
08.30 - 08.45	**Tribute 3** Tribute in honour of Françoise Gasse **Florence Sylvestre**	Grand Salon
08.45 - 09.30	**Plenary 5** Toxin-producing diatoms and zooplankton – a co-evolutionary interaction? **Nina Lundholm**	Grand Salon

Parallel Special Oral Sessions — Amphithéâtre Hydro-Québec

S-3B - Marine diatoms / paleoceanography

Chair: **Scott W. Starratt**

09.30 - 09.50	Introduction – **Scott W. Starratt**	
09.50 - 10.10	New finds of Eocene marine diatom assemblages from the Kamchatka region, Russian Far East **Andrey Y. Gladenkov**	
10.10 - 10.30	Shifting planktonic microfossil regimes during the Eocene-Oligocene transition: response to Antarctic ice-sheet inception and variability from Maud Rise, Atlantic Sector of the Southern Ocean **Michael Harrison**	
10.30 - 10.50	*Coffee break*	*Atrium Jean-Guy Paquet*
10.50 - 11.10	Epiphytic diatoms in Southern Ocean abyssal sediments as a new proxy to reconstruct Antarctic paleoenvironmental changes: implications of floating 'macroalgal biotic oases' **David M. Harwood**	
11.10 - 11.30	Diatom-based quantitative reconstructions of sea ice and sea surface temperature offshore West Greenland for the past 11000 years **Diana Krawczyk**	
11.30 - 11.50	A Holocene history of the Little Belt region, Baltic Sea **Jonathan Warnock**	
11.50 - 12.10	Spatio-temporal distribution and assemblage similarity of planktonic diatom along Bangladesh coast in the Bay of Bengal **Mahmudur R. Khan**	
12.10 - 13.30	*Lunch*	*Le Cercle*

Thursday, August 25, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

13.30 - 14.15	**Plenary 6** Diatoms in monitoring and ecotoxicology - Valuable, useful, important, complicated, redundant and beautiful **Maria Kahlert**	Grand Salon

Parallel Special Oral Sessions		**Amphithéâtre Hydro-Québec**
S-3B - Marine diatoms / paleoceanography Chair: **Scott W. Starratt**		
14.15 - 14.35	A comparison of epizoic diatom communities on green turtle (*Chelonia mydas*) from two remote localities **Roksana Majewska**	
14.35 - 14.55	Evolution of marine thalassiosiroid diatoms **Richard W. Jordan**	
14.55 - 15.15	Recent research on Cretaceous, Paleogene and Recent silicoflagellate double skeletons **Kevin McCartney**	
15.15 - 15.35	*Coffee break*	*Atrium Jean-Guy Paquet*

17.00 - 18.30	**Poster session 3**	Atrium Jean-Guy Paquet
18.30 - 22.00	**Workshop 5** Marine benthic diatoms – internet data base on Atlantic Ocean benthic diatoms **Andrzej Witkowski** & **Matt P. Ashworth**	Grand Salon

Friday, August 26, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

08.00 - 08.15	**Tribute 4** Pierre Compère, a tribute to a gentleman-diatomist **Bart Van de Vijver**, **Cathérine Riaux-Gobin**, **Christine Cocquyt** & **Luc Ector**	Grand Salon
08.15 - 08.30	**Tribute 5** Tribute to Horst Lange-Bertalot in honour of his 80th birthday **Andrzej Witkowski**	Grand Salon
08.30 - 09.15	**Plenary 7** A hard day's night: diatoms recycle photosystem II in the dark **Douglas A. Campbell**	Grand Salon

Special Oral Sessions — Grand Salon

S-4A - **Ecophysiology of diatoms** with emphasis on **Diatoms in stressful environments**

Chairs: **Johann Lavaud** & **Benjamin Bailleul**

09.15 - 09.35	C:N:P:Si stoichiometry of *Chaetoceros socialis* growing on different nitrogen sources at low and high light – **Nicolas Schiffrine**	
09.35 - 09.55	Analysis of multiple species presence on diatom motile responses to high-light irradiation – **Stanley A. Cohn**	
09.55 - 10.15	A new method to measure photosynthetic activity in algal mixtures reveals allelopathy between diatoms and dinoflagellates **Benjamin Bailleul (First author: A. Peltekis)**	
10.15 – 10.35	Do polar marine diatoms take up a quantitatively important fraction of dissolved dimethylsulfoniopropionate? – **Michel Lavoie**	
10.35 - 10.50	*Coffee break*	*Grand Salon*
10.50 - 11.10	Acclimation of a sea-ice diatom, *Fragilariopsis cylindrus*, to simulated polar winter darkness and spring-like return to light – **Philippe-Israël Morin**	
11.10 - 11.30	Quantitative targeted proteomics and electrochromic shift for measuring photosystem content of marine phytoplankton – **Christopher Brown**	
11.30 - 11.50	Elucidating retrograde signal transduction processes in the diatom *Phaeodactylum tricornutum* – **Orly Levitan**	
11.50 - 12.10	Lhcx1 knockout causes loss of qE in *Phaeodactylum tricornutum* **Bernard Lepetit**	

Friday, August 26, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

12.10 - 13.30	*Lunch*	*Le Cercle*
13.30 - 14.55	ISDR General Meeting	Grand Salon
15.15	Departure for Post-Symposium Excursion to Charlevoix	Bus pick-up at the back entrance of Pavillon A.-Desjardins–M.-Pollack

Poster program

There will be three poster sessions (Monday, Tuesday and Thursday) in the *Atrium Jean-Guy Paquet*. Poster set-up is in the morning of the respective poster session during registration time (8:00 – 8:30). While the posters will remain posted during the whole day and coffee breaks will be held in the Atrium, we invite the presenting authors to be present at their poster during the poster session period (17.00 – 18.30).

Posters will have to be printed by the presenters themselves. Poster boards are made of tissue and presenters will be provided with adhesives to attach their posters. Presenters should set up their poster at the designated poster board matching the number of their presentation in this program.

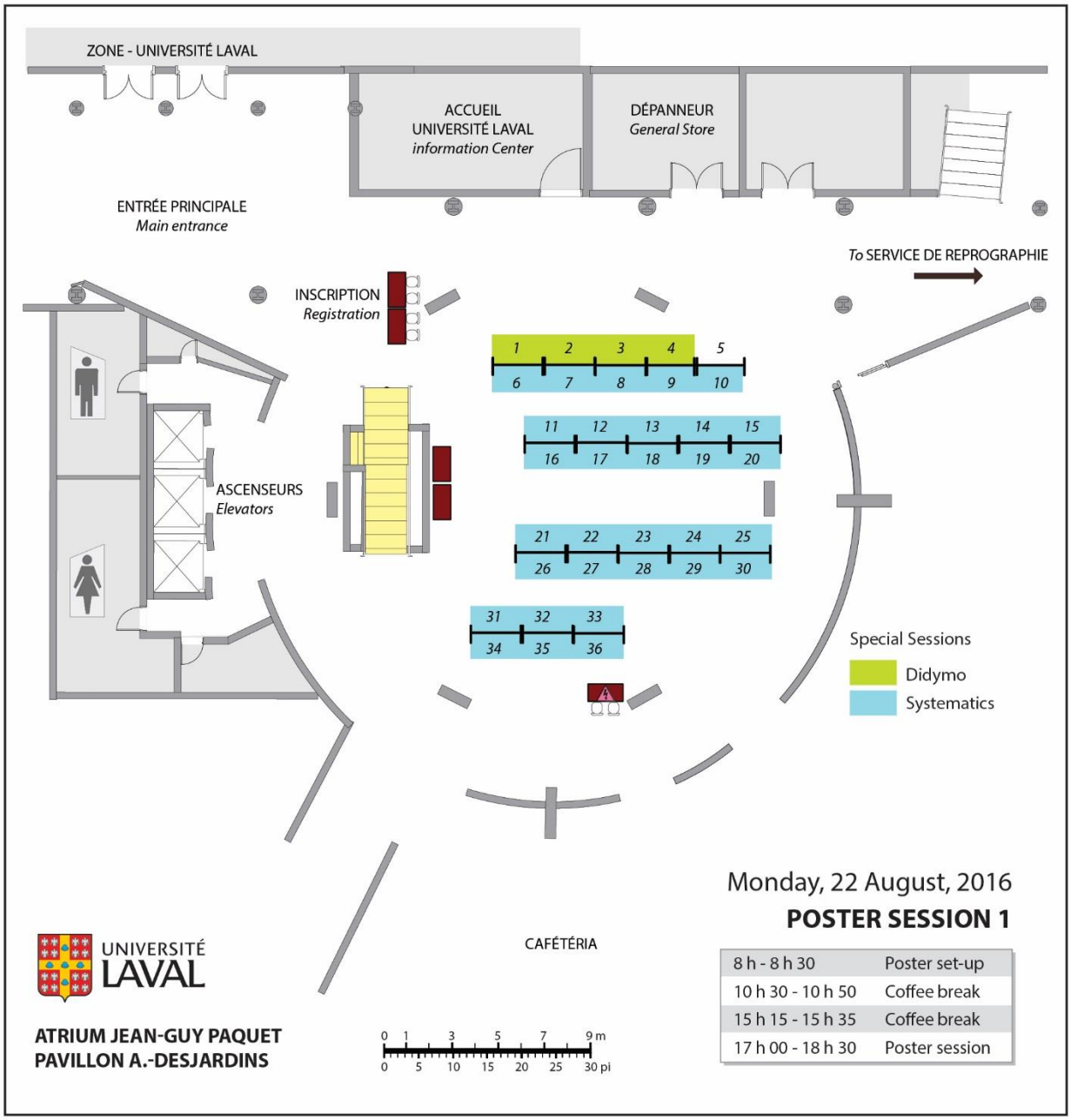
Posters need to be taken down the same day after the poster session.

Poster Sessions at IDS 2016

P-1 Monday, August 22, 2016

Didymosphenia geminata as a nuisance species: P1-1 – P1-4

Diatom systematics into the next century: P1-6 – P1-36

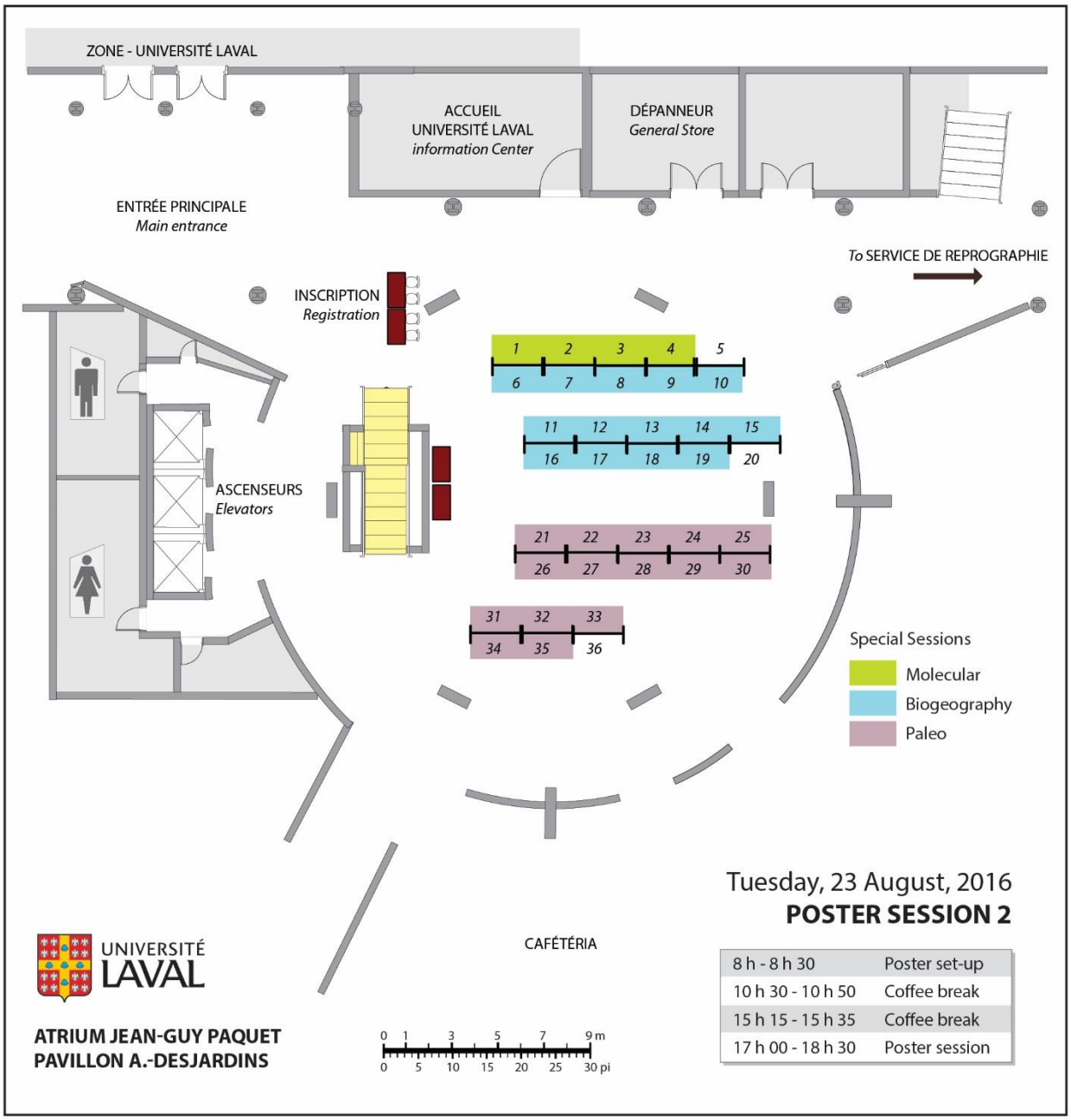


P-2 Tuesday, August 23, 2016

Molecular aspects of diatom biology: P2-1 – P2-4

Diatom biogeography and species traits: P2-6 – P2-19

Diatoms in the paleosciences: P2-21 – P2-35



P-3 Thursday, August 25, 2016

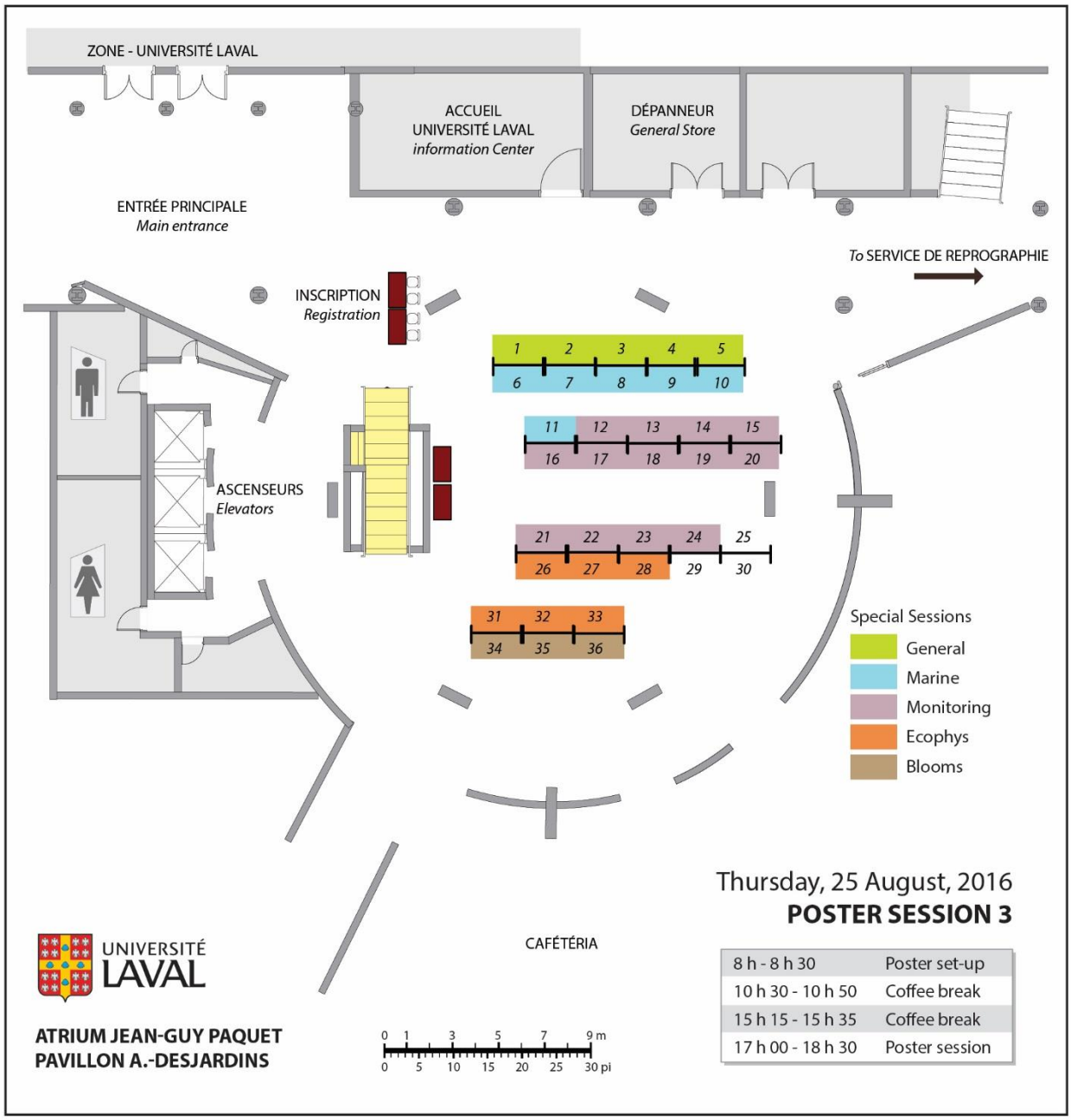
General Topics: P3-1 – P3-5

Marine diatoms / paleoceanography: P3-6 – P3-11

Diatom-based assessments and monitoring of freshwater habitats: P3-12 – P3-24

Ecophysiology of diatoms with emphasis on Diatoms in stressful environments: P3-26 – P3-33

Diatoms and harmful algal blooms: P3-34 – P3-36



Monday, August 22, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

Poster Session 1	Atrium Jean-Guy Paquet
***Didymosphenia geminata* as a nuisance species**	
P1 - 1	Inter-annual variability of the occurrence and severity of *Didymosphenia geminata* throughout the Restigouche River watershed **Carole-Anne Gillis**
P1 - 2	Ecological stoichiometry of juvenile Atlantic salmon diet in eastern Canadian rivers experiencing nuisance growths of *Didymosphenia geminata* **Joshua Kurek**
P1 - 3	Experimental determination of the role of iron on the growth of *Didymosphenia geminata* **Sarah A. Spaulding**
P1 - 4	Has geographic expansion of *Didymosphenia geminata* impacted diatom community structure in rivers of central-southern Chile? **Max Bothwell (First author: M.L. Carrevedo)**
Diatom systematics into the next century	
P1 - 6	Morphological diversity of the rimoportula **Kenta Abe**
P1 - 7	Evolution and structural diversity of the fultoportula **Miho Abe**
P1 - 8	Valve morphogenesis in a multipolar diatom genus *Hydrosera* **Masahiko Idei**
P1 - 9	*Actinocyclus setanensis* a new freshwater diatom from Early Miocene sediment, located in Setana Town, Hokkaido, Japan **Tamotsu Nagumo**
P1 - 10	Epiphytic diatoms on a red alga *Laurencia nipponica* Yamada from Hokkaido, Northern Japan **Tamotsu Nagumo**
P1 - 11	*Seminavis aegyptiaca* sp. nov., a new epilithic diatom species from the estuary of the Damietta Branch of the River Nile (Egypt) **Marco Cantonati**
P1 - 12	The diatom genus *Coscinodiscus*: further observations on *C. alboranii* Pavillard using scanning and transmission electron microscopy **James A. Nienow**
P1 - 13	Observations of the diatom genus *Minidiscus* Hasle (Thalassiosirales, Bacillariophyta) in the northeastern Gulf of Mexico **James A. Nienow (First author: A.K.S.K. Prasad)**

Monday, August 22, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

Poster Session 1	Atrium Jean-Guy Paquet
Diatom systematics into the next century	
P1 - 14	Three new epizoic *Achnanthes* species (Bacillariophyta) living on marine turtles and manatees **Roksana Majewska**
P1 - 15	*Hippodonta fujiannensis* sp. nov. (Bacillariophyceae), a new marine diatom from China **Changping Chen**
P1 - 16	A new extant species of the genus *Pseudopodosira* (Pseudopodosiraceae, Bacillariophyta) from coastal waters of Argentina **Carlos E. Wetzel (First author: E.A. Sar)**
P1 - 17	*Haslea nusantara sp. nov*., a novel species of blue diatom from Indonesia **Jean-Luc Mouget (First author: C. Falaise)**
P1 - 18	A new species of *Eunotia* from the thermal springs in Australia - a relic species in Refugia **Jacob John**
P1 - 19	A new Naviculoid diatom genus from an Inselberg in Western Australia **Jacob John**
P1 - 20	Systematics and Biodiversity: an international peer-reviewed journal **Elliot Shubert**
P1 - 21	Stephanodiscaceae succession from Pleistocene sediments of Lake Peten Itza (Guatemala, Central America): new fossil genus and species **Christine Paillès**
P1 - 22	Araphid, monoraphid and biraphid individuals with rimoportulae in a single diatom taxon Meet a new diatom genus from Venezuela **Jana Veselá**
P1 - 23	The ultrastructure of the apical pore field in raphid and araphid diatoms **Bart Van de Vijver**
P1 - 24	*Psammothidium germainii* in the Antarctic Region **Bart Van de Vijver**
P1 - 25	Taxa of the Orthoseiraceae (Orthoseirales) from Patagonia, Argentina, with comments on the circumscription of the group Arctic **J. Patrick Kociolek**
P1 - 26	The genus *Delicata* in the United States **Mark B. Edlund**

Monday, August 22, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

Poster Session 1	Atrium Jean-Guy Paquet
Diatom systematics into the next century	
P1 - 27	*Semiorbis* in North America **Mark B. Edlund**
P1 - 28	Species of *Gomphonema* with wide axial areas from North America **Karin C. Ponader**
P1 - 29	Application of taxonomic free sorting to *Fragilariophyceae* of the southeastern United States **Ian W. Bishop**
P1 - 30	What do we really know about *Fragilariforma virescens*? **Jovita Yesilyurt**
P1 - 31	Diatom types of REM Archibald from Lake Sibaya, South Africa **Jonathan C. Taylor**
P1 - 32	Monoraphid diatoms genus *Schizostauron* Grunow: the preliminary data on its diversity and a review of the life cycle **Ewa Górecka**
P1 - 33	Examination of the type specimens for *Odontella* and *Zygoceros*, evidence for a new family *Odontellaceae*, and the description of two new genera **David M. Williams (First author: P.A. Sims)**
P1 - 34	I'll have the red pill please: visualizing diatoms and their environment in the virtual universe **Matthew L. Julius**
P1 - 35	Automated diatom image analysis with SHERPA **Michael Kloster**
P1 - 36	Findings on morphological variation of *Fragilariopsis kerguelensis* between glacial and interglacial periods **Michael Kloster**

Tuesday, August 23, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

Poster Session 2	Atrium Jean-Guy Paquet
Molecular aspects of diatom biology	
P2 - 1	Biosynthesis of silver nanoparticles by *Phaeodactylum tricornutum* **Asher Wishkerman**
P2 - 2	*Phaeodactylum tricornutum* co-cultured with *Bacillus* sp. displays enhanced growth **John Sittmann**
P2 - 3	Uncovering the sex determining locus in diatom *Seminavis robusta* **Petra Bulankova**
P2 - 4	Molecular phylogenetic analysis of diatoms (Bacillariophyta) from ancient Lake Ohrid: A species flock perspective **Elena Jovanovska**
Diatom biogeography and species traits	
P2 - 6	Species diversity and geographic distribution of the diatom genus *Skeletonema* along the coast of China **Yahui Gao**
P2 - 7	Diatom assemblages in the western Pacific and eastern Indian Ocean **Ryohei Fujita**
P2 - 8	Morphological and geographical studies of *Terpsinoe americana* (Bailey) Ralfs **Takanori Matsuoka**
P2 - 9	New records of diatom flora from Bangladesh coast, Bay of Bengal **Mahmudur R. Khan**
P2 - 10	Structure of the phytoplankton (diatom) assemblage in the northeastern Gulf of Mexico during 2011-2012 **Courtney M. Bryller**
P2 - 11	*Navicula salinicola/N. perminuta* species complex in New Jersey coastal wetlands **Nina Desianti**
P2 - 12	Observations on some rarely-recorded *Navicula* species from Egyptian inland waters including the recently-described *N. flandriae* **Marco Cantonati**
P2 - 13	First exploration of diatom biodiversity in rivers and streams in the Man and Biosphere Reserve of Yangambi, Tshopo Province, DR Congo **Christine Cocquyt (First author: E. Lokele Ndjombo)**
P2 - 14	New species, new taxon reports and biogeography of the diatom genus *Gomphoneis* Cleve (Bacillariophyceae) in Patagonia, Chubut Province, Argentina **J. Patrick Kociolek**

Tuesday, August 23, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

Poster Session 2	Atrium Jean-Guy Paquet
Diatom biogeography and species traits	
P2 - 15	Diatoms from Bodoquena karstic system, Brazil **Thelma Ludwig (First author: E. Tusset)**
P2 - 16	The Japanese 'endemic' freshwater diatom taxa and its appearance in neighboring nations **Akihiro Tuji**
P2 - 17	Assessing distribution patterns of planktonic diatoms in Lake Superior **Amy Kireta**
P2 - 18	Biodiversity of stream periphyton in response to environmental drivers along a latitudinal gradient in the eastern Canadian Arctic **Jennifer Lento**
P2 - 19	Epilithic and aerophilic diatoms in the artificial environment of Kungsträdgården metro station, Stockholm, Sweden **Lena Norbäck Ivarsson**
Diatoms in the paleosciences	
P2 - 21	Modern and Late Quaternary diatoms of Africa - Quantitative palaeoenvironmental reconstructions: Examples from Tunesia, Kenya and Angola Basin **Leila Ben Khelifa-Jacobsen**
P2 - 22	Pliocene diatom record of Paleolake Hadar in the Afar Depression, Ethiopia **Jeffery R. Stone**
P2 - 23	Novel *Aulacoseira* and *Stephanodiscus* from the Pliocene Hadar Formation, Afar Depression, Ethiopia **Jeffery R. Stone (First author: J. Mohan)**
P2 - 24	Miocene/Pliocene Playa lakes from the Peruvian Altiplano **Maria Velez**
P2 - 25	The Miocene freshwater diatom flora of the Antarctic Continent **Eveline Pinseel**
P2 - 26	Evolution of *Lindavia* (*Pliocaenicus*) species in the Late Pliocene and Pleistocene record from Lake El'gygytgyn, Far East Russian Arctic **Jeffrey Snyder**

Tuesday, August 23, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

Poster Session 2	Atrium Jean-Guy Paquet
Diatoms in the paleosciences	
P2 - 27	A palaeolimnological reconstruction of the nature and timing of Lateglacial – Holocene environmental change, Shetland, UK **Melanie Kingsbury**
P2 - 28	Variations in Holocene precipitation across the western United States **Scott W. Starratt**
P2 - 29	Environmental history of southeastern Pennsylvania valley bottom wetlands and streams reflected in composition of their diatom assemblages **Marina Potapova**
P2 - 30	Unravelling the drivers of diatom evolution in ancient Lake Ohrid: ecosystem resilience and species resistance; a link between geology and biology **Aleksandra Cvetkoska**
P2 - 31	The present is the key to the past – an investigation of the distribution of modern diatom communities in Lake Kinneret (Israel) **Hannah Vossel**
P2 - 32	Past and present: Changes in species diversity in diatom populations within a paleo-core from Lake Towuti, Indonesia **Lucas Wilson**
P2 - 33	Modeling climate-driven lake level change in a southwest Greenland lake using the sedimentary diatom record **Rachel Fowler**
P2 - 34	Environmental DNA preserved in lake sediments: Calibrating a new tool for paleolimnology using diatoms **Joanna Gauthier**
P2 - 35	Millennial-scale variability of diatom paleoproductivity during the last 70 kyr: an equator-to-subtropics comparison along the western African coast **Oscar E. Romero**

Thursday, August 25, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

Poster Session 3	Atrium Jean-Guy Paquet
General Topics	
P3 - 1	Edmund Grove (15th February 1823 - 11th February 1911) and his diatom collection at the Natural History Museum, London (BM) **David M. Williams**
P3 - 2	Diatoms as a quality food resource for zooplankton in a subtropical shallow lake **Denise Matias de Faria**
P3 - 3	Diatom colony lengths: Biomechanics and statistical modelling **Virginia Card**
P3 - 4	Does the chemical composition of diatom stalks code a taxonomic signal in stalked diatoms? Preliminary results of FTIR spectroscopy analyses on *Opephora* spp. **Andrzej Witkowski**
P3 - 5	Cryopreservation of diatoms: tips & tricks **Eveline Pinseel**
Marine diatoms / paleoceanography	
P3 - 6	The marine benthic diatom flora of western tidal flat, Korea **Sang-Ok Chung**
P3 - 7	A review on the studies of Microphytobenthos in and around the Korean tidal flats **Jinsoon Park**
P3 - 8	Tracing environmental changes in the Baltic Sea coastal zone during the last 2000 years **Lena Norbäck Ivarsson**
P3 - 9	Middle and Late Holocene climate forcing on the open Baltic Sea: a diatom stratigraphical investigation from Integrated Ocean Drilling Program (IODP) Expedition 347 sediment core M0063 Landsort Deep **Falkje van Wirdum**
P3 - 10	Holocene diatom assemblages from section JPC/JTC17 (Maxwell Bay, King George Island, South Shetlands) **Marlena Świło**
P3 - 11	Holocene diatom paleoclimatology along the western margin of North America **John A. Barron**

Thursday, August 25, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

Poster Session 3	Atrium Jean-Guy Paquet
Diatom-based assessments and monitoring of freshwater habitats	
Topic: **Marine diatoms**	
P3 - 12	Development of a diatom-based, cost-effective biomonitoring tool for the Saudi Arabian Red Sea coastline **Matt P. Ashworth**
Topic: **Reaction to toxic substances**	
P3 - 13	Diatom teratologies in bioassessment and the need for understanding their significance: are all deformities equal? **Isabelle Lavoie**
P3 - 14	Effects of arsenic in periphytic diatoms after a short-term exposure **Soizic Morin (First author: L. Barral-Fraga)**
P3 - 15	Toxic spill monitoring using diatoms and the implications for cell retention in biofilms **Jonathan C. Taylor**
Topic: **Bioindicators of water quality**	
P3 - 16	Diatoms assemblages as bioindicators of water quality in a transboundary river system: A case study of the Limpopo River Basin, Southern Africa **Ntambwe Albert-Serge Mayombo**
P3 - 17	Use of diatoms as a bioindicator of water quality (The case of Lake Tonga, El Tarf, Algeria) **Hasna Chabaca**
Topic: **Environmental Assessments Streams**	
P3 - 18	Metacommunity structure and community-environment relationships in the Delaware River Watershed: implications for bioassessment using diatoms **Alison Minerovic**
P3 - 19	Diatom diversity and ecological status of Mediterranean rivers in central Italy **Valentina Della Bella**
Topic: **Plankton**	
P3 - 20	Long-term and short-term responses by planktonic and epibenthic diatoms to changing flood patterns and nutrient composition in a Midwestern hardwater stream (USA) **Stephen Main**

Thursday, August 25, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

Poster Session 3	**Atrium Jean-Guy Paquet**
Diatom-based assessments and monitoring of freshwater habitats	
Topic: **Lakes & reservoirs**	
P3 - 21	Eutrophication homogenizes diatom assemblages in tropical reservoirs **Elaine C. Rodrigues Bartozek**
P3 - 22	Long term assessment of ecological status of two karstic lakes (Plitvice Lakes NP, Croatia) using three multimetric diatom indices **Petar Žutinić**
P3 - 23	Do water depth and water-level changes influence the diatom diversity of Yunlong Lake, South China? **Yafei Zou**
P3 - 24	A method for the evaluation of the ecological Integrity of temperate Lakes in Quebec **Roxane Tremblay**
Ecophysiology of diatoms with emphasis on **Diatoms in stressful environments**	
P3 - 26	Probing PSI protein pools for evidence of photoinhibition in *Thalassiosira* species **Natalie Donaher**
P3 - 27	Various lipid accumulation profiles under different nutrient limitations in the diatom species *Thalassiosira weissflogii* and *Chaetoceros muelleri* **Junrong Liang**
P3 - 28	The effect of nutrient limitation on the response of *Cyclotella sensu lato* taxa to light in Arctic lakes **Heera Malik**
P3 - 31	Photoprotection of Arctic ice algae from low and high snow sites during spring **Virginie Galindo**
P3 - 32	FTIR imaging analysis of cell content in sea-ice diatom taxa during a spring bloom in the lower Northwest Passage of the Canadian Arctic **Nikki Pogorzelec**
P3 - 33	What happened to my plastids? - Persistence of functionality in diatom plastids stolen by grazer intertidal benthic foraminifera **Jean-Luc Mouget (First author: T. Jauffrais)**

Thursday, August 25, 2016

Pavillon A.-Desjardins – Université Laval, Québec City

Poster Session 3	Atrium Jean-Guy Paquet
Diatoms and harmful algal blooms	
P3 - 34	*Pseudo-nitzschia simuloris* sp. nov. (Bacillariophyceae), the first domoic acid producer from Chinese coastal waters **Yang Li**
P3 - 35	Phylochips: a tool for routine monitoring of toxic algae and pathogens in aquatic ecosystems **Linda K. Medlin**
P3 - 36	Predominance of the potentially harmful centric diatom *Thalassiosira mala* Takano (Thalassiosiraceae) in plankton net hauls collected from the east coast (Bay of Bengal) of India in December 2015 **James A. Nienow (First author: A.K.S.K. Prasad)**

1st Young Scientists Meeting (YSM)

Where	**Amphithéâtre Hydro-Québec of Pavillon A.-Desjardins, Université Laval**
Day	**Wednesday, August 24, 2016 at 10.50 h**
Time	**10.50 - 12.10**
Leaders	**Hannah Vossel / Olivier Jacques**

We are very pleased to organize the 1st Young Scientists Meeting during this year's IDS. The main idea of this meeting is to bring together the younger generation of diatom scientists in a more informal atmosphere, creating a place to discuss future projects and a platform to stay in contact after the IDS 2016.

For the first time, an early career researcher representative for the ISDR Council will be elected during the YSM and we hope to be able to establish this meeting format in future IDS symposia.

2-3 minutes speed talks – related to any diatom research topic – will be given by the participating students and the best and most creative talks will be award-winning.

AGENDA FOR THE YSM

10.50 – 11.30	Speed-talks given by Bachelor-, Masters- or PhD students
11.30 – 11.50	Election of an Early Career Researcher representative for the ISDR Council and discussion
11.50 – 12.10	Open discussion – Future projects and communication platform

SPEED-TALKS

Name	Title of talk
David R.L. Burge	Diatoms as indicators of wetland disturbance
Marianne G. Camoying	Variations in the phytoplankton community assemblages reflected in adjacent sardine fishery areas
Rachel Fowler	Modeling climate-driven lake level change in a southwest Greenland lake using the sedimentary diatom record
Elena Jovanovska	Unrevealing the evolutionary history of ancient Lake Ohrid: combining deep-drilling geological information with fossil and molecular data of diatoms (Bacillariophyta)
Amy Kireta	Assessing Distribution Patterns of Planktonic Diatoms in Lake Superior
Michael Kloster	(Semi-)automated diatom morphometry with SHERPA
Heera Malik	The effect of nutrient limitation on the response of *Cyclotella sensu* lato taxa to light in Arctic lakes
Ntambwe Albert-Serge Mayombo	Diatom assemblages as bioindicators of water quality in a transboundary river system: A case study of the Limpopo River Basin, Southern Africa
Luis D. Mora Hernández	Building a DNA reference library for river diatoms from central Mexico
Lena Norbäck Ivarsson	Tracing environmental changes in the Baltic Sea coastal zone during the last 2000 years
Eveline Pinseel	Disentangling the evolutionary history and biogeography of the diatoms in the Polar Regions: data from fossils and molecular phylogenies
John Sittmann	*Phaeodactylum tricornutum* co-cultured with *Bacillus* sp. displays enhanced growth
Falkje van Wirdum	Middle and Late Holocene climate forcing on the open Baltic Sea: a diatom stratigraphical investigation from IODP Expedition 347 sediment core M0063 Landsort Deep
Yafei Zou	My opinions on diatom application in Paleolimnology

Special Workshops

Five workshops will be held during the International Diatom Symposium 2016. Each workshop, presenter, scheduled time and abstract are listed below.

W-1 Freshwater monoraphids — Grand Salon — Monday 22 Aug.: 18h30

Lead: **Marina Potapova**, Academy of Natural Sciences, Drexel University (USA), (marina.potapova@drexel.edu)

Are you confused by the new genera names in this group or overwhelmed by the diversity of *Achnanthidium* in your samples? Wonder whether it makes sense trying to separate varieties of *A. minutissimum*? Puzzled by a monoraphid that may be an undescribed species? Don't know how to tell a monoraphid from biraphid diatom? Bring your slides, SEM images, or just questions, and together we will try to solve your problems. We will first briefly talk about the current state of taxonomy and systematics of monoraphids (~30 minutes) and then examine materials brought by participants. Only four microscopes will be available, so it is important that participants inform Dr. Potapova beforehand whether they are planning to bring diatom slides. The workshop is free and open to all IDS attendees, but student members of the International Society for Diatom Research will have the first access to microscopes.

W-2 Gomphonemoids — Grand Salon — Tuesday 23 Aug.: 18h30

Lead: **J. Patrick Kociolek**, University of Colorado Museum of Natural History (USA), (patrick.kociolek@colorado.edu)

This group has over 1000 described taxa, and with a notoriety of significant variation within individual species, the freshwater gomphonemoid diatoms are usually considered one of the most taxonomically difficult groups. There is significant confusion about the circumscription and distribution of the genera, as well as species.

The workshop will contain 3 sections:

The first section of this workshop will present an overview of the group, including the history of the four extant genera (*Gomphonema*, *Gomphoneis*, *Gomphocymbella* and *Gomphosinica*) and their phylogenetic relationships. We also will discuss briefly the unrelated genus *Gomphosphenia*. A discussion of valve features will be offered, and the features used to identify subgroups within each genus will be illustrated and discussed. We will examine typical size diminution series for members of this group, which is important to understand species circumscription. The biogeography of each genus, and the subgroups within each genus, will be presented. And this section of the workshop will conclude with a list of the most helpful publications for identifying species of each genus.

The second section of the workshop will include showing species of each genus, to illustrate how to distinguish the genera and certain species within each genus.

Finally, in the third section, workshop participants will be invited to show specimens of this group to illustrate species and for help in identifying previously-described species or those that may be new to Science. If you are interested in bringing specimens to examine with light microscopy, please let the workshop leader know ahead of time so that we can allocate time to this aspect of the workshop appropriately.

W-3 Terminology — Grand Salon — Wednesday 24 Aug.: 8h30

Co-lead: **Richard W. Jordan**, Yamagata University (Japan), (sh081@kdw.kj.yamagata-u.ac.jp);
Eileen J. Cox, Natural History Museum (UK), (e.j.cox@nhm.ac.uk)

The guidelines on diatom terminology published during the 1970s continue to be cited but are now in dire need of revision. Thus, a working group (called DIATERM) was set up in St. Paul (21st IDS) with subsequent meetings held in Ghent (22nd IDS) and Nanjing (23rd IDS). Small teams of diatomists were given the task of reviewing and revising the terms associated with particular structures (e.g., the raphe, portulae, striae, ribs, pore types, etc.), with a view to producing an authoritative, highly illustrated, account of morphological terminology for diatoms (excluding terminology around sexual reproductive stages, see Kaczmarska et al. 2013). These teams have been asked to prepare posters for the 24th IDS, so that they can receive feedback on the definition and usage of each term. The importance of consistent terminology cannot be over-stressed. The correct application of terminology underpins our understanding of structures, potential homologies and taxonomic decision-making based on morphology. Inconsistent usage or the creation of duplicate terms for the same structure, leads to confusion and the need to repeat observational studies. Therefore, we would like to invite everyone to visit our posters and to join our discussion on what still needs to be done.

Kaczmarska, I., Poulíčková, A., Sato, S., Edlund, M.B., Idei, M., Watanabe, T. & Mann, D.G. 2013. Proposals for a terminology for diatom sexual reproduction, auxospores and resting stages Diatom Research 28:263-294.

W-4 Web-based diatom reference sites — Amphithéâtre Hydro-Québec — Wednesday 24 Aug.: 8h30

Lead: **Sarah A. Spaulding**, INSTAAR, University of Colorado (USA), (sspaulding@usgs.gov)

The Diatoms of the United States web project (westerndiatoms.colorado.edu) has now been available online since 2010. In that time, the project has grown from 3 contributors to over 80 and from 25 species pages to over 700.

The project was established to increase diatomist's access to accurate taxonomic information in order to reduce errors and uncertainty in documenting diatom biodiversity. That is, the project was established to increase taxonomic consistency and accuracy, primarily for survey and monitoring programs in North America.

Is the project on the right track? What are the next steps for online identification tools for diatoms? What is the potential for computer aided identification? The project has developed based on input from the scientific community. This IDS workshop is an opportunity for the community to provide input to direct the future of the resource.

The workshop will include a discussion of copyright and what constitutes fair use as it relates to taxonomic descriptions. We will also consider errors introduced by large databases and the dangers that accompany large data. Participants are also invited to submit topics for discussion, especially to submit topics during the registration process.

W-5 Marine benthic diatoms – internet data base on Atlantic Ocean benthic diatoms

Grand Salon **Thursday 25 Aug.: 18h30**

Co-lead: **Andrzej Witkowski**, Szczecin University (Poland), (andrzej.witkowski@usz.edu.pl);
Matt P. Ashworth, University of Texas at Austin (USA), (mashworth@utexas.edu)

The margins of the Atlantic Ocean are framed with a diverse array of rich coastal habitats, ranging from the polar coasts to temperate upwelling zones to coral reefs. It is well known that benthic diatoms are significant contributors to primary production in the coastal system, but our knowledge of the benthic marine diatom flora in general and on Atlantic Oceans coasts is rather poor and fragmentary. Even where diatom assemblages of American (Canada, USA, Caribbean, Brazil, Argentina) and European (Baltic, North Sea, Great Britain, France, Mediterranean) coasts are at places quite well studied, there is still much we don't know about the ecology of these assemblages. Even estimates of total diversity in the Atlantic (genera and species) are likely to be underestimated, and with the increased reliance on high-throughput DNA sequencing to generate ecological models, the paucity of curated and vouchered benthic marine diatom DNA available in public databases, diatom diversity will likely continue to be underestimated and undervalued.

Based on our own recent culture based projects, largely dedicated to diversity, taxonomy and molecular phylogeny of the Atlantic Ocean benthic diatoms we aim to correct this underestimation with a coordinated effort to sample and characterize these diatoms using microscopy and molecular tools, with the ultimate goal of establishing an internet data base on Atlantic Ocean benthic diatoms. The project shall in large resemble the existing data base of "The Diatoms of the United States" including a peer review system for posting taxa and ecological data with distribution records for taxa. Our plan is to invite diatom researchers from both sides of the Atlantic Ocean, representing the best studied regions, to contribute with their knowledge and with their resources as a start to this webproject. We hope to supplement distribution and ecological records with DNA data from our own or existing cultures. Our own resources include well over 1000 strains isolated from the Atlantic Ocean realm including the Sub-Arctic/Arctic and Antarctic Peninsula taxa and the most fertile and productive systems including the whole Benguela Current. The only continent from which we do not have cultures the yet is South America.

We hope this project will also serve as an anchor-point for study into the geographic distribution of marine benthic taxa (cosmopolitan vs endemic taxa). With the magnitude of data possessed we are already able to identify some marine taxa which are likely cosmopolitan: morphologically and genetically identical with a wide distribution. However, poor taxa sampling is still the major obstacle in the discussion on the distribution of diatom taxa. The ideas behind the grounding of the project on Atlantic Ocean diatoms and examples of globally distributed taxa will be presented during the workshop. We also expect that during the workshop a group of diatomologists willing to join our project will crystalize during the workshop and recognize this will be a great opportunity for researchers who work on marine benthics to get together and share knowledge and expertise.

ABSTRACTS

Plenary Presentations

A hard day's night: diatoms recycle photosystem II in the dark

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Marine diatoms, like all oxygenic photoautotrophs, face light dependent photoinactivation of their Photosystem II complexes, which photooxidize water to generate biosynthetic reductant. To maintain photosynthesis this photoinactivation must be countered by slow and metabolically expensive protein turnover involving proteolysis and ribosomal protein synthesis, in association with the triply stacked thylakoids of diatoms. We tracked daily cycles of the content, synthesis and degradation of Photosystem II protein and function, in a small and in a large marine diatom, under low and high growth light levels. We show that, unlike plants, diatoms maintain an active cycling of Photosystem II proteins even in the dark. Continued protein cycling in dark periods allows the diatoms to catch up to excess photoinactivation accumulated over the preceding illuminated period. The cumulative diel cycling of Photosystem II proteins exceeds Photosystem II inactivation, so the diatoms preemptively recycle functional Photosystem II units before they are inactivated. Through the diel cycle the contents of active Photosystem II centers and Photosystem II proteins change predictably, but are not correlated, generating large changes in the fraction of total PSII that is active at a given time or growth condition. We propose that steady cycling of Photosystem II proteins is driven by the tight integration of chloroplastic and mitochondrial metabolism in diatoms, supporting their success in mixed water environments with variable light.

Diatoms in monitoring and ecotoxicology - Valuable, useful, important, complicated, redundant and beautiful

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So where to start on an overview on diatoms in monitoring and ecotoxicology? One could state confidently that diatoms are valuable indicators of environmental factors impairing marine and freshwater aquatic systems and that diatoms have been found useful for monitoring of lakes and rivers in many countries. One could continue saying that diatoms should be monitored because they are an ecologically important group in most aquatic ecosystems. On the other hand, one could declare that diatom identification is a tedious and complicated task, or wonder if diatom indices might give redundant information in comparison to other methods assessing water quality.

However, research has definitively not stopped at such well-known issues, on the contrary, research on diatoms and their coupling to the environment is a very active topic during the last decades and years. Many countries have just started to use diatoms for monitoring, the development and comparison of different indices is very much ongoing even if it started over a century ago, and marine diatom monitoring is recently discussed. Diatoms are also used to assess the effects of toxic agents on both cell and community level, and single-species populations of diatoms are used to assess the toxicity of chemicals and environmental samples for risk assessment purposes. Trends include the monitoring of diatoms together with soft-bodied algae, the increasing application of functional measures, and the coupling between diatom metrics and ecosystem function. Then, new molecular tools are evolving quickly, bringing up unexpected questions also on taxonomy. Which brings us back to a maybe aged issue: We might want to preserve diatom diversity just because diatoms are so beautiful, even if we need a microscope to see them.

Non-native diatoms: the case of *Didymosphenia geminata* in New Zealand

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New Zealand was the last major isolated, uninhabited land mass on the planet to be settled by humans. Polynesians arrived no more than 750 years ago, and Europeans arrived in serious numbers only in the 1840s. Despite distinctive macro-flora and fauna, the earliest reports on the freshwater diatom flora of New Zealand in the 1860s described a largely cosmopolitan assemblage, even in remote areas. But there were some notable apparent absentees, including distinctive taxa such as *Didymosphenia geminata* (didymo). Therefore, when massive growths of didymo were discovered in a South Island river in 2004, it was immediately treated as a non-native, invasive species, with potential to change river ecosystems. Its incursion into New Zealand seemed to be part of a worldwide expansion of the geographical range of didymo proliferations. Initially, the global expansion was assumed to be caused by the human-mediated spread of an invasive variant. However, experiments, surveys and observations of distributional patterns in New Zealand provided the basis for a proposal that novel didymo proliferations were actually a consequence of environmental change, particularly declines in dissolved phosphorus. In view of New Zealand's largely cosmopolitan native diatom flora, an environmental explanation for proliferations raised the question of whether didymo had always been present in the region, but extremely rare. The overwhelming view in New Zealand is that didymo is non-native, but evidence for that can only ever be circumstantial. I trace the history of didymo in New Zealand, focussing on how what we have learned about it since 2004 supports its status as a non-native species, explains its distribution in New Zealand, and helps with understanding its impacts.

How to build a glass house: from silica morphogenesis in diatoms to a synthetic biology for biominerals

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The intricately structured cell walls of diatoms are composed of amorphous silica (~90 %) and tightly associated organic macromolecules (~10%). Silica biogenesis in diatoms shares many features with the biomineralization mechanisms in other organisms (sponges, mollusk shells, bone) irrespective of differences in the mineral chemistries. Diatoms are unicellular, can be easily cultivated, are readily accessible to genetic manipulation, and are thus excellent model systems for studying fundamental mechanisms of biomineralization. I will present recent discoveries about the molecular machinery for silica biomineralization in diatoms particularly regarding the role of insoluble organic matrices and mineral forming vesicles. I will also provide examples how such insight can be translated to the biological synthesis of biominerals with tailored properties for applications in catalysis and targeted drug delivery.

Toxin-producing diatoms and zooplankton – a co-evolutionary interaction?

Lundholm, Nina[1]

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The number of diatom species reported to produce toxins are increasing, now including 19 *Pseudo-nitzschia* as well as two *Nitzschia* species. These species all produce a toxic amino acid, domoic acid, a potent neurotoxin which may accumulate in organisms grazing on toxic *Pseudo-nitzschia* species e.g., planktivorous fish and shellfish, that may then serve as vectors for DA in the food web. Despite the harmful effects that DA-producing diatoms are known to have on higher trophic levels, only a few studies have explored the relations between toxic diatoms and their immediate grazers. We have studied the interaction between toxic diatoms and their zooplankton grazers in order to reveal how the organisms interact. Are they an example of a co-evolutionary relationship? Questions to be addressed will be: Do the toxins affect the zooplankton organisms and their grazing? Does zooplankton grazing affect the diatoms? How do we understand their interaction? How do the results relate to field data?

Integrating ecological and paleolimnological approaches to interpret diatom records of environmental change

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Sedimentary diatom profiles from lakes have been used to infer the effects of climate, atmospheric chemistry and land use change on lake ecosystems. These inferences rely on understanding the relationships between diatom taxa and environmental variables, which are derived from contemporary studies. Recently, the use of indicator taxa has resurfaced as a tool to decipher sedimentary diatom records. This approach avoids the recently identified problems with community-based approaches such as transfer functions. It focuses on the use of taxa with a strong relationship with the variable of interest (e.g., nitrogen, thermal structure), hence a key step with this approach is better assessment of this relationship. This is often accomplished by using neo-ecological approaches, including experiments and seasonal distribution assessments. In this talk, I will discuss examples of the use of indicator taxa in paleolimnological studies and the approaches used to decipher their ecology, with the goal of enhancing our reconstructions of environmental change.

The evolution of polar diatom biomes

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There is emerging evidence that global biogeographical patterns may differ between major groups of microbial eukaryotes, reflecting their unique evolutionary histories and adaptive potential. Among these, diatoms are particularly amenable for biogeographic studies because of their extraordinary morphological diversity and rich fossil record. Here, I will use the case of high latitude diatom biomes to explore the current and past biogeography of lacustrine diatom floras using a combination of morphospecies inventories of extant and fossil taxa, amplicon sequencing and phylogeographic studies. Lineage sorting by climatic factors and dispersal limitation has left a strong latitudinal gradient in genus-level taxonomic composition. Marked interhemispheric differences in species-level taxon richness and bioregionalisation suggest an important role for speciation and regional extinction in response to past climate and tectonic events. Specifically, in pristine Southern Hemisphere lakes, modern diatom communities appear to have evolved from a distinct Gondwana flora which became impoverished in response to climatic forcing and decreasing habitat availability since the Miocene. Today, lake dwelling diatom floras in (sub)Antarctica have strong affinities with terrestrial floras in the region and lack key functional groups compared to the Arctic. In addition, they show indications for repeated local radiations as well as rare colonisation events. The strong bioregionalisation of microbiota represents a potential obstacle for ecological prediction and paleoecological reconstruction. However, to what extent anthropogenic perturbations of diatom biomes have contingent or deterministic responses remains to be elucidated.

Oral Session Presentations

Gomphonema acuminatum species complex: Evaluation of morphological and molecular characters

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Gomphonema acuminatum s.l. has long been recognized as a highly variable species-complex with broad ecological tolerances in which many species and varieties have been described. Taxonomic discrimination between taxa, however, is hard to unravel because of morphological similarities and high infra-specific variation. The current separation is mainly based on morphological characters of the valve, e.g., the pattern of the central area, density and branching of the striae, the form of the punctae, as well as the outline. In cases where morphological and ultrastructural characters are insufficient for species delimitation, molecular data provides evidence on taxonomy.

In order to differentiate taxa and to assess potential cryptic species, infraspecific variation and biogeographical distribution patterns, 42 uni-algal cultures identified as from the *Gomphonema acuminatum* complex were isolated from environmental samples from Germany, Spain, France, Faroe Islands, Korea, and Mexico. These cultures had been studied by light and electron microscopy, showing overlapping and variable morphological characters within some uni-algal cultures, thus indicating the need of finding more stable morphological characters. In addition, three molecular markers were tested for these cultures.

Recent diatom assemblage changes in shallow lakes of the Selenga Delta, Siberia reveal drivers of environmental change

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Lake Baikal is a World Heritage Site in Siberia, with high levels of biodiversity and endemicity. The Selenga River is the principal source of inflow to Lake Baikal, entering the lake through a floodplain wetland, the Selenga Delta (henceforth "the Delta"). The Delta is a Ramsar Site, containing hundreds of shallow lakes, and providing crucial habitat for migratory birds and spawning fish due to high levels of habitat heterogeneity. Twentieth century anthropogenic activities, including agriculture, industry, hydrological modifications, and climate change, have increased the vulnerability of the lake ecosystems. However, the impacts of such stressors on the Delta ecology have never before been assessed. New research from this region, using diatom-based palaeolimnological reconstructions from sediment cores collected from lakes within (SLNG04 and SLNG05) and around (BRYT02) the Delta in 2014, will allow for the examination of ecosystem impacts and sensitivity in response to human-mediated pressures.

Low diatom concentrations in SLNG04 occur between ~1910-1955 AD, and are synchronous with elevated ostracod abundances and $CaCO_3$, possibly indicating increased alkalinity due to decreased connectivity and lake depth/volume of SLNG04. Diatom concentrations begin to increase ~1960 AD, coinciding with declining ostracod abundances. Breakpoint analysis indicates concurrent (~1960 AD) shifts in SLNG05 diatom assemblages, with declines in *Staurosirella pinnata* and epiphytic species, and increases in planktonic species. Simultaneous assemblage changes in SLNG lakes at this time are likely due to extensive flooding in the Delta resulting from construction of the Irkutsk Dam in the late 1950s, and leading to increased connectivity with the Selenga River. Diatom assemblages of BRYT02 show significant shifts, assessed through breakpoint analysis, at ~1940 and ~1995 AD. Assemblage changes primarily include shifts between Fragilarioids and *Stephanodiscus* spp., and likely reflect increasing nutrient levels, with recent signals of slight recovery. Diatom communities of lakes within and around the Delta appear to be sensitive to changes in both connectivity and nutrients, with possible signs of recovery in recent years related to socioeconomic shifts in southeastern Russia.

Reconstructing the history of coastal eutrophication and quantifying total nitrogen reference conditions in Baltic Sea coastal waters

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Reference conditions are needed to identify the status of present-day ecological conditions and to assess actions needed to achieve a good ecological status under the European Union Water Framework Directive. In the Baltic Sea, nutrient levels of pristine ecosystems are unknown as systematic monitoring of water quality only began in the early 1970s.

Total nitrogen (TN) reference concentrations for the Gårdsfjärden estuary in the Baltic Sea (central Bothnian Sea), which receives discharge from an industrial point-source, have been estimated from diatom assemblages using a transfer function. The training set consists of 229 sheltered sites (combining surface-sediment diatom counts and water chemistry data provided by monitoring programmes) from Baltic Sea coastal areas, the Swedish west coast, Danish waters, Oslo Fjord, and the Netherlands (http://craticula.ncl.ac.uk/Molten).

Before 1920 there is a good ecological status with an assemblage dominated by benthic taxa, high diatom species richness, and low organic sedimentation with well oxygenated sediments. Many diatoms were epiphytic indicating that the sea floor in the estuary was covered with macrophytes. Diffuse laminations started to form in the early 1930s with fully developed laminations in the late 1940s indicating a deterioration in oxygen conditions, loss of bottom fauna, and weak ecosystem functioning. Discharge from the pulp mill peaked between the 1960s and 1980s and poor water transparency changed the available habitats and, consequently, dominant diatom life-forms with the establishment of a planktonic dominated assemblage.

The trend in reconstructed TN-values matches the history of the discharge from the mill, reaching maximum impact during the years of high discharge between 1945 and 1990. Monitoring data, dating back to 1980, can validate the diatom-inferred total nitrogen reconstruction, and our model performs well when measured TN is <400 µg L^{-1} and the diatom analogue quality is fairly good. The reconstructed TN values of 260-300 µg L^{-1} before 1920 could be considered reference nutrient conditions for Gårdsfjärden, even though the industrial history of the paper mill dates back to AD 1685. Diatoms are evidently a sensitive and early warning indicator to changes in nutrient input but in Gårdsfjärden the most obvious change occurs when suitable habitats for epiphytes disappear.

Molecular and morphological investigations of the stauros-bearing, raphid pennate diatoms (Bacillariophyceae): *Craspedostauros* E.J. Cox and *Staurotropis* T.B.B. Paddock and their relationship to the rest of the Mastogloiales

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Several lineages of raphe-bearing diatoms possess a “stauros” which is a transverse, usually thickened hyaline area across the center of the valve. It has been suggested that this structure has evolved several times across the raphid diatoms, but we have noticed similarities beyond the stauros between two marine genera – *Craspedostauros* and *Staurotropis* – in the structure of their pore occlusions. We have isolated, cultured and extracted DNA from several strains of both genera to infer the phylogenetic relationship between these taxa, as well as test the suggested relationship of *Craspedostauros* to *Achnanthes* and *Mastogloia* based on chloroplast morphology. We have also reexamined the morphology of the type species of *Staurotropis* (*S. seychellensis* [Giffen] Paddock) with light and electron microscopy to better describe that species. DNA sequence data (nuclear-encoded rRNA SSU, chloroplast-encoded *rbc*L and *psb*C) suggest that, except for *Mastogloia*, these genera are closely related, though not sister taxa. The DNA phylogeny also suggests that the Mastogloiales are not monophyletic, with clades containing *Achnanthes* and *Craspedostauros* sister to clades containing taxa in the Bacillariales. We also describe two species of *Craspedostauros*, from the Red Sea and Guam, two species of *Staurotropis* from the Red Sea and the Gulf of Mexico and a new genus – *Dreuhlago* – based on DNA and morphological data.

Constructing a phylogenetic classification for the Eunotiophycidae: testing hypotheses for raphe evolution

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The origin of the raphe in diatoms is a widely debated, but yet an unresolved question involving multiple factors in the group's evolution. The diatom sub-class Eunotiophycidae has long been accepted as the first raphid lineage within the phylogenetic tree, but detailed taxon-based investigations of the evolutionary relationships among species on this branch have never been formally conducted. This leaves many unanswered questions concerning the identity and morphology of the first raphid diatoms, and therefore the temporal sequence for raphe evolution. Historically, there are several major competing phylogenetic hypotheses which may be summarized as: 1) the "Eunotioid" and "true raphid" diatoms share a common proto-raphid ancestor and therefore the raphe structure in both groups is homologous; a taxon such as *Peronia* is basal in the evolution of the raphe and the Eunotioid raphe represents subsequent raphe reduction and marginalization; 2) the Eunotiophycidae and Bacillariophycidae raphe structures are homologous and a short marginal raphe structure such as in *Amphicampa* represents the basal lineage; or 3) the raphe structure in Eunotioid and Naviculoid diatoms are independently derived and are therefore analogous, not homologous structures. A detailed morphological phylogenetic analysis using 120 independent characters and 60 taxa was conducted within the Eunotiophycidae and select araphid and Naviculoid species. Particularly *Psuedohimantidium*, a proposed proto-raphid diatom ancestor, and other similar marine epizoic diatoms were included in the analysis. Additionally, a molecular tree with a limited taxon set using gene data available in GenBank was used to corroborate the morphologically-based phylogenetic tree. The idea of *Peronia* as a basal taxon to the Eunotioid diatoms was rejected. Gaps in taxon sampling are identified that may offer further support for either a different Eunotioid raphe ancestor or a separate Naviculoid ancestor. Morphological characters that are particularly informative for phylogenetic analysis are also discussed.

Using automated microscopy and image analyses in intrageneric morphometrics: a case study with Southern Ocean *Fragilariopsis* spp.

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Automatic, including *in situ*, image acquisition methods are explosively spreading in marine research, especially in investigating phyto- as well as zooplankton and other particulates. Automated imaging has also become widespread in medical/histological microscopy, technically coming closest to requirements in light microscopic diatom analyses. Building on these developments, we can now implement substantial parts of an automated diatom imaging workflow, resembling those drafted by the ADIAC project. To reflect the special characteristics of light microscopic images of diatom frustules (relatively simple closed outline shapes, low optical contrast), we developed SHERPA (http://www.awi.de/sherpa), an image segmentation and analysis tool which can be applied as a diatom specific component of high throughput diatom analysis workflows. Although a fully automated process enabling routine diatom counting is still far from becoming reality, we have successfully applied this workflow both in an intraspecific (see presentations by Michael Kloster) and in an intra-generic setting for morphometric analysis. Increasing the speed of analysis is thereby not our main motivation at the moment, much rather an improved precision in morphometric data capture and improved transparency of analysis results. In this talk I will give an overview of the current state of development of automated optical diatom analysis in our group, and highlight the potential as well as some major challenges using examples from Southern Hemisphere species of the pennate diatom genus *Fragilariopsis*.

A comparison of planktonic diatom communities from the summer epilimnia and deep chlorophyll layers in the Laurentian Great Lakes

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Historically, spring diatom blooms have been a major contributor to the overall phytoplankton biomass of the Laurentian Great Lakes, with populations of characteristic "spring" diatoms (including representatives of the genera *Aulacoseira* and *Stephanodiscus*) persisting well into the summer stratified period. Recent pelagic monitoring data has revealed interesting seasonal patterns in the vertical structure and composition of the phytoplankton community. Specifically, there is a marked dissimilarity between phytoplankton assemblages from the summer epilimnia and corresponding deep chlorophyll layers (DCLs). During stratification, diatom biovolume is lower in the epilimnion than in the DCL, and the epilimnetic diatom assemblage exhibits elevated relative abundances of small centric forms, particularly representatives of *Cyclotella* sensu lato. In contrast, DCL assemblages contain many taxa commonly found in spring samples, and likely represent a sunken, relict spring assemblage. Further, diatom cell sizes (both overall and within taxa) are larger within the DCL than the epilimnion. These findings suggest that recent, prolonged periods of stratification associated with climate change have contributed to the rise of *Cyclotella* species and valve size diminution recently reported from Great Lakes paleolinmological records.

Quantitative targeted proteomics and electrochromic shift for measuring photosystem content of marine phytoplankton

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Abundance and stoichiometry data for the photosystems, the intersystem electron transport complexes and the Calvin cycle enzymes are rich in information about light and nutrient acclimation. Quantifying these complexes is essential for understanding limitations on and capacities for photosynthesis. Targeted quantitative immunodetections of conserved subunits (eg. PsbA for PSII; PsaC for PSI) are becoming an established method for absolute measurement of these complexes. An advantage of protein measurements is that they can be done with non-living flash-frozen samples and processed post-field. A pitfall of physical versus functional measures is that in some scenarios, such as during photoinhibition of photosystem II (PSII), physical and functional measures give different values, but such disparities are often meaningful, informing targeted studies of regulation, repair and enzyme kinetics. Electrochromic Shift (ECS) is an alternative and fully independent method to measure the photosystems. The basis for electrochromism is that pigments in the photosynthetic membrane exhibit a shift in their absorption spectra in an electric field, such as that generated in the light by the proton motive force. ECS can be exploited to determine PSI:PSII ratios in living cells. Cross-validation of methods by independent measures builds confidence in results from both approaches and can be useful for ground-truthing of on-way or high-throughput optical measurements or functional measurements from bioassays. We present comparative data from immunoquantitation and ECS for an array of diatom taxa. The physical data fall within established ranges. The basis for similarities and disparities in the photosystem stoichiometries between the methods are discussed.

Seasonality and ontogeny in *Diatoma vulgaris*

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Morphology is at the foundation of diatom taxonomy and therefore when characterizing a species it is important to understand the seasonality and allometry of the taxon. Knowledge of morphotypes can be very important when describing autecological information about a species. Over three summers *Diatoma vulgaris* was studied *in situ* from the epilithon of East Lake Okobojii, Iowa, USA. Populations were observed undergoing annual size restoration in the spring followed by size diminution during the summer. Using Relative Warps shape analysis, allometric trends characterized the variation in valve morphology across the size series. The allometry results were used to compare with taxa in the literature as morphotypes or separate taxa.

Advancement of phytoplankton research in the Philippines: the use of an auto-imaging device (FlowCAM) in the development of an image database of phytoplankton from two key sardine fishery areas in the country

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In the Philippines, baseline to long-term data on phytoplankton composition and distribution are quite limited, if not unavailable, even in major productive fishery sites. This could be attributed to the overall laborious and time-consuming process of field sampling and sample analysis which is commonly done through the conventional microscopy method, and not to mention the relatively few phytoplankton experts in the country. In this study, the pioneering use of an auto-imaging device called FlowCAM is introduced with the main objective of developing a phytoplankton image database of samples collected from two key sardine fishery areas in the country. This database of FlowCAM images was built using the Django web framework based on python programming language. This aims to provide taxonomic information about the different phytoplankton species encountered in the study sites and other important details such as coordinates of the sampling stations and the date and time of sample collection, etc. Ideally, the long-term goal here is to make the database available online and to serve as an interactive platform that can be accessed by other users, to share data as well as assist in phytoplankton identification. The present database can be extended further by continuously populating it with images of phytoplankton samples collected from different sampling periods and from other bodies of water in the country, thereby extending both its temporal and spatial scope. Thus, this has the potential of providing a more systematic and detailed information on the different phytoplankton species found in the Philippines. The phytoplankton species that are currently available as well as other data that can be extracted from the database will be presented and discussed.

Mediterranean-climate streams diatom biodiversity: indications from environmental-assessment studies in two geographically-distant areas

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Streams in Mediterranean climate settings are highly-stressed environments, mainly because of the wide seasonal fluctuation in water quantity. This natural pressure (which may be exacerbated by climate change) requires organisms to be specially adapted. This presents a significant challenge when establishing assessment methods, because discharge fluctuations might obscure the signal of the target environmental stressor (e.g., nutrients). We studied environmental parameters (geomorphology; hydrological, physical, and chemical background) and diatom assemblages using 185 samples from 66 stations in a Cypriot stream network covering an area of 2350 km^2. The detailed taxonomic analysis was carried out based on the latest taxonomic concepts. More than 350 taxa belonging to more than 70 genera were identified. Many interesting taxa were found, and several species new to science were discovered, and their taxonomic and ecological features were characterized. Four species, in the genera *Craticula, Mastogloia*, *Navicula*, and *Ulnaria* were proposed as new to science on the basis of LM and SEM studies, and of careful comparison with similar taxa. For another poorly-known *Ulnaria* species, an amended description and ecological preferences was created. A comprehensive comparison with the somewhat-sparse literature allowed us to use this large and taxonomically-homogeneous database to point out relevant features of Mediterranean-stream diatom assemblages (e.g., principal genera, most characteristic species within the main genera, particularly widespread species, typical genera and species of high-ecological-integrity sites, rare species etc.). To validate the features identified, and to ascertain the relevance of the biogeographical factors among the candidate determinants, after careful taxonomic harmonization, the Cypriot dataset was compared to a dataset from southern California of similar size, generated with comparable taxonomic standards. The streams in California were located in a distant geographic area, but at latitude 32°40` N to 34°40`N, possessing comparable hydrological, physical, chemical and climate settings. The stream diatom flora from southern California was diverse, including seven new to science species belonging to the genera *Amphora, Halamphora* and *Rhoicosphenia*. This comparison has revealed a series of robust features characteristic of Mediterranean-climate stream diatom assemblages, and has allowed us to estimate the extent of associated biogeographical patterns.

DNA Barcoding as tool to identify *Didymosphenia* spp. in Chile: How many species are there?

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Microalgae are one of the most abundant microorganisms in aquatic systems, and several works have shown that invasive microalgae may be highly recurrent in aquatic environments. Among those invaders, *Didymosphenia geminata*, is one of the most aggressive commonly named Didymo or “Rock snot”. The species has been able to establish in rivers and lakes of North America, Europe, Asia, and the Southern Hemisphere. In Chile, Didymo has expanded its range up to 3000 km from 38°S to 53°S. Currently, the genus *Didymosphenia* has 10 recognized species that have been defined based on morphological traits. In Chile, it is still unknown how many Didymo species inhabit and thus, a thorough analysis is essential. Here we attempt to unravel the taxonomic diversity of Didymo in Chile and the spatial distribution of genetic diversity of Didymo. To reach the aim we used a phylogenetic analysis employing DNA barcoding and used molecular markers commonly used which included the nuclear encoded small ribosomal subunit rDNA (SSU), the chloroplast encoded ribulose bisphosphate carboxy-oxygenase large sub- unit (rbcL) and the Citochrome Oxidase I (COI) genes. The data presented herein confirm the presence of *Didymosphenia geminata* in Chile but suggest the presence of local Didymo species. In addition, a spatial genetic structure analysis suggests the hypothesis of multiple introductions of *D. geminata* in Chile.

Long-term lacustrine evolution of the high-altitude Lake Allos (Southern Alps, 2200 m a.s.l) during the Holocene revealed by diatom assemblages

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Lacustrine sediments in mountains represent valuable archives for obtaining a long-term insight on past mechanisms which led to present-day alpine ecosystems. Palaeolimnological studies also offer the opportunity to identify “boundary conditions” within which an ecosystem may change in response to external forcing (i.e. climate and/or human activities) leading to a variety of responses (ranging from gradual to sudden changes).

Lake Allos is the largest, natural high altitude French alpine lake located at 2200 m a.s.l in the “Mercantour” national park. It reaches 1-km-long by 700-m-wide (5 km²) and is 50 meters deep. We studied, within a multidisciplinary framework, long-term aquatic dynamics of this lake using the aquatic bioindicators (diatoms and ostracods) recorded in sediment cores covering the last 13,500 years.

Our results highlight the influence of several factors controlling the past lacustrine ecosystem such as watershed, water chemistry, and changes of land-use. Development of soils and vegetation during the early Holocene led to a lowering of calcium input into the lake followed by the disappearance of ostracods to the benefit of diatoms (ca. 7000 cal. BP). From 7000 to 3300 cal. BP diatom assemblages were mainly dominated by *Puncticulata bodanica* var. *lemanica* in association with benthic species, *Ellerbeckia arenaria* f. *teres* and *Gomphonema* spp. From 3300 to 1500 cal. BP, an increase in small-sized *Pantocseckiella* species (e.g. *P. comensis* and *P. rossii*) might be the sign of stable conditions in a deeper water column. Finally, from 1500 cal. BP, increasing human pressure on vegetation and a recovery of erosive activity on slopes were concomitant to a change in aquatic assemblages composed of more eutrophic species. In response to this evolution of alpine environments, current diatom assemblages are completely different from those that have colonized the lake in the past and, are mainly composed of *Cyclotella cyclopuncta* and *Fragilaria ulna* var. *acus*.

Diatom dynamics in the phytoplankton of a small deep crater lake in East Africa

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Lake Challa, a small deep crater lake near Mount Kilimanjaro on the border of Kenya and Tanzania, is the subject of intensive multidisciplinary studies in order to better understand the impact of climate change in East Africa. Severe droughts and heavy rainfall frequently affect this part of Africa with catastrophic impact on the well-being of the vulnerable rural populations and on their socio-economic systems. Wolff et al. (2011) reported already a tight link between the thickness of annual laminations and interannual rainfall variability. The thickness is mainly determined by variation in the abundance of diatoms. Windy conditions mix the water column to greater depth and stimulate diatom growth due to the upwelling of nutrient-rich bottom water.

The present study demonstrates how reliable the sediments in Lake Challa are to reconstruct past climate changes. The survey of a monthly phytoplankton sampling allowed us to study diatom dynamics in the pelagic for a period of eight years (2007-2014). The results of the quantitative investigation demonstrated great changes in diatom productivity over the study period. A strong interannual variability was also observed during the eight years of the monitoring between the dominant diatoms: the endemic *Afrocymbella barkeri*, a needle-like *Nitzschia* sp. and *Ulnaria* spp. Moreover, a recent sediment core, taken in fall 2015, allowed us to compare the results of the diatom investigation from the phytoplankton survey with those recorded in the recent settled sediment between 2008 and 2013. *Afrocymbella* becomes dominant in the phytoplankton during period of upwelling of nutrient-rich hypolimnion water, notwithstanding the presence of an apical pore field suggesting that the primary habitiat of this taxon probably involves attachment to a substrate. The effects of temperature, wind and precipitation, all affecting the mixing regime and hence the nutrient availability in the lake, are studied to understand the driving forces after the dominance of *Afrocymbella*, needle-like *Nitzschia* or *Ulnaria* in the phytoplankton of Lake Challa. Needle-like *Nitzschia* are known to be a typical component of the phytoplankton in African lakes but during the second half of the 20th century *Ulnaria* appeared and became sometimes dominant in the plankton of the lake.

Analysis of multiple species presence on diatom motile responses to high-light irradiation

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In order to better understand the role of benthic diatoms in the development and maintenance of aquatic ecosystems, it is important to understand the ecological stimuli that regulate their motility within these systems. Our lab is working to understand how species composition, light and other local conditions affect diatom movement. We have characterized the photophobic motility responses of three diatom species (*Stauroneis phoenicenteron*, *Pinnularia viridis*, and *Craticula cuspidata*), and our data suggests that light-stimulated directional responses are characteristic for each species. Moreover, these responses can often be modified by the presence of other diatom species, and this effect can be dependent on the relative abundance of diatom species present. For example, when exposed to high blue light irradiations at their leading tip, *Stauroneis* cells will reverse direction in 34±4 s. However, in the presence of *Craticula* cells, the direction change is delayed in a concentration dependent manner, increasing to 172±39 s when the *Craticula*:*Stauroneis* ratio is 10:1. This effect can be generated quickly, and also appears to be rapidly reversible; the time of response of *Stauroneis* cells to high blue light irradiation increased by ~30% when these cells were subsequently exposed to a large number of *Craticula* cells (e.g. *Stauroneis* cells alone reversed direction upon irradiation after 34±3 s, which increased to 42±2 s after just a few minutes of exposure to a large number of *Craticula* cells). Upon removal from the *Craticula* cells and rinsing in fresh medium, *Stauroneis* returned to a response time of 35±3 s. In both cases the response times of *Craticula* cells to high light exposure were unaffected by the presence of *Stauroneis*. *Stauroneis* cells also had increased response times when placed in medium alone from mixed *Craticula*/*Stauroneis* assemblages. Similar species-dependent effects on adhesion and rates of cell accumulation into light spots were also observed. Understanding such species-dependent modulations of motile characteristics will help determining how diatoms undergo stratification and niche partitioning within a local assemblage.

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Heritability of deformities in diatoms

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Diatom teratologies have intrigued scientists since the XIX century, with respect to the causes and origins of their outbreak. They were mainly observed in long term cultures or under high pollution, and were poorly considered, except recently, as a potential indicator of toxic impairment of freshwaters. However, nothing is known neither about the processes involved in their induction nor on the ecology of these forms.

In this study, we compared morphologically distinct descendants of the same cell line of *Gomphonema gracile* (teratological vs. non teratological forms), by determining their growth abilities, alone and in competition, as well as their physiology (photosynthesis) and behavior (motility) over a typical growth cycle. Contrarily to our expectations, teratological cultures grew faster (0.49±0.04 div/day, vs. 0.44±0.01div/day in the non-teratological forms) and had similar physiological performances as the non-teratological ones. Under the same culture conditions, we were not able to demonstrate any competitive exclusion of one phenotype over the other. Moreover, the deformities were faithfully reproduced over time, and no evidence of decreased viability in teratological forms was provided.

These new insights call into question the common hypothesis that deformed diatoms are altered individuals produced by unfavorable conditions and outcompeted when pollution is removed, thus highlighting ecosystem dysfunction. They call for further investigations on their ecology.

Impact of glyphosate on aquatic ecosystems: experimental analysis using periphytic diatoms (Laguna del Cisne, Uruguay)

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Freshwater ecosystems are essential for the support and development of human societies, and are very sensitive to anthropogenic impacts. The intensification of agricultural practices is a global phenomenon which implies abundant use of fertilizers and agrochemicals. After application to crops, these chemicals may enter aquatic ecosystems through surface runoff and groundwater inputs. Glyphosate is the active ingredient of the most widely used herbicide around the globe. It is often considered relatively safe for biota, although several studies have found adverse effects of both glyphosate and its metabolites, and surfactants on microbial communities, invertebrates, amphibians, fishes, and periphyton. It has also been recently classified as a possible carcinogen by the World Health Organization.

Laguna del Cisne (Canelones, Uruguay) is a lake that has been used, since 1971, as a source of potable water for over 70,000 people. However, intensive agriculture, including the application of glyphosate, has also been present in its catchment for the past two decades. The objective of this study was to determine the effect on a natural periphytic diatom community from Laguna del Cisne of the exposure to different concentrations of glyphosate. Bioassays were carried out for fifteen days, where periphytic diatoms, grown *in situ*, were exposed to 4 concentrations of glyphosate (1, 3, 5, and 10 mgL^{-1}), in addition to a control sample with no glyphosate added. It was done in two seasons: winter 2014 and spring 2015 and samples were taken every five days. The species composition of the diatom community was similar for the two seasons; however, the percent composition of the dominant assemblages differed greatly. In winter, *Melosira varians* was the most abundant species in every sample, while the composition in spring was more evenly distributed. While the spring experiment is still being analyzed, PCA and Multilevel pattern analysis of winter samples have shown clear community changes with increasing glyphosate concentrations. In particular, certain *Nitzschia* species appear to be sensitive to increasing glyphosate concentrations while *Fistulifera* species appear to show tolerance.

Exploring generic relationships within the Cymbellales – a morphological analysis

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D.G. Mann in Round et al. (1990) considered the Cymbellales to comprise four families, the Anomoeoneidaceae, Cymbellaceae, Gomphonemataceae and Rhoicospheniaceae. Taxa within these families all have a single chloroplast with a more or less conspicuous central pyrenoid, but are differentiated on a number of morphological and ultrastructural characters. There are also striking differences in cell shape and symmetry between some of the genera. Traditionally the Cymbellaceae and Gomphonemataceae were separated on cell symmetry, the former containing taxa exhibiting dorsiventral symmetry, the latter being heteropolar. The Anomoeoneidaceae contained isopolar, bilaterally symmetrical taxa, while the Rhoicospheniaceae contained heteropolar or isopolar taxa with some degree of valve flexure in girdle view. Using evidence from ontogeny and ultrastructure, Cox (2002, 2015) suggested a re-arrangement of genera within the Cymbellaceae and Gomphonemataceae, grouping some genera across symmetry groups, for example, placing *Cymbella sensu stricto* and *Didymosphenia* together. There have also been a number of molecular analyses including representatives of this order (Kermarrec et al. (2013), Abarca et al. (2014), Thomas et al. (2016)), which similarly bring the traditional taxonomic arrangement into question. Incorporating more recent generic revisions, this paper will present the results of a cladistic analysis based on the published morphological characters of the genera currently included within the Cymbellales. This study also highlights the need for careful description and consistent use of terminology.

Unravelling the drivers of diatom evolution in ancient Lake Ohrid: ecosystem resilience and species resistance; a link between geology and biology

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Ancient lakes act as “evolutionary cradles and reservoirs” as their prolonged isolation has resulted in high biodiversity and number of endemic lineages. Their great age, high biodiversity and potentially well-preserved fossil records make ancient lakes prime targets for evolutionary palaeoecological research. A ~600 m long continuous sediment sequence retrieved from Europe’s oldest lake, Lake Ohrid (Macedonia, Albania) as part of the ICDP deep drilling campaign, Scientific Collaboration on Past Speciation Conditions in Lake Ohrid, is unique in the preservation of diatoms (Bacillariophyceae) over the last ~2 million years. Here, we present the first results of diatom analysis of the complete sequence at a resolution of ca. 1500 years, comparing with geochemical data to assess the influence of environmental change on evolution of the dominant diatom lineages.

The preliminary biostratigraphic data from core catcher analysis show evidence for evolution within the dominant genus, *Cyclotella*. Ongoing, morphological and taxonomic analyses reveal extraordinary morphological variability within some of the endemic species lineages (e.g., *Cyclotella fottii*, *C. cavitata*). A remarkable example occurs at the penultimate interglacial-glacial transition, ~190−185 ka, 80 m depth, when rhombic-elliptic forms, ultra-structurally similar to *C. fottii*, which dominate between ~290−190 ka, are gradually replaced by elliptic forms and, ultimately, by the typical, round valves of *C. fottii*, which occurs in the modern flora. The bio(geological) data indicate cold, arid conditions and a lake-level low-stand of ~60 m below the present water-level of Lake Ohrid that occurred during the penultimate glacial. This event in the diatom record can represent: i) speciation, ii) extinction or iii) presence of different *C. fottii* eco-phenotypes. Under the third hypothesis, the high morphological plasticity can be further related to high species adaptability, which may promote its resistance to climate and environmental change. This scenario is further supported by the bio(geological) data which shows high ecosystem stability during the last interglacial-glacial period, demonstrating Lake Ohrid’s high resilience may be important in mitigating external disturbances, and ultimately, maintaining its biodiversity. Further analyses of the complete sequence are needed to test the hypothesis for the role of high species resistance and ecosystem resilience in preventing major extinction events in Lake Ohrid.

Reconstructing wetland dynamics in northeastern Iceland in response to climatic change and human impacts over the last 1000 years

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The Svalbarð farm was established in the 10th century and is located in the Svalbarð Valley, which formed on the Þistilfjörður shelf in northeastern Iceland. It is the main farm in the valley and is still active in the present day. Over the last 1000 years, several secondary farms were also established in the valley that had direct and indirect relationships with the Svalbarð farm and were then abandoned. Most of these farms were abandoned at different times, but the reasons for their abandonment remain unclear. Since the 1990s, archaeological studies have been conducted in this valley, but little paleo-environmental research has been done.

The aim of this project is to reconstruct the paleo-environmental conditions of Svalbarð Valley in response to recent climate change and human activity. Specific objectives were 1) to date the established peatlands in Svalbarð Valley and reconstruct their temporal evolution; 2) to document lake evolution in the vicinity of a satellite farm; 3) to estimate the impacts of known climatic periods (Little Ice Age and Medieval Climate Optimum) on the evolution of peatlands and lakes; and 4) to identify anthropogenic signatures present in lacustrine sediments. The following hypothesis was tested: the wetlands located on the northeastern part of the island were affected by climate and anthropogenic activities more than other coastal regions of Iceland because of their location.

Analyses of peat and lacustrine sediment (including plant macrofossils, diatoms and geochemistry) were used to document the environmental changes that occurred over the last 1000 years.

Preliminary diatom results from Chew Bahir, Ethiopia – a contribution to the Hominin Sites and Paleolakes Drilling Project

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The Hominin Sites and Paleolakes Drilling Project (HSPDP) aims to test the numerous hypotheses linking climatic trends, events and variability to human origins and dispersal. Long continuous sediment cores spanning critical intervals of evolutionary history have been obtained from five lacustrine sites close to globally significant hominin sites in eastern Africa. Here we present preliminary results from Chew Bahir in Ethiopia, close to the Omo Valley and providing the environmental context to the oldest known *Homo sapiens* fossils dating back c. 200 ka.

Chew Bahir (4°40'N, 36°50'E; 600 m asl) is in southern Ethiopia between the Main Ethiopian and Kenyan rifts. Today the basin floor is a seasonally inundated playa, covering an area c. 30 km E-W and 70 km N-S. Chew Bahir is classified as an 'amplifier' lake, highly sensitive to climatic fluctuations and an ideal site for palaeoclimate reconstruction. Palaeo shorelines indicate a much larger lake once occupied the basin (Foerster et al., 2012). Chew Bahir straddles the boundary between a tropical equatorial and summer monsoonal climate, influenced by the Intertropical Convergence Zone (ITCZ) and the Congo Air Boundary (CAB). Shifts in the location of these key features of the large scale atmospheric circulation have a profound influence on precipitation and therefore hydrological balance of the basin.

Two parallel cores of 279m and 266m were obtained in December 2014. A team of UK, German and Ethiopian researchers is developing the multi-proxy record for Chew Bahir. A composite sequence has been established, with initial core descriptions completed and high-resolution XRF scanning underway. Preliminary assessment for diatom content indicates poor or no preservation in large sections of core. Diatom-rich zones have been identified within the top 80 m, particularly in the top 5m and centred around 30m and 70m depth. The chronology of these has not yet been established. Species of *Aulacoseira, Stephanodiscus* and *Cyclotella* are common in these zones, indicating open water conditions substantially different to today. Considerable variability within the diatom-rich zones indicates potential for high-resolution reconstructions for specific time periods. Work is ongoing to establish potential for diatom analysis of the lower portion of the core.

Diatom responses to the construction of prehistoric and medieval wetland occupation sites around the Irish Sea

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Crannogs are artificial islands that were constructed in Scotland and Ireland, mainly during the Iron Age and the Early Medieval Period (c. 3000-1000 BP). In this study the impact of crannogs on diatom assemblages will be assessed using two sites: Lough Yoan (LY), a small lake in Co. Fermanagh, Northern Ireland, and Black Loch of Myrton (BLM), a reedy fen in south west Scotland. The results from palaeoecological diatom analysis will be compared with sediment geochemistry (X-ray fluorescence and loss-on-ignition) to infer changes in the catchment and possible shifts in lake hydrology. The diatom assemblages of LY indicate a clear shift coinciding with a peak in XRF Ti, likely to be associated with clay minerals used for crannog construction as the core was from under 10m from the edge of the crannog. After that change the sequence contains sediments rich in macro and micro-charcoal and organic debris associated with crannog occupation. This initial change in the diatom assemblage was probably driven by elevated nutrient levels, as indicated by a shift in dominance from *Aulacoseira* spp. to *Cyclostephanos dubius*, followed by moderate nutrient loading, with increases in *Cyclotella* and *Stephanodiscus* spp., which might indicate a reduced occupation phase. For BLM it was initially uncertain if the site was surrounded by a fen or a lake, due to modern drainage, but diatom analysis indicates that BLM was probably an open body of water for a long period of time. At BLM planktonic diatoms are almost absent (<1%), while tychoplanktonic diatoms (*Staurosirella, Staurosira*, *Pseudostaurosira* and *Stauroforma* spp.) and epiphytic taxa *Achnanthidium minutissimum* and *Gomphonema angustum* are dominant, suggesting shallow (<2m) water and with abundant macrophytes. There is some evidence of eutrophication in BLM, although this is hampered by our understanding of tychoplanktonic taxa. This study highlights the use of diatom analyses on sediment archives near wetland occupation sites, to better understand the environment surrounding them and the history of these unusual archaeological sites.

Exploring the impact of *Didymosphenia geminata* nuisance growths on juvenile Atlantic salmon

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Since 2006, nuisance growths of *Didymosphenia geminata* (didymo) have occurred in the Restigouche River system in eastern Canada. These dense mats have shifted macroinvertebrate community structure and juvenile Atlantic salmon (JAS) prey abundance. To understand the impacts of didymo on JAS, we assessed its effect on prey production, location, and availability. In parallel, we outlined the impact of mats on prey-predator interactions, habitat selection, and growth rates of JAS. Increasing didymo coverage lead to a significant positive relationship between proportions of benthic forays vs. drift forays ($R^2 = 0.54$, $p < 0.001$). This shift in foraging behavior was not triggered by limited drifting prey availability. Isotopic signatures of JAS in didymo-affected sites suggest that these consumers have a more depleted diet resulting in lower lipid content than consumers sampled in didymo-free sites. As for habitat selection, JAS site fidelity is sustained with increasing didymo cover. Further, JAS daily weight gain is significantly lower in didymo-affected sites than didymo-free sites ($p < 0.001$). Underlying mechanisms by which *D. geminata* alters Atlantic salmon habitat will be discussed and the importance of thresholds dynamics will be highlighted.

New finds of Eocene marine diatom assemblages from the Kamchatka region, Russian Far East

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Fossil diatoms occur widely in onshore and near-shore upper Cenozoic stratigraphic sequences of the Kamchatka region, Russian Far East, and are among the primary biostratigraphical tools for the precise dating and correlation of the post-Eocene sedimentary successions in this area. In contrast to relatively well-studied Oligocene through Quaternary floras, data on Eocene diatoms from the region are still quite poor. In general, rare finds of diatoms referred to the Eocene were known only from a few onshore localities lacking direct correlation with calcareous plankton or magnetostratigraphy. In addition, these assemblages lack marker taxa of marine plankton that are used for zonal subdivision in other regions. This hampers the exact dating of diatom floras.

New materials on the Eocene marine diatoms from the Kamchatka region were accumulated during the last years. Eocene diatom assemblages yielding oceanic planktic species have been documented from dredge samples off southeast Kamchatka (the Pacific coast). Middle Eocene assemblage containing planktic diatoms and directly correlated with calcareous plankton has been studied from the Paleogene stratigraphic section of northeast Kamchatka on the Il'pinskii Peninsula (west coast of the Bering Sea).

Data on Eocene diatoms from west Kamchatka (the Sea of Okhotsk-side) were essentially absent. That is why materials obtained recently on Paleogene assemblage from the deep hole drilled off west Kamchatka are of special interest. The presence of *Triceratium* (*Lisitzinia*) *inconspicuum* var. *trilobata*, *Tr.* (*L.*) *brachiatum*, *Cestodiscus trochus*, and *Pyxilla gracilis* are typical of the studied marine diatom assemblage. The co-occurrence of these taxa may imply a middle Eocene age for the studied flora. This is the first record of fossil diatom assemblage containing biostratigraphically-important planktic Eocene species from the Sea of Okhotsk province.

The obtained data are important for an elaboration of biostratigraphic subdivisions based on siliceous microfossils, and contribute to regional correlations of the Eocene strata in Kamchatka. New materials on Paleogene diatom assemblages from the Kamchatka region probably indicate a beginning of relatively wide distribution of diatoms in the peripheral marine basins in the western North Pacific in the middle Eocene.

The apoplast of diatoms - important polysaccharides identified with glycomic approaches

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Diatom extracellular polymeric substances (EPS) have gained a degree of notoriety of late with the emergence of *Didymosphenia geminata* as a nuisance species. Didymo produces huge amounts of EPS in the form of stalks with significant impact on streams worldwide. It is feasible that, at any time, other diatoms may follow suit and ramp up EPS production to the prodigious levels accomplished by Didymo. The variety in form and function of diatom EPS is exhibited in pads, tubes, fibrils, cell coatings including capsules and the organic component of frustules. Determination of the chemical/biophysical properties of diatom saccharides is of critical interest in assignment of structure/function/impact. Glycomics based screening for critical sugars can be accomplished quickly and easily with a toolkit including specific enzymes, lectins, antibodies and mass spectrometry applied in a multifold and iterative process. This approach yields detailed information about and allows prediction of adhesion, cohesion, viscosity, and chemical characteristics of diatom saccharides important in inter- and extra-cellular interactions. A mini-update of our much cited diatom EPS review in the Journal of Phycology ~20 years ago will be presented. We are amassing amazing but true diatom EPS stories. If you have one, please let us know.

Genetic and morphological variation in *Gyrosigma acuminatum* across eastern North America

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Genetic (genotypic) and morphological (phenotypic) expression in the species *Gyrosigma acuminatum* was examined from individuals and populations across eastern North America. Variations in basic valve size (length: 60–155 µm) were present in addition to a wide range in valve shape and morphology. Using *rbcL* and *18S* sequences obtained from isolated *G. acuminatum* specimens from the Ottawa ON area, intraspecific variation was compared between sequences using Maximum Likelihood (ML) and Bayesian phylogenetic analysis (BA) and visualized using haplotype networks. No significant variation was found within the *18S* dataset, however the *rbcL* dataset contained haplotypes. ML and BA trees showed significant branching in the *rbcL* dataset, with one very isolated monophyletic group, this group was represented by two haplotypes within the haplotype network diagram. The nested AMOVA grouped by location showed no geographic structure, however when grouped by collection date, 23.85% (FCT = 0.23848, $p<0.05$) of the variation was identified, indicating variability in lab results was greater than geographic location. Molecular analyses combined with morphometrics suggest that this widely distributed species has evident phenotypic and genotypic variability which highlights the need for a better understanding of total gene expression within diatom taxa.

Cliff-nesting seabirds influence productivity of lakes situated above their colony

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Seabirds that congregate in large numbers during breeding season concentrate marine-derived nutrients to their terrestrial nesting sites, and these nutrients disperse and enhance production in nearby terrestrial, freshwater and marine ecosystems. In the Canadian Arctic, large seabird colonies (>100,000 breeding pairs) nest on cliff faces that drain directly into the ocean, ultimately returning the nutrients back to the marine environment from which they were derived. Here, we assess the degree to which seabird nutrients and metals have been delivered (largely by wind) to coastal lakes in Hudson Strait (Canada) over the past century. We have analyzed the water chemistry and diatom assemblages collected from rock scrapes of ~20 lakes situated above a thick-billed murre (*Uria lomvia*) colony (~400,000 breeding pairs). These samples help identify the main water chemistry variables (e.g., nutrients, conductivity) structuring the modern assemblages of diatoms, as well as identify diatom species associated with bird impacted lake conditions. Diatom assemblages, nitrogen isotopes, and metal/metalloids were analyzed in dated sediment cores collected from three lakes located at increasing distance from the seabird colony to track the long-term influence of murres on these aquatic ecosystems. Elevated nutrients and major ions as well as an enriched $\delta^{15}N$ signature in the sediment cores were measured in the lake <100 m from the cliff compared to lakes > 1 km from the seabird colony. In contrast, similar diatom assemblages were identified across the rock scrapes and in the three sediment cores, suggesting that diatoms are not influenced by enhanced nutrient inputs. Chemical tracers and algal assemblages in the lake near the colony suggest an effect of climate warming on the lake since ~1950, but this effect was more muted in the distant lakes. These pronounced changes in the seabird-impacted lake suggest that with warming air temperatures and longer growing seasons, diminished lake ice may allow for aquatic organisms to more fully utilize the seabird nutrients.

Shifting planktonic microfossil regimes during the Eocene-Oligocene transition: response to Antarctic ice-sheet inception and variability from Maud Rise, Atlantic Sector of the Southern Ocean

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A major climatic reorganization occurred near the beginning of the Oligocene referred to as the Eocene-Oligocene transition (EOT). During the EOT climate changed from relatively ice-free, greenhouse conditions into icehouse conditions with growth of a continental ice sheet in Antarctica. Decreasing temperature and ice sheet expansion had profound effects on paleoceanographic conditions on the Antarctic margin and adjacent ocean. As ice grew, terrigenous input into the oceans increased from the erosive effects of growing ice-sheets. Decreasing temperature may have increased continental aridity and resultant dust flux into the Southern Ocean. These new nutrient supplies may have provided new pathways for more opportunistic species or groups to dominate the pelagic siliceous microbiota, comprising marine diatoms, ebridians and silicoflagellates. To characterize the fluctuating conditions across the EOT, a quantitative analysis of siliceous microfossils was conducted using samples from ODP Site 689 cores located on Maud Rise off the margin of Antarctica, in the high latitude Atlantic sector of the Southern Ocean. This analysis aimed to characterize surface water conditions during shifts in glacial and climatic regime, and to provide a robust high-resolution record useful for comparison with other circum-Antarctic sections. Samples from the cores cover a 1 million years (m.y.) time interval, with samples spaced at approximately 3.3 k.y. intervals. The site 689 record was then compared to existing geochemical and stratigraphic records, providing further insight into the regional effects of ice sheet expansion and influence on oceanic processes. Existing geochemical data indicate two stages of ice growth, with a quiescent period separating the two stages, along with indications that terrigenous input followed a pattern similar to the marine stable isotope record. Across the EOT, the Site 689 siliceous microfossil record exhibits waxing and waning dominance between the various groups of planktonic flora and fauna. The nature of these transient shifts presents an opportunity to better understand the EOT greenhouse to icehouse transition, as well as provide new insight into changes in the ecological structure of the pelagic realm in the South Atlantic sector of the Southern Ocean.

Epiphytic diatoms in Southern Ocean abyssal sediments as a new proxy to reconstruct Antarctic paleoenvironmental changes: implications of floating 'macroalgal biotic oases'

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The stratigraphic occurrence of large, benthic epiphytic diatoms of genera *Arachnoidiscus, Isthmia, Rhabdonema, Gephyra, Trigonium*, and smaller *Achnanthes, Cocconeis, Grammatophora*, and *Rhaphoneis* in sediment cores from Southern Ocean abyssal plain Deep Sea Drilling Project Site 269 reflects a diverse, epiphytic diatom flora that maintained its position in the euphotic zone attached to buoyant macroalgal hosts. Their discontinuous stratigraphic occurrence (often exceeding 10% of the total diatom flora) amongst the background of planktonic diatoms in Core 9 of this site, suggests environmental changes induced by either warm or cold events that controlled the production and/or release of the macroalgae and their attached epiphytes into the deep-sea. Warm events may have led to ice sheet margin retreat and increase of Antarctic neritic space where the macroalgae lived, or alternatively, cold events leading to the formation of anchor-ice on the macroalgae that increased their buoyancy and lift-off into the pelagic realm. Comparison with coeval records from Integrated Ocean Discovery Program Expedition 318 sediment cores will reveal the correct paleoenvironmental interpretation. Stratigraphic intervals rich in epiphytic diatoms suggest episodic times when these floating 'biotic oases' were common in the pelagic Southern Ocean. These displaced benthic communities comprise buoyant macroalgae, epiphytic diatoms, grazing amphipods. Macroalgae attach to coastal substrates with a holdfast, a multi-fingered structure that serves as an anchor that can raft large sedimentary particles into the deep-sea. Amphipods thrive in this community, grazing epiphytic diatoms and producing diatom-rich fecal pellets that sink rapidly to the abyssal seafloor where they accumulate with normal pelagic diatom-rich sediment. Documentation of the epiphytic diatom occurrences offers an opportunity to develop a new paleobiological proxy to interpret Antarctic paleoenvironmental history, specifically to: (1) provide insight into Neogene extent of open marine shelves on the Wilkes Land margin; (2) infer intervals of substantial Neogene ice sheet retreat from interior Antarctic basins; (3) reassess interpretations of terrigenous sediment grains in the deep-sea, inferred previously to result from iceberg-rafted debris in the Southern Ocean that may also result from biological (macroalgal) rafting; and (4) consider the timing for paleobiogeographic dispersal of invertebrate organisms living within macroalgal holdfast communities to Subantarctic islands.

Indexing and registering scientific diatom names and nomenclatural types

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The project "Building a Global Registration and Index System for Scientific Names and Types of Algae", funded by the German Research Foundation (DFG) from 2016 - 2019, aims at giving sound and easy access to scientific names and nomenclatural acts, and will serve as a repository for newly published names. This project has received support by the International Society for Diatom Research (ISDR), the Global Biodiversity Information Facility (GBIF), and the Special Committee on Registration of Algal and Plant Names (including fossils). The system will be open for pre, simultaneous and post publication algae names registration with special focus on diatoms and ambiregnal taxa.

Scientific names, nomenclatural types, and references are essential for diatom research. Nomenclatural types are physical objects linked to a name. Names are the backbone for biodiversity research and the basic entities for indicating taxa in monographs, checklists, red data books, for taxonomy and ecological research as well as for monitoring.

Different name sources and databases have been around for decades. Each data resource has its own focus and value but all resources fail in being complete for all algal names. Index Nominum Algarum (Berkeley, http://ucjeps.berkeley.edu/INA.html) and Catalogue of Diatom Names (developed by CAS) are focusing on names, AlgaeBase is focusing on taxonomic and distribution information, AlgaTerra is focusing on type and reference library data. However, comparing single data entries of names may end up in discrepancies, due to validity, spelling, references, and different authors between data bases. This might be due to the amount of publications, the lack of cross referencing between data bases and the existence of hidden information in scarcely available references. To overcome these shortcomings, the new project will establish a registration system, building on the experience of the former IAPT Registration of Plant Names Database at B. Furthermore, an index linking to relevant data sources will be provided to serve the scientific community.

Refugia as source of speciation in Diatoms - a perspective from flora studies in Australia

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The objective of the paper is to explore the concept of 'refugia' as a source of variation and eventual speciation of diatoms in Australia. Australia as an island continent embraces tropical, subtropical and temperate regions. Seventy percent of its land is arid. Having studied the Australian diatom flora for the past 35 years, I can show that the above geographical elements do influence the basic pattern of the distribution pattern of diatoms. However, I have found ecological barriers behave like 'islands' within this 'Island' nurturing unusual or unexpected species many of them new to science. The concept of 'refugia' as source of variation and eventual speciation is explored through three examples.

1) The dystrophic fresh water bodies in the subtropical islands of Stradbroke and Fraser in the south east of Queensland function as refugia for several new species of *Eunotia, Actinella*, *Eunophora* and *Pinnularia*. The genus *Eunophora* is considered as a Key genus believed to have been excluded from the main land of Austraila and found only in Tasmania the largest island which is part of Australia and, in New Zealand. But I have found *Eunophora* species in the mainland of Queensland close to these islands as well as in a single river in Western Australia. In examining 300,000 year old fossil from Western Australia, I found them abundantly in few samples. So obviously once this genus might have been widely prevalent in Australia but have now become sparse and those two islands are acting as refugia.

2) The inselbergs (Rock outcrops) in the subtropical arid regions of Australia harbour several species of diatoms with unique morphological and life cycle features adapted to surviving the high temperature and short wet period. Within few days of water availability, they exchange genetic materials and settle in their dormant stages.

3) Thermal springs in the arid zones of Australia with its high temperature are not ideal for diatom growth, but I have found some new *Eunotia* species not reported elsewhere. The surface water resources are salty; most of the thermal springs with diatoms are fresh.

All the three environments noted above are also refugia for invertebrates and some plants.

Evolution of marine thalassiosiroid diatoms

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The genera in the Thalassiosirales share a number of key characters: one (rarely two or more) rimoportula – tubular or a simple pore externally, slit-like internally; fultoportula(e) – almost always a ring of marginal fultoportulae, either tubular or as a simple pore externally, and internally as a short buttressed tube surrounded by a number of satellite pores, which varies between species and through geological time; loculate areolae – external valve face usually perforated by foramina (arranged in either a radial, fasciculate, tangential or linear pattern), which may be partially occluded by finger-like projections, and internally by cribra. Alternatively, the external valve face may have tangential or concentric undulations perforated by radially arranged small pores, and internally as radial rows of pores or cribra; split valvocopula – often ligulate. Copulae perforated by numerous pores (loculate only in *Lauderia*); occluded processes – often tubular structures on the valve face, which do not penetrate through to the inner valve surface (e.g., *Lauderia* and *Thalassiosira*). This set of morphological features can be traced back in time through the Cenozoic and into the late Mesozoic.

Both *Praethalassiosiropsis* (Early Cretaceous) and *Thalassiosiropsis* (Late Cretaceous-Late Eocene) lack a rimoportula and marginal fultoportulae, and while the former has a central annular process, the latter possesses a central structure similar to a fultoportula, which in some specimens is surrounded by 'satellite pores'. All *Thalassiosiropsis* specimens have groups of cribral pores reminiscent of *Thalassiosira*. However, the first true thalassiosiroids (Middle Eocene-Early Oligocene) possess a marginal rimoportula, marginal fultoportulae, radial rows of pores, and perforate copulae, while those with groups of cribral pores (i.e., assignable to *Thalassiosira*) first appear in the Miocene.

It's all in the timing: a densely calibrated molecular clock estimate of diatom divergence events

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Speculation on the temporal appearance and diversification of diatoms is varied. Past research has largely focused on identifying the origin of the diatoms. Estimates based upon fossil speculation range from the late Precambrian or early Paleozoic to Triassic. Molecular clock estimates range from the late Paleozoic to Middle Triassic. Little effort, comparatively, has been focused on identifying the timing and divergence of evolutionary subgroups within diatoms; this work has been largely focused on freshwater Thalassiosiroid taxa utilizing both fossil and molecular datasets. Estimates for the origin of Thalassiosiroids range from the Eocene to late Miocene. An abundant literature base exists with ample "well-dated" species specific observations as a result of past and ongoing IODP/ODP/DSDP efforts. Additionally, phylogenetic hypotheses based upon molecular data for diatoms are beginning to coalesce (sort of). We present a densely calibrated molecular clock estimate for diatoms. This estimate was created using the BEAST software package utilizing first and last occurrence estimates gleaned from the IODP/ODP/DSDP literature and a 250+ taxon, three genes phylogenetic hypothesis generated from genbank submissions. Results support a Triassic/ Jurassic origin for the diatoms and reveal multiple, concurrent diversification events within major diatom subgroups. The estimate also corroborates specific fossil and molecular estimates of subgroups and further supports diversification events driven by major geological and ecological transitions. Finally, areas in need of greater taxon sampling are identified for the focus of future paleontological and systematic investigation.

Spatio-temporal distribution and assemblage similarity of planktonic diatom along Bangladesh coast in the Bay of Bengal

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The biodiverse coastal area of Bangladesh in the Bay of Bengal (BOB) has significant regulation by fresh water discharge and mixing within water column. Considering total coastal area into four zones - head of swatch of no ground area near Sundarbans (western), turbulent area in middle (northern-mid), along Cox's Bazar peninsula (eastern) and calm area around Saint Martin's island (south-eastern), in total of 96 planktonic diatom species had been identified by a study from 2013 winter (November-February) – 2015 pre-summer (March-June) from 15 stations, 4 from each zone except eastern. The highest abundance (individuals/m^2) was recorded in western zone with 210,000 – 240,000 in pre-summer 2014 indicating spring bloom; whereas the lowest (55,000 – 80,000) was estimated during winter 2013 in south-eastern zone. Seasonal changes in diatom abundance and diversity was significantly differed showing maximum diversity in pre-summer with high diversity index (2.76 in 2014) and minimum in winter (0.326 in 2013). The species evenness varied from 0.137 (winter 2013) – 0.991 (pre-summer 2015), which signifies minimum variation in individual species percentage contribution to total diatom population in pre-summer and maximum in winter. Multivariate analysis like principal component analysis (PCA) and multi-dimensional scaling (MDS) based on occurrence and magnitude of abundance of diatom indicated that some genera (*Odontella aurita, Biddulphia sinensis, Gyrosigma normanii, Coscinodiscus granii, Bacteriastrum delicatulum* etc.) had specific preferences for water temperature and salinity, and flourished maximally in particular season, while other genera appeared in wide range of temperature and salinity gradient. The similarity analysis also showed that diatom distribution within station and season have very close similarities, but too far similarities between the zones. These results reveal that diatom distribution and assemblage are not totally directed to physical parameters of the zones, but also other parameters like chemical and ecological in Bangladesh coastal area.

eDNA detection versus microscopy observations for assessing presence-absence of *Didymosphenia geminata* in Quebec rivers (Canada)

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Microscopy versus qPCR (quantitative Polymerase Chain Reaction) were compared for the detection of *D. geminata* in biofilms and water filtrates from seven Gaspesie rivers (Canada). Presence-absence diagnosis based on the two approaches was consistent. However, replications were needed at certain sites to observe the presence of *D. geminate* cells by microscopy. This underscores the necessity of replicate analyses, which is cost-effective to achieve when using qPCR in the context of a large scale assessment. qPCR based bioassays successfully demonstrated its capacity to detect the diatom in the two sample matrices, although DNA recovery efficiency was higher for biofilms compared to water filtrates. Microscopy observations showed that few cells were detected in the biofilms at certain sites, whereas the water filtrates were rich in *D. geminate* cells. This suggests that the environmental conditions were not favorable for the establishment of dense mat accrual at the sampling location, and that *D. geminata* was established further upstream in smaller order reaches of the watershed offering suitable habitat requirements.

Diatom community response to accidental ammonium nitrate addition to the river Jagst, Germany

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The river Jagst is a tributary to the Neckar and flows through the Central German Uplands in Baden-Württemberg. Routine monitoring in compliance with the European Water Framework Directive was carried out at four sites during July 2015. In August 2015, a mill next to the river burned down. During the fire-fighting operations a barrel of ammonium nitrate was accidentally spilled into the river. Oxygen depletion led to a large fish kill. The authorities decided to repeat the collection of diatom samples at seven sites about four weeks after the accident. Further sampling will take place in summer 2016.

Diatom sample evaluation followed the German routine monitoring instruction protocol (analysis of 400 valves, calculation of relative abundance and determination of ecological status by combination of the metrics “sum of reference taxa” and “trophic status”). Diatom communities found before the accident indicated moderate ecological status, were very similar between the four sampling sites and dominated mainly by *Amphora pediculus* and *Cocconeis placentula* varieties. After the accident, diatom community and the indication of ecological status changed drastically close to the site of the accident. A large increase in halophilic taxa and a reduction of reference taxa led to an ecological status classification of bad and poor close to the accidental site. Further downstream the river recovered, ecological status and diatom community composition were similar to before the accident.

Late-glacial and early-Holocene palaeoenvironments reconstructed from multi-proxy records, Loch of Sabiston, Orkney, UK

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The Northern Isles of the UK are sensitive to changes in the North Atlantic. Pollen, geochemical and stratigraphic evidence of high magnitude and abrupt changes such as the Bølling/ Allerød interstadial, the Late-glacial/ Holocene transition and events, such as the 8.2 ka event, the MCA and the LIA during the Holocene have been identified in this region. They are strongly influenced by the North Atlantic Oscillation (NAO), which influences both terrestrial and aquatic ecology. However, the paleolimnological record has not been utilized fully here, even though aquatic proxies tend to respond quicker to a change in external forcing then terrestrial proxies. This paper examines the relationship between diatom, pollen and geochemical records from Orkney to determine how synchronous observed changes are, the duration of instability and what is occurring prior to observed tipping points in their responses to change in the environment.

A 4.32 m core was retrieved from the Loch of Sabiston on Mainland Orkney (N59°04'58.6", W001°16'35.9") and was sampled for diatoms, organic content, and pollen. Elemental content and magnetic susceptibility was analysed using an ITRAX µ-XRF core scanner with Bartington MS attachment. The chronology of the core will be confirmed when AMS radiocarbon dates are obtained. Based on the sedimentology, the core encompasses basal glaciolacustrine clays through to Holocene organic lake sediments with stratigraphic evidence for the Bølling/ Allerød interstadial and Younger Dryas.

Loch of Sabiston has a distinct sedimentation record with marl precipitation dominating during periods of increased temperatures, and a return to a silty clay/clay sediment during the colder periods such as the Younger Dryas. The diatom record from the late glacial through the start of the Holocene consistently follows the changes in sediment for example, the association of *Mastogloia lacustris* with marl sedimentation. However, based on cluster analysis, there are discrepancies between the timing of changes in the pollen, diatom and geochemical results. These relationships will be explored using multivariate and time-series modelling such as PCNM and Fisher Information to determine the patterns and scale of diatom instability and to determine the temporal resolution of assemblage shifts and the detection of stable states.

Seasonal changes in valve size distributions of the Southern Ocean diatom *Fragilariopsis kerguelensis*: a window on the species' life cycle

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Little is known about life cycle details in open ocean diatoms, such as the preparation for overwintering or timing of sexual reproduction. We applied SHERPA, a diatom image analysis software, to the valves of *Fragilariopsis kerguelensis* (O'Meara) Hust. captured in a Polar Frontal Zone sediment trap (54°S, 141.45°E, 800m), to investigate these events. The time-series analysis revealed four significant phases:

1) Prolific vegetative reproduction phase: The fraction of smaller valves increased significantly during late spring and early summer, representative of ongoing and potentially rapid seasonal vegetative reproduction.

2) Ceasing vegetative reproduction phase: The bias for a smaller sized population notably reversed from mid-summer through to early autumn, and an increase in the minimum valve size occurred in conjunction with the end of the vegetative productive phase observed from sediment trap fluxes.

3) Sexual reproduction phase: Valves in the initial cell size range (≥ 76µm), from which sexual reproduction can be inferred, occurred principally in autumn.

4) Overwintering vegetative phase: During late autumn and through winter, valve size distributions remained nearly symmetrical with low percentages of smaller valves, and a very low vegetative reproduction rate is hypothesized.

The distribution shift towards smaller valves from Phase 1 reflects the spring bloom event. We hypothesize that initially in Phase 2 the very strong distribution shift may be resultant of two concurrent factors: a) a cessation of the productive phase due to a change in environmental factors (e.g. light, nutrient availability), and b) grazing selection pressure was enhanced on the population due to the rapid increase in smaller valves. We speculate, from our observations during Phases 3 and 4, that an overwintering strategy is in place for the species. In these phases only large cells maintain sufficient storage capacity to survive a Southern Ocean winter, and could even sustain a source of ready supplies for inoculating the population in the next spring season. Such a "tactic" relieves the limitation of minimum size restrictions impacting on enhanced generation cycles. The results of this time-series size analysis from sediment trap fluxes, provides the first indication of the life cycle and survival strategy for *Fragilariopsis kerguelensis*.

Catalogue of Diatom Names Resurrected: DiatomBase will be the new authority resource for diatom names and more

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There has been a long history of Catalogues documenting the names given to the great diversity of diatoms. Some of these catalogues were limited in distribution and impact, including the published catalogues of Habirshaw, Chase and Peragallo. More complete, widely distributed and widely cited catalogues of diatom names included the multi-volume sets of Mills and, especially, Van Landingham. Other, unpublished resources available only by physically visiting them included Index Nominum Algarum (INA, a reference on the names published for all algae) and New Species File at the Academy of Natural Sciences of Philadelphia (ANSP).

The catalogues of VanLandingham, INA and ANSP were collaboratively integrated into a single database and made available on line and presented by Fourtanier and Kociolek as the Catalogue of Diatom Names. It was developed and supported at the California Academy of Sciences, and attempted to resolve conflicts and make additions of names not found, or published subsequently, from these three sources of information. In its first iteration, the Catalogue of Diatom Names contained 64,000+ names derived from over 12,000 references. It debuted in 2005, and in 2010 alone it was accessed by over 30,000 unique IP addresses and over 5,000,000 pieces of information were downloaded. The database kept growing until 2011, but has not been updated since.

Names are an important reference for all aspects of Biology, and the World Register of Marine Species is one portal to access names and other information about species occurring in marine environments. It was developed at VLIZ, and in 2015 it contained over 500,000 names. The source of diatom names for WoRMS has been AlgaeBase.

A new collaboration between the editors of the Catalogue of Diatom Names and VLIZ will result in a new, reliable resource for diatom names, with input from experts worldwide. This new collaboration takes the Catalogue of Diatom Names and integrates it into the VLIZ Aphia database structure, to support WoRMS as well as a standalone resource for diatom nomenclature, called DiatomBase.

This talk describes this history of diatom names and the future organization and development of DiatomBase within the context of VLIZ.

Diatom-based quantitative reconstructions of sea ice and sea surface temperature offshore West Greenland for the past 11000 years

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Distribution of diatoms in the West Greenland marine waters is closely related to oceanographic conditions. The diverse marine ecosystems around Greenland are influenced by a circumventing coastal current originating from the Arctic Ocean with input from North Atlantic current systems and seasonal freshwater inputs from the Greenland Ice Sheet. This species-environment relationship provides a reference for palaeoceanographic reconstruction of the West Greenland marine sediments, based on analogy of present-day and fossil diatoms. The purpose of this study is to identify variability in oceanographic conditions, in particular water temperature and sea ice cover during the last 11000 years in the context of Arctic climate changes.

In this study, long data series from deep sea sediments were compared with surface sediment dataset from the West Greenland region. The former data were collected from Disko Bay during Maria S. Merian cruise in summer 2007 and the latter were collected along the entire West Greenland coast during Paamiut cruises in summer 2014. These datasets were analyzed using diatoms and compared with the remote sensing data providing information on changes in oceanographic conditions, i.e. Sea Ice Concentration (SIC) and Sea Surface Temperature (SST). Our newly developed quantitative reconstruction using 'Transfer Function' shows that oceanographic changes recorded throughout the last 11000 years reflect seasonal interplay between spring (April SIC) and summer (July SST) conditions.

Our record shows significant fluctuation in oceanographic conditions correlated with climate events recorded in the north-east Atlantic region. This fluctuation is linked to the local melting of sea ice/glacial ice and large-scale ocean-climate interactions within the North Atlantic Oscillation and the Atlantic Meridional Overturning Circulation.

Deciphering the chrysolaminarin biosynthetic pathway in the diatom *Phaeodactylum tricornutum* using molecular tools

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Chrysolaminarin is the main storage compound in diatoms, a glucan consisting of linear 1,3-β-chains with 1,6-β-branches. In diatoms, chrysolaminarin is stored in intracellular vacuoles in a non-crystalline form. The biosynthetic pathway of chrysolaminarin in diatoms as well as the involved enzymes so far are poorly investigated. Therefore, we aimed at studying this pathway in the diatom model system *Phaeodactylum tricornutum*. We screened the respective genome and identified genes encoding enzymes that are potentially involved in chrysolaminarin synthesis or modification, including UDP glucose pyrophosphorylases, a -β-glucan synthase and β-1,6-transglycosylases. By expression of GFP fusion proteins in *P. tricornutum*, we determined the respective intracellular localizations of the proteins. We also investigated the functionality of the glucan synthase and the putative transglycosylases from *P. tricornutum*, by applying gene silencing techniques or by complementation of transglycosylase-deficient yeast strains. Silencing of the glucan synthase yielded a number of phenotypic cellular changes including reduced growth, a higher NPQ and a changed thylakoid morphology. Phylogenetic analyses finally revealed that these proteins are conserved between the Stramenopiles, a taxonomic group including diatoms, brown algae and non-photosynthetic Oomycetes. Here, we will present model of the carbohydrate storage pathway in diatoms.

Genetic variation of *Nitzschia traheaformis* Li Ch., Witkowski & Yu Sh. and *N. dubiiformis* Hustedt (sect. Nitzschiae Dubiae) from various geographic regions based on molecular and morphologic data

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In the course of culture-based research on marine benthic diatoms, 28 strains belonging in or close to a recently described species, *Nitzschia traheaformis* Li Ch., Witkowski & Yu Sh. (belonging in *Nitzschia* section Dubiae) were isolated from the Atlantic, Indian and Pacific Oceans, in the Adriatic, Barents, Caribbean, Mediterranean and Yellow Seas and the Sea of Japan. Examination of live, wild samples revealed this species to be one of the most abundant taxa in our collections. We examined the frustule morphology of these strains using LM and SEM, measuring the length, width, stria, fibula and areola density. All strains presented similar ranges of variation in stria and fibula density. They all possessed nitzschioid frustules, with a submarginal canal raphe with the central nodule always present, a constriction at the center of the raphe-bearing valve margin, a broad girdle, and two chloroplasts per cell. The phylogeny of the strains was established based on sequences of small subunit (SSU) of ribosomal RNA and two chloroplast genes (rbcL and psbC). Although the morphology of the strains was consistent, the concatenated three gene tree showed considerable genetic diversity. There was no obvious relationship between the genetic variation and the geographic origin of isolates and a high degree of genetic variation was observed even in strains from the same locality. Based on these results, *Nitzschia traheaformis*, a species originally described from the southern coast of the Yellow Sea, is interpreted to have a very broad geographic distribution and a high adaptability to oceanic water temperature. *Nitzschia traheaformis* seems to be a perfect (indeed, the first well documented) example of a cosmopolitan marine benthic diatom species with high genetic variation.

Molecular investigation of the diatom genus *Envekadea* with remarks on biogeography and new species

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The genus *Envekadea* Van de Vijver, Gligora, Hinz, Kralj & Cocquyt was described in 2009 on the basis morphological investigations of *Navicula hedinii* Hustedt (Gligora et al. 2009). A second species, *Navicula pseudocrassirostris* Hustedt (*Envekadea pseudocrassirostris* (Hustedt) Van de Vijver, Gligora, Hinz, Kralj & Cocquyt, was transferred to the new genus in this original study. New species from this genus were later described, including *Envekadea vanladinghamii* Graeff, Kociolek & S.R. Rushforth and *Envekadea metzeltinii* Lee, Tobias & Van de Vijver (Graeff et al. 2013, Lee et al. 2013). Additionally, *Stauroneis pachycephala* P.T. Cleve was transferred to the genus as *Envekadea pachycephala* (P.T. Cleve) I. Atazadeh & M.B. Edlund (Atazadeh et al., 2014). In all, the genus now includes six species. All these species were studied on the basis morphology, and the systematic position of this genus is unknown. E.J. Cox (2015) considers this genus within the Naviculales, but is uncertain as to its placement within a family.

In our presentation, we will give new data based on a molecular investigation of *Envekadea* and remarks on its systematic position within the raphid diatom tree of life. Comprehensive investigation of samples from marine and brackish water ecosystems like seas surrounding Indonesia, Vietnam, China and others, as well as the Caspian and Black seas allow us to described one new species. Biogeography of the genus is discussed on the basis of these new observations.

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Do polar marine diatoms take up a quantitatively important fraction of dissolved dimethylsulfoniopropionate?

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Dimethylsulfoniopropionate (DMSP), with about 10^9 tons being produced annually in the marine environment, constitutes a major compound in the global sulfur cycle. This widespread algal osmolyte is the principal precursor of dimethylsulfide, a climatically-active trace gas affecting the climate at high latitudes. DMSP also supplies a significant fraction of the sulfur and carbon required for growth of heterotrophic bacteria in surface ocean water. Studies over the last decade have revealed that not only bacteria, but also eukaryotic phytoplankton may take up DMSP from the dissolved pool. However, little is currently known on the mechanisms and quantitative importance of DMSP uptake by phytoplankton. Here we undertook short-term ^{35}S-DMSP uptake kinetic experiments in axenic laboratory batch cultures of three polar marine diatoms (*Thalassiosira gravida*, *Chaetoceros neogracile*, and *Chaetoceros socialis*) to unravel mechanisms whereby dissolved DMSP is taken up by these algal species. DMSP uptake by *C. neogracile* and *C. socialis* was below detection limit, but significant DMSP uptake by *T. gravida* was measured. Results show that cell-associated ^{35}S rapidly increased within the first 5 minutes of exposure to DMSP and then slowly continued to increase over the following 5.5 h exposure period. This biphasic DMSP uptake kinetics is consistent with a fast DMSP adsorption step onto the algal cells followed by slower DMSP internalization by the cells. Pre-exposure of the cells to a culture medium supplemented with 1 mM cysteine for 5 days did not affect initial DMSP adsorption but decreased by 3.8 times the mean internalization rate relative to that measured for algal cells acclimated to the control medium, suggesting that cysteine non-competitively inhibits DMSP uptake. Based on conservative extrapolation of DMSP uptake kinetics measured in *T. gravida* cultures to the complex consortium of diatoms found in oligotrophic marine environments, the fraction of dissolved DMSP taken up by polar diatoms is probably small compared to that taken up by bacteria and (perhaps) other eukaryotic algae. Our results shed new light on the quantitative importance and mechanisms of DMSP uptake by polar marine diatoms.

A comparison of molecular barcodes and morphology of *Neidium* (Bacillariophyta) of North America

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Historically the morphospecies concept has been used in delimitation of diatom species. This has led to confusion between taxa within the benthic diatom genus *Neidium*. In this study samples from Eastern Ontario (Canada), Western Quebec (Canada), Nova Scotia (Canada), Avalon Peninsula, Newfoundland (Canada) and Adirondack Park, NY, (USA) were examined for *Neidium* taxa under LM and SEM. Isolated individuals from the samples were also amplified and sequenced for four molecular markers (*rbcL, psbC, psbA* and *18S*). Phylogenetic reconstructions were completed with the concatenated chloroplast dataset and the *18S* dataset using Maximum Likelihood and Bayesian analyses. The concatenated chloroplast dataset showed a species-level resolution phylogeny of *Neidium* taxa. In contrast the *18S* dataset had a much lower amount of sequence divergence and was unable to differentiate between *Neidium* taxa. We present emended species descriptions and sequence data of four previously described species *N*. *sacoense*, *N*. *longiceps*, *N*. *fossum*, and *N*. *affine*. Additionally, we describe three novel species (*N. lowei, N. promontorium,* and *N. potapovii*) and also describe two additional species which have yet to be named. The distinguishing morphological features of *N. lowei* are its size, valve shape, and longitudinal canal. *N. promontorium* can be distinguished by its valve shape, longitudinal canal and apex along the raphe. *N. potapovii* can be distinguished by its size, valve shape and longitudinal canal. Future taxonomic work which uses single cell multi-gene sequencing techniques may allow for taxonomic confusions within other diatom and protist genera to be resolved.

Lhcx1 knockout causes loss of qE in *Phaeodactylum tricornutum*

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Diatoms possess a high capacity for the fast photoprotection mechanism qE (energy dependent fluorescence quenching), which enables them to populate nutrient rich habitats such as estuaries or upwelling regions, where highly dynamic light conditions prevail. qE of diatoms depends on three factors: 1) a transthylakoidal proton gradient established during illumination, 2) the subsequent de-epoxidation of the xanthophyll diadinoxanthin into diatoxanthin, 3) Lhcx proteins. In the diatom *Phaeodactylum tricornutum* Lhcx1 confers the basic qE capacity, and other Lhcx provide additional qE capacity during prolonged high light exposure. We aimed to produce *P. tricornutum* knockout mutants of Lhcx1 by applying a TALEN approach. We obtained several bi-allelic knockout mutants, where Lhcx1 protein was completely absent. All of those Lhcx1-KO mutants exhibited an extremely reduced qE, which was similar to wildtype qE when de-epoxidation was blocked. Moreover, the Lhcx1-KO mutants were strongly impaired in establishing additional qE capacity under prolonged high light exposure, indicating that Lhcx1 is the master-switch of qE. The *P. tricornutum* Lhcx1-KO mutants are the first loss-of-qE mutants in algae with secondary plastids and may serve as a model to study in depth the mechanism and impact of Lhcx-diatoxanthin dependent qE.

Elucidating retrograde signal transduction processes in the diatom *Phaeodactylum tricornutum*

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The ability of diatoms to rapidly and reversibly respond to changes in environmental cues (e.g., light, nutrients, temperature) is reflected in physiological plasticity. This physiological plasticity has allowed them to rise to ecological prominence over the past 30 million years. However, the mechanisms underlying perception and transduction of these signals remain enigmatic. We postulate that the redox state of the photosynthetic electron transfer chain is a major factor in controlling the expression of nuclear genes. Consequently, we hypothesize that in diatoms, environmental cues are communicated via a retrograde signal transduction (RST) pathways emanating from the plastid. Using our experimental data and the most recent annotation of the *P. tricornutum* genome, we conducted a bioinformatic analysis to identify homologs of proteins that have been identified in signal transduction pathways in higher plants and green algae. Our bioinformatics survey suggests that RST pathways in *P. tricornutum* comprise a simpler, trimmed-down version of those found in the green lineage. However, we suggest that the RST pathway(s) found in extant diatoms are a relic "starter set" of core molecules that were later elaborated upon in other taxa. Currently, we are systematically genetically modifying all of our target genes in *P. tricornutum* to find "environmentally-numb" strains. Here we will present our current RST model and experimental data of our genetically modified strains.

Variable exposure: the ability for periphytic diatoms to track nutrient concentrations over both short and long time scales in tributaries of northern Lake Erie

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Impacts of broad-scale land transformation, including intense agricultural activity, urban development and industrial practice has been an on-going concern to aquatic ecosystems throughout the northern Lake Erie watershed for more than a century. As a result, there is a desire to understand how stressors impact the biotic integrity of both Lake Erie as well as its tributaries. In Ontario, routine water quality monitoring through the Provincial Water Quality Monitoring Network (PWQMN) has been the standard for assessment and basis for decision making. Single-point water chemistry samples only provide a snapshot of conditions and as a result may not be representative of ecological conditions. Biomonitoring, primarily of fish and benthic invertebrate assessment is used to supplement water chemistry monitoring, however, fish and invertebrate diversity can be driven by variation in naturally occurring environmental factors, rather than impacts of anthropogenic stress. To remedy this problem, we examined the change in periphytic diatom communities at 18 stations sampled during four events between 2002 and 2015. Community composition data was transformed into index scores for each event using the Eastern Canadian Diatom Index (IDEC). IDEC scores were compared to contemporary water chemistry samples collected concurrently with diatom samples, averaged water chemistry from the preceding months, and long term water chemistry trends from 2002-2015, using PWQMN data. IDEC scores were found to be more representative of averaged short term Total Phosphorus (TP) concentrations, than single-point contemporary samples. Additionally, IDEC scores were found to closely track long term TP trends, over the course of the study duration. This suggests that assessment of periphytic diatoms act as a reliable proxy for biotic integrity in response to water quality conditions, supplementing single-point water chemistry samples. Furthermore, fluctuations in periphytic diatom community composition closely reflect TP concentrations over long time frames in a predictable and reliable fashion. Combined this lends credibility to the use of periphytic diatoms in streams throughout Ontario, complementing existing aquatic biomonitoring programs.

A comparison of epizoic diatom communities on green turtle (*Chelonia mydas*) from two remote localities

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Diatoms are often some of the earliest colonizers on any marine substrate and it has been suggested that sea turtles should harbour epibiotic diatom communities. Nevertheless, direct evidence of epibiotic diatoms on sea turtles has only recently been provided from loggerhead *Caretta caretta* and olive ridley *Lepidochelys olivacea* turtles.

Here, we present our most recent findings from studies on sea turtle diatoms associated with green (*Chelonia mydas*) turtles from two different and remote localities. Using Scanning Electron Microscopy and techniques involving Critical Point Drying, we examined carapace samples from multiple individuals of green turtles collected in Costa Rica (Atlantic coast) and Iran (Persian Gulf). The examined diatom communities differed largely in terms of abundances, species number, and growth form structure. At both sampling stations, however, attached erect taxa, such as *Achnanthes* spp., *Poulinea* spp., and *Chelonicola* spp., dominated. Twenty-one diatom taxa were found in Costa Rica, but only 6 in the Persian Gulf. Diatoms from both localities were surrounded by large amounts of exopolymeric matrix. Interestingly, in Costa Rican samples, apart from diatoms, abundant mats of bacteria and some filamentous algae were observed, whereas Iranian samples contained diatoms only. This suggests that some diatom taxa might be associated with other epizoic organisms rather than with the turtle itself. Epibiosis in the marine environment is primarily facultative in nature and this is probably the case with the majority of diatom taxa documented here. On the other hand, some diatoms observed in our study are likely to be truly epizoic taxa. The diatom genera, *Chelonicola* and *Poulinea*, have only recently been described from olive ridley carapaces and, so far, have not been observed elsewhere. Therefore, we predict that many more previously undescribed taxa will be discovered with continued research.

Uses of fine level taxonomy in bioassessment **and accuracy indicator power of diatom communities**

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Using diatoms for evaluation of water quality is very desirable for state and national policy makers. More than 300 streams and rivers in the State of Georgia were sampled, processed, and enumerated following standard protocols. The State has several ecoregions, has been under drought conditions for the last three years, and urban areas continue to sprawl. Those facts make it an interesting area for research for future modeling of stream ecosystem ecology based on diatom community analyses. The goal of this research was to compare classifications of Georgia streams based on diatom community composition and physicochemical characteristics. Stream collection sites were classified as least impacted, impacted, or highly impacted. Classes were based on both land use percent value and number of National Pollutant Discharge Elimination System permits in the watershed upstream of the sampling site. Traditional land use based classification of sites related to conductivity, pH, TN, or TP was evaluated. Many of the least impaired samples were designated as reference sites prior to collection and the algal membership from those sites was counted three independent times at three random starting points on two different replica slides. Each sample was counted before and after digestion to ensure diatoms were the dominant algal group in each sample. Identification was performed to the lowest possible level. Diatom biovolumes were documented and population characteristics were compared within the 3 sample groups. Preliminary data suggests that abundance based classification compared well with land use stream classification. Specific species presence and species community combinations (for example, *Cymbella* and *Achnanthidium* representatives) were evaluated as possible indicators. When available within an ecoregion, state or an area, reference sites provide species membership and abundance data that can be compared with historic data and potentially used as a proxy for areas where reference sites are not available.

Presence of the scattered dot-like chloroplast DNA was verified in large *Pinnularia* species

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Mayama & Shihira-Ishikawa (1994) reported dot-like chloroplast DNA (cpDNA) that is scattered throughout the plastid of *Pinnularia nobilis* by using a confocal laser microscope. The configuration of this cpDNA corresponded well to that of the holes observed in chloroplasts of the same species by Geitler (1937). However, using a transmission electron microscope (TEM), Schmidt (2003) advocated that the scattered dot-like DNA belonged to endobacteria and that Geitler's holes were "scars" made by endobacterial invasion/evacuation. Her TEM photographs showed many endobacteria placed on the inward surface of the chloroplast accompanied by some invading bacteria. She also reported that endobacteria moved towards the nucleus during cell division. We accepted her observation, but we never observed endobacteria in our material using TEM and we always observed dot-like cpDNA stained with DAPI even during cell division. Generally, it is easy to prove "presence", but usually it is difficult to prove "absence".

In this study, we observed DAPI fluorescence and the cellular fine structure in the same cell using a confocal laser microscope and TEM. Single cells were embedded in LR White, a water-soluble resin, which allows preparation of ultrathin sections required for TEM observation. Using an ultra-microtome, continuous two adjacent sections were cut manually with a thickness of 200 nm and 50 nm. Confocal laser microscopy showed several DAPI fluorescent dots in 200 nm thickness section. The size of the dots was ca. 500 nm. The DAPI fluorescence disappeared by DNase treatment. TEM observation of the other section revealed no endobacteria and some intermissive parts of thylakoid lamella, namely "scar". These positions corresponded to those of DAPI fluorescence. Detailed observations showed fibrous structures around peripheral part of "scar", which indicate DNA filaments.

Recent research on Cretaceous, Paleogene and Recent silicoflagellate double skeletons

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Recent research has advanced our understanding of silicoflagellate double skeletons. Our prior work demonstrated that two Late Cretaceous silicoflagellate genera with paired skeletons rotated into a Star-of-David configuration differ from all modern silicoflagellate doublets, which have aligned corners. Rare preserved Paleocene and Eocene doublets show three- and four-sided skeletons in both configurations. These two configurations are proposed to represent separate lineages. At present, the doublet configuration cannot be determined based on single skeletons.

Work continues on the exact timing of events in the double skeleton record, from the Early Cretaceous to Recent. Most Cretaceous silicoflagellates, prior to the appearance of three-sided *Corbisema,* lack a basal ring and have limbs that include unusual offset spines and terminal devices whose functional morphologies only became well understood with the construction of physical and computer models of double skeletons. These models show skeletal components of early and modern morphologies to be analogous.

A study of modern *Octactis* double skeletons shows morphologies distinct from modern *Dictyocha* and *Stephanocha* (previously known as *Distephanus*), which have doublets held in place by pikes and strut attachments offset to form a basal ring with a zigzag design when seen in lateral view. *Octactis* has a relatively flat basal ring lacking pikes, with doublets held presumably together by organic material. Some *Octactis* doublets were observed to have a daughter skeleton that lacks an apical ring, similar to the fossil genus *Bachmannocena.* These doublets suggest that *Octactis* may not be as closely related to other modern taxa as is often assumed.

Secondary structure alignment and multiple outgroups confirm the monophyly of the diatom classes using SSU, LSU rRNA genes and plastid genes

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Since 1993, many trees have been produced to infer the phylogeny of the diatoms. The resolution of the monophyly of the three diatoms classes described by Medlin and Kaczmarska in 2004 has been controversial. Medlin and Kaczmarska advocated that the monophyly of the three diatom classes could only be achieved if: 1) a secondary structure of the SSU rRNA gene was used to construct the alignment and not an alignment based on primary structure and 2) multiple outgroups. The evidence for both of these factors in recovering the three clades at the class level is evaluated and reviewed. The use of the secondary structure for the alignment for the SSU rRNA gene seems to be accepted but the use of multiple outgroups has only recently been tested. Taking only bolidophytes or other heterokonts as the only outgroups never produced monophyletic clades in single gene analysis, but will recover a monophyletic mediophyte class in multi-gene analysis using BI or ML but not using a MP analysis, unless it is a weighted analysis. Multiple outgroups including many heterokonts and certain members of the crown group radiation recovered monophyletic classes in single gene and multi-gene analyses. The three classes can be defined by clear morphological differences primarily based on auxospore ontogeny and envelope structure, the presence or absence of a structure (tube process or sternum) associated with the annulus and the presence of the cribrum in those genera with loculate areolae are supported by molecular analyses if the proper conditions are used.

Contemporary limnology and phytoplankton communities of the Ugandan crater lakes

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Western Uganda has >80 crater lakes, which vary in size and limnological characteristics. Early research on (larger) tropical lakes was undertaken in the early 1900s (through to 1930), but it was not until the 1950s that renewed interest in, and study of, smaller tropical lake systems enabled a deeper understanding of limnological and ecological processes affecting these systems. Much of this early work focused on the physical limnology (e.g. by Talling, Baxter, and Beadle) and chemical composition of tropical waters (e.g. by Talling, and Melack), the zooplankton and phytoplankton (e.g. by Hecky, Green, and Ganf), including much work on diatoms (e.g. by Kilham, Talling, and Gasse).

The two outstanding characteristics of the crater lakes of western Uganda are their limnological variety and natural division into groups along major environmental gradients (e.g. a salinity gradient across all lakes, and a total phosphorus gradient across the dilute lakes). This study describes the results of limnological surveys (conducted between 2000 and 2007) of 48 lakes in western Uganda and is reported in terms of their physical, chemical and biological attributes.

The chemical composition of the lakes reflects variations in the regional geology and nutrient inputs; the contemporary diatom assemblages are dominated by *Aulacoseira* and *Nitzschia* species. Results suggest that the input of phosphorus has increased in the recent past, though the relationship between catchment agricultural activity and total phosphorus values is complex, and may be due to several confounding factors such as contribution from large semi-aquatic herbivores and in-lake processes.

The study provides additional data and a much-needed update on the crater lakes of western Uganda. However, in the absence of long-term monitoring data, there is still much that is unknown about the seasonal and inter-annual variability of these systems and their response to environmental change. In the light of increasing human impacts on lakes (such as sediment and nutrient loading from catchment agriculture and tourism development) the monitoring, and understanding, of these systems is a pressing issue, especially with the increasing reliance of remote and vulnerable populations on these systems for the provision of ecosystem services in an uncertain future.

Spatio-temporal population dynamics of the invasive diatom *Didymosphenia geminata* in central-southern Chilean rivers

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We document the distribution of *Didymosphenia geminata* in central-southern Chilean rivers and identify the chemical and physical factors associated with its presence/absence (p/a). Surveys in successive years provided evidence that after five years *D. geminata* could be nearing a biogeographic equilibrium in the region. *D. geminata* databases from extensive biological and environmental surveys in 187 rivers (10 catchments), south of 38°S commenced in November 2010 and ran through May 2013. In addition, data from recent surveys were used. The sites, evenly distributed latitudinally, were climatically characterized. The recent sampling program, following a published species distribution model, was designed to explore *D. geminata* distribution within 13 catchments (34°S - 48°S). An extensive river survey in 2014 (spring-summer) and in 2015 (autumn) included the p/a, and relative abundance of *D. geminata* cells in phytobenthos and in the drift. These p/a results showed that the probability of re-encountering *D. geminata* cells at sites where the species was previously found was significantly high while the probability of finding *D. geminata* cells at sites that previously did not have the species was significantly low. This suggests that the distribution of *D. geminata* cells among suitable habitats was nearing completion. The relative abundance of *D. geminata* cells in the phytobenthos versus in the drift indicates seasonality, with higher proportion of cells in the phytobenthos during the spring-summer than during the autumn. During the final surveys, principle component analysis of chemical and physical characteristics of rivers showed significant differences between rivers with and without *D. geminata*. Based on our observations of the distribution of *D. geminata* cells among rivers with suitable habitat conditions and the fluctuating rate of spread between rivers, we conclude that *D. geminata* is probably in the ending stage of its spatial demographic expansion in Chile surmounting the different barriers of the invasive process.

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Epilithic diatoms in streams from central Mexico: comparison between the morphological and metabarcoding identification approaches

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Environmental DNA (eDNA) metabarcoding is deemed as a promising tool to complement the time-consuming process of morphology-based identification of diatoms, which requires in-depth knowledge of species diversity and of single species variation across the life cycle.

The present investigation compares the diatom composition obtained from the morphological and metabarcoding approaches of freshwater samples from central Mexico.

Five sampling sites were investigated, located in the north-end of the Lerma-Chapala Basin at elevations ranging 2,000 to 2,400 meters above sea level. The sites were sampled seasonally, during the rainy season of 2013 (September-October) and the dry season of 2014 (February 2014). Epilithon samples were scrapped from 5 cobbles at each site to make composite samples and divided into three subsamples: 1) for metabarcoding using Next Generation Sequencing (Illumina MiSeq); 2) for culturing; 3) for morphological identifications based on light and scanning electron microscopy observations. For the metabarcoding identification approach, the first 300 base-pairs of the V4 region of the 18S rDNA gene was used as barcoding marker and GenBank as reference database, as well as our own laboratory reference database.

The resulting community compositions show that the eDNA metabarcoding approach leads to a higher number of taxa. Nevertheless, during the morphological examinations taxa had been identified, that were not found by the metabarcoding approach, highlighting how crucial is to have a good reference database for sequence comparison.

Our results agree with previous studies that plea for the use of both morphological and eDNA metabarcoding analysis for better describing diatom diversity.

Acclimation of a sea-ice diatom, *Fragilariopsis cylindrus*, to simulated polar winter darkness and spring-like return to light

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Polar winter in the Arctic can last as long as 6 months each year at high latitude. During this period, no light is available for photoautotrophic growth. Nevertheless, in spring, as soon as snow and ice melt and as soon as light becomes sufficient for photosynthesis, a sea-ice algae bloom develops, followed by a spring phytoplankton bloom in the surface ocean layers. Therefore, the following question can be asked: How do photoautotrophic communities (mainly diatoms) survive through winter darkness until light returns in spring?

Although dark survival of phytoplankton has been studied for several decades, we still know very little about the physiological and metabolic mechanisms underlying their survival in darkness and growth upon the return of light. Our goal was to understand the acclimation processes at stake both in darkness and during the return to light by closely looking at the changes in intra-cellular content and functional capacity of a polar sea-ice diatom, *Fragilariopsis cylindrus*.

We measured a set of parameters at specific time-points: in the dark from the first days up to 3 months, and upon return to light (30 µmol photons m^{-2} s^{-1}) during the first hours up to 6 days. This set included cell number and cytometry, cellular carbon and nitrogen ratio, lipids and pigments contents, photosynthetic proteins (D1, Rubisco), photosynthetic parameters, photoprotective xanthophyll cycle activity and non-photochemical quenching (NPQ).

Important acclimation processes were documented both during prolonged darkness and upon return to light. A rather stable state was reached few days following transition to dark and was maintained until the return of light: stable cell size and number, low decrease of chl a and fast decrease in photosynthetic capacity that remained low thereafter. Subsequent transition to light rapidly reactivated light-dependent energy flow (within 5 h re-exposure) and cell size and growth rate.

We conclude that during prolonged darkness, *Fragilariopsis cylindrus* enters a « physiologically resting state » by dropping photosynthetic capacity. Nevertheless, thanks to fast photoprotection and renewal of photosynthetic components, rapid recovery of photophysiology occurs already few hours after the return of light, followed by subsequent cell growth (after 1 day).

Variation in morphological characters of diatotepum in relation to valve ultrastructure

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Diatotepum, an organic layer underlining the silicified valve, has been observed from sectioned cells of many diatoms. However, there are only a few reports revealing the intact structure of diatotepum and its functions still remain unclear. In this study, we observed the entire structure of diatotepum from 25 diatom species and compared them with their frustule morphology.

Structure and localization of the diatotepum are not uniform among the taxa compared in this study. Under LM, diatotepum, separated from the silicified frustules and stained with toluidine blue, often exhibited morphology corresponding to the entire theca, whereas in some taxa the structure seemed to be partial, e.g. only corresponding to the girdle areas without a valve counterpart. Under TEM, intact diatotepum, reflecting their thecae shape, were classified into three types based on patterns of the high electron density area, apparently corresponding to the valve ultrastructures, i.e, those with patterns reflecting to 1) areolae, 2) striae, and 3) without pattern. AFM observation revealed that these high electron density areas were thicker than other areas of the diatotepum, suggesting that the thicker part acts as an organic occlusion of the areolae/striae. On the other hand, diatotepum had partial openings at particular areas corresponding the valve penetrations which are (potentially) used for material secretion, such as raphe slits, ocelli and rimoportulae. In EDX analysis, nitrogen, sulfur and phosphorus were detected as components of diatotepum, along with elements of carbohydrate. Thus, it is possible that diatotepum contains proteins and plays an important role in cell functions.

Functions of the diatotepum are discussed particularly with special emphasis on physical protection of the cells.

Combined paleoenvironmental inference models from sediment diatom assemblages and $\delta^{18}O$ analyses of biogenic silica in Nettilling Lake (Baffin Island, Canada) and reconstruction of summer water temperature

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Nettilling Lake (Baffin Island, Nunavut) is currently the largest lake in the Canadian Arctic Archipelago. Recent studies indicate that the Nettilling Lake basin experienced postglacial marine invasion from ca. 8000 cal BP (before present). Around 5000 cal BP, freshwater lake conditions were established following isostatic rebound. To reconstruct environmental conditions during this freshwater phase, we analyzed a 35 cm sediment core taken from the western part of the lake. The age model was established using one radiocarbon date and the paleomagnetic approach. Paleoenvironmental inference models (Joynt and Wolfe, 2001) were applied to down-core diatom assemblages to reconstruct past conductivity, pH, summer water temperature and mean annual temperature. Measured oxygen isotope composition of biogenic silica from the same core were also used as an additional independent proxy to infer summer water temperature. Although there was insufficient diatom silica for analysis in some intervals due to the contamination effect, a fairly good correlation between the two paleotemperature proxies (r= 0.40) exists. This correlation is mainly observed in the oldest section of the core with slightly warmer mid-Holocene temperature and the most recent past, with cooler conditions associated with the Little Ice Age. Over the past 5000 years, the amplitude of the reconstructed summer lake water temperature is on the order of 4.9°C based on diatom assemblage-inferred values, and of 6.5°C, based on the oxygen isotope record. This is expressed mainly as cooling event intervals, with the start of the Neoglacial period and culminating with the Little Ice Age. To the best of our knowledge, this is the first study to combine temperature inferences based on sedimentary diatom assemblages with the isotopic signal extracted from biogenic silica. This combination of proxies provides new and exciting insights for paleotemperature reconstructions and future studies of postglacial environmental changes in Arctic lakes.

Using diatom assemblages to assess the influence of nutrient loading and climate warming on lakes that sustain Lake Trout populations in Ontario, Canada

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Lake Trout (*Salvelinus namaycush*) are a rare and valuable natural resource in the province of Ontario, Canada. Widespread deterioration of Lake Trout habitat due to the depletion of hypolimnetic dissolved oxygen (DO) has prompted concern regarding the amount of suitable habitat available for this species in many Ontario lakes. A variety of stressors can influence hypolimnetic DO (nutrient loading, climate warming, changing inputs of dissolved organic carbon, etc.); however, a lack of long-term monitoring data makes it difficult to disentangle the influence that these stressors have on DO dynamics. Here we examine sedimentary diatom assemblages to determine how Lake Trout lakes have changed over the past ~200 years, specifically assessing stressors that can influence hypolimnetic DO such as nutrient loading and climate change. We selected Lake Trout lakes across Ontario that either have monitoring data for comparison with our paleolimnological inferences, or that have been identified by resource managers as having water quality problems. We examined trends in diatom-inferred total phosphorus (DI-TP) as an assessment of changes in nutrient loading, and explored qualitative shifts in the diatom assemblages to assess the influence of regional climate warming and other environmental stressors on Lake Trout habitat. To date, three lakes in south-central Ontario and three bays from Lake of the Woods in north-western Ontario have been analyzed. The diatom-based TP inference models depict little change or slight decreases in DI-TP in the study lakes over the past ~200 years, confirming available monitoring data and suggesting increased nutrients are not driving DO depletion in these specific Lake Trout lakes. Qualitatively, diatom assemblage shifts in all studied lakes are characterized by increases in the relative abundance of small cyclotelloid taxa and decreases in the relative abundance of heavily silicified *Aulacoseira* taxa. The shifts in the diatom assemblages are indicative of enhanced thermal stability and changes in water-column properties that are associated with regional climate warming, which may lead to depleted deepwater oxygen levels. These data suggest that, to better protect Lake Trout habitat, lake managers should incorporate the influence of warming, in addition to nutrients, into future management plans.

A new method to measure photosynthetic activity in algal mixtures reveals allelopathy between diatoms and dinoflagellates

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Despite the central role of phytoplankton in the Ocean-atmosphere exchanges, our understanding of the forces shaping the dynamics and structure of phytoplankton communities remains limited. One of the major parameters contributing to the ecological structure is allelopathy, i.e. the direct inhibition of the metabolism of competitors thanks to secondary metabolites. Photosynthesis is an ideal probe to study allelopathy between marine microalgae because it is one of its main targets. However, any approach based on photosynthesis remains hampered by a major methodological constraint: the lack of a reliable method allowing the extraction of the contributions and photosynthetic physiologies of the several microalgae comprising a mixture.

We developed an innovative approach based on a physical phenomenon, the electro-chromic shift (ECS) of photosynthetic pigments, when subjected to the electric field generated across the thylakoid by photosynthesis. This innovative method allows a full dissection of the photosynthetic activities of each microalga in mixtures, here a dinoflagellate/diatom assemblage. Indeed, electro-chromic spectra of diatoms and dinoflagellates show different signatures, permitting the extraction of the photosynthetic responses of each species in an assembly. Moreover, all complexes involved in photosynthesis contribute to the generation of the electric field (photosystems, cytochrome b6f) or to its consumption (ATP synthase); this allows a complete deciphering of the photosynthetic function in the two microalgae.

With this method, we observed that the photosynthetic activities of the diatoms *Thalassiosira pseudonana* or *Phaeodactylum tricornutu*m are inhibited by 80% when mixed with the dinoflagellate *Amphidinium carterae*. In the laboratory, we studied the mechanism of the inhibition of the diatom's photosynthesis, and how this interaction depends on the physiological state of the two species and growth conditions (light, temperature and nutrients). The annual event of diatoms and dinoflagellates bloom in the estuary of the Penzé (Roscoff, France) gave us the opportunity to demonstrate that the ECS-method can provide us with the specific photosynthetic activities of diatoms and dinoflagellates *in situ.* This new method is therefore a powerful tool for studying *in situ* and in real time the cellular mechanisms that are key determinants of the structuration of the phytoplankton community in the ocean.

The history and current status of *Didymosphenia geminata* in Lake Superior

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While historic periphyton records for Lake Superior are sparse, reports suggest that the diatom *Didymosphenia geminata* has been part of the benthic community and readily collectable since at least 1961. However, since 2008 researchers have witnessed blooms of *D. geminata* along Lake Superior's North Shore that seem more extensive and regular than previously recorded events. Seasonal periphyton collections were made along the North Shore of the lake typically from Duluth to Grand Marias, Minnesota, from 2010-2016 to characterize the timing and extent of recent blooms. The morphology of recent *D. geminata* valves were compared among North Shore sampling sites and to other North American populations and historic Lake Superior samples using a Generalized Procustes Analysis procedure. We found *D. geminata* to be relatively consistent in shape over time and among North Shore locations. This suggests that environmental factors, rather than a recently introduced strain are responsible for the increase in blooms found in Lake Superior. Environmental changes that may have triggered these events are discussed. We also present evidence that the duration of these blooms are increasing within the lake.

Opening Pandora's box: species diversity, evolutionary history and biogeography of the *Pinnularia borealis* species complex

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Because of their immense diversity, the systematics of protists, and diatoms in particular, is complex and challenging. Since species taxonomy has far-reaching consequences for our understanding of diatom evolutionary history, ecology and biogeography, detailed studies into species limits and diversity are needed if we are to advance our understanding of the range dynamics and diversification of diatoms. However, the biogeography and ecology of (pseudo)cryptic diatom species is highly understudied and there are virtually no data available on the timing of lineage splitting within species complexes. Recent advances in next generation sequencing currently make it possible to undertake such large-scale molecular based studies. In the present study, we used the semi terrestrial diatom complex *Pinnularia borealis* Ehrenberg as a case study for speciation, evolutionary history and biogeography of diatoms and more generally microscopic eukaryotes.

During field campaigns on various localities, including Arctic and Antarctic regions, more than 500 samples from (semi)terrestrial habitats were collected. About 25 % of these contained living *P. borealis* cells. In total, more than 700 monoclonal cultures were established. A five-marker molecular phylogeny of *P. borealis* was reconstructed and time calibrated using five *Pinnularia* fossils. Species accumulation curves were calculated to assess the sampling coverage. Although morphological differentiation between several lineages is incomplete, automatic species delimitation based on molecular methods revealed the presence of at least 42 species-level lineages worldwide. The age of the complex is estimated at 30-47 million years old and the diversification of *P. borealis* started between 15 and 27 million years ago. Whereas some lineages are cosmopolitan, most seem to have a very restricted geographic distribution, including most Maritime Antarctic lineages. Whenever lineages were recovered from several localities, various haplotypes were found, suggesting phylogeographic patterns.

Altogether, the results indicate a high degree of hidden species diversity in *P. borealis* worldwide, and hint at a high regional species diversification in Maritime Antarctica and the presence of regional endemics in the (sub)Antarctic. The topology of the phylogenetic tree and the age of the lineage splitting suggest multiple independent colonization events in or out the Antarctic and Arctic regions during the past 20-30 million years.

Hypoxia in Lake Erie is mostly driven by diatoms

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When it comes to harmful algal blooms in Lake Erie, cyanobacteria get all the attention. Re-eutrophication of the lake has resulted in a renewed call for remedial measures such as reductions of phosphorus loads, which should presumably reduce algal biomass. However, winter-spring blooms of diatoms have not been fully recognized as a source of algal biomass supporting summer hypoxia. We compared spring and summer phytoplankton abundance in central and western Lake Erie based on monitoring data to show that spring phytoplankton biovolume was 1.5- to 6-fold greater than summer biovolume and that most spring biovolume was composed of filamentous diatoms, primarily *Aulacoseira islandica*, that is likely supported by an increasing silica load from Lake Huron. The rise of silica export was attributed to the dreissenid mussel invasion and establishment that reduced diatom abundance in Lake Huron and thereby increased silica availability in the receiving water body of Lake Erie. Winter-spring diatoms, not summer cyanophytes, are likely contributing the majority of the carbon load to the hypolimnion of the central basin of Lake Erie, so remedial measures aimed at reducing hypoxia in Lake Erie must consider these early-year blooms as important contemporary features of the lake that deliver algal biomass to the profundal zone.

A diatom functional-based approach to assess changing environmental conditions in temporary depressional wetlands

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Functional-based assessments to identify the effects of human-induced disturbances on diatom communities are increasingly used. However, information on the response of functional groups to natural disturbances in temporary depressional wetlands is limited although important for the development of temporary wetland biological assessments. We assessed how diatom life-form and ecological guilds responded to a seasonal hydrological and hydrochemical gradient in three least human-disturbed, temporary depressional wetlands. We assigned species to their respective life-form and ecological guild groups and compared metric composition along the gradient. Overall, temporal variability in alkalinity and ionic composition, essentially Na^+, as well as hydrological factors, wetland depth and total relative evapotranspiration (ETo), were good predictors of diatom species and functional group composition. Low profile guilds dominated by pioneer life-forms showed the strongest relationship with higher disturbance levels (i.e. increasing Na^+, alkalinity with a decrease in depth). Similarly, the planktonic guild and mucous, rosette and adnate life-forms dominated at higher disturbance levels whereas the high profile diatoms displayed the reverse trend. Our study shows the effectiveness of functional-based assessments beyond traditional species-based approaches for understanding and predicting community responses to temporal changes in environmental conditions. We also highlight the benefit of using both life-forms and ecological guilds where a broad set of metrics can enhance our understanding of the mechanisms relating diatom composition to environmental stressors and provide signs of underlying ecological processes.

Morphology and ecology of a new centric diatom from Northeastern China, *Lindavia khinganensis* sp. nov.

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During an investigation on the diatom communities of volcanic lakes of Northeastern China a new species belonging to the "*Cyclotella comta* species complex" was observed. This taxon forms relatively large populations in the phytoplankton of Lake Tuofengling Tianchi, a 33m-deep, oligotrophic, crater lake located in Inner Mongolia. In this paper, the valve morphology and ultrastructure of this taxon is described using light and scanning electron microscopy and a new name, *Lindavia khinganensis sp. nov.*, is proposed. A discriminant analysis based on morphological SEM data confirmed that *L. khinganensis* is distinct from other *Lindavia* species with a similar morphology such as *L. balatonis* (Pantocsek) Nakov et al., *L. praetermissa* (Lund) Nakov et al., *L tenuistriata* (Hustedt) Nakov et al. and *L. lacunarum* (Hustedt) Nakov et al. In addition, the seasonal and interannual distribution of *L. khinganensis* was investigated using sediment trap samples collected over a two-year period. Limnological data from Lake Tuofengling, including water chemistry and temperature recording from a thermistor chain provided complementary information about the ecology of this new species. Finally, the analysis of a short sediment core revealed that *L. khinganensis* has been a major component, both in terms of relative abundance and biovolume, of the diatom plankton flora of Lake Tuofengling for at least the past 600 years. This species was not found in any other lakes from Northeastern China that we investigated and we may assume that it has a limited biogeographical distribution.

Diatom-bacteria interactions in marine intertidal biofilms: nature, constraints and specificity

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Since their origin, diatoms have shared their habitats with bacteria. It is becoming increasingly clear that this has resulted in the coevolution of often highly specific interactions, ranging from antagonistic to symbiotic. Especially in biofilms, interactions are assumed to be intimate and intense. However, little is known about the exact nature of these interactions, what biological and environmental factors constrain them, and how specific they are. In order to better understand the importance of diatom-bacteria interactions, we studied associations and interactions between bacteria and intertidal benthic diatom species, with a focus on the species complex around *Cylindrotheca closterium*. While our experiments show that different diatom species harbour distinct bacterial communities, we found no evidence for clade-specificity within the *C. closterium* species complex. Instead, amplicon sequencing revealed a strong environmental and geographic signal in the associated bacterial communities of about 80 *C. closterium* strains from various tidal flats in The Netherlands, Belgium and Northern France. Diatom competition experiments with and without bacteria showed that bacteria altered the outcome of competitive interactions and as a result biofilm species composition. Diatom-bacteria co-culture experiments evidenced both antagonistic and synergistic effects of bacteria on *C. closterium* strains. Apart from effects of the bacteria on diatom fitness, the bacteria also caused remarkable behavioural changes in growth form and aggregation patterns in the diatoms. Positive effects on diatom growth were especially pronounced under nutrient-limited conditions. Several *Marinobacter* strains strongly inhibited diatom growth, but this effect did not always persist and could vary even between different isolates from the same *Marinobacter* strain. Whole-genome comparisons between an inhibitory *Marinobacter* and closely related *Marinobacter* strains revealed pronounced interspecific differences in sequences coding for mobilome elements such as plasmids and transposons, suggesting that these could be involved in the inhibitory effect on diatom growth, and offering a potential explanation for the loss of this antagonistic effect in some strains. Ongoing research is now focusing on diatom-bacteria signalling mechanisms, and the use of transcriptomics and metabolomics to uncover the genes and pathways underlying the observed interactions.

The proliferation of lake snow in South Island lakes: a new case of diatoms as a nuisance in New Zealand freshwaters?

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Over the past 12 years, many rivers in New Zealand's South Island have been invaded by the stalk-producing diatom *Didymosphenia geminata* (Lyngbye) M. Schmidt, 1899. The fouling of NZ's pristine rivers therefore exacerbates the recent discovery of a rare phenomenon coined "lake snow" in two of the South Island's large iconic lakes: Lakes Wanaka and Wakatipu, located near Queenstown. Lake snow consists of suspended macro-aggregates in the water column composed of non-toxic algae, detritus, bacteria and protozoans embedded in a gelatinous polysaccharide matrix. It has only been reported from a few lakes worldwide, including Lake Constance (Germany) and Lake Youngs (USA). However, marine snow, which is the result of the diversion of fixed carbon into compounds secreted to the environment under conditions of nutrient stress and characteristic of some marine diatoms, is not a rare phenomenon. Lake snow has been present in Lake Wanaka for over 10 years. Last year (2015) it was reported for the first time in another lake, Lake Coleridge (around 270 km away), and more recently in Lake Wakatipu (May 2016). Our microscopic observations of lake snow suggest that the culprit for the presence of this mucilaginous substance in these ultra-oligotrophic lakes is the planktonic diatom *Lindavia intermedia* (Manguin ex Kociolek and Reviers) T. Nakov et al. 2015 (ex *Cyclotella bodanica* var. *intermedia* Manguin ex Kociolek & Reviers 1996), typically found in cold and alpine lakes around the world. There is currently no information on its status as a native or introduced species in New Zealand. Furthermore, the enumeration of diatom remains in the sedimentary record of Lake Wanaka found that its arrival in the lake coincided with the first reports of lake snow by local fishermen in 2004. Will *L. intermedia* do to the South Island's pristine lakes what *D. geminata* has done to its rivers?

C:N:P:Si stoichiometry of *Chaetoceros socialis* growing on different nitrogen sources at low and high light

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Warming induces sea ice melt and an increase in river discharge in the Arctic Ocean. These changes strengthen vertical stratification and impact the availability of light and nitrogen (N) in the upper ocean, thereby affecting growth conditions for primary producers. Because primary production is generally N-limited during summer in the Arctic Ocean, it is crucial to evaluate how the growth rate and elemental stoichiometry of phytoplankton respond to the availability of different N sources under contrasted irradiance. We examined the biochemical and physiological responses of *Chaetoceros socialis* RCC2046, a cosmopolitan diatom commonly associated with subsurface chlorophyll maxima (SCM) in Arctic waters, to the supply of ammonium (NH_4^+), nitrate (NO_3^-) or urea as sole N source for the cells grown at subsaturating and saturating photon flux. Growth rate, external nutrient concentrations and internal inorganic nutrient pools were measured together with particulate N, carbon (C), phosphorus (P) and biogenic silica (Si). *Chaetoceros socialis* was able to grow with the three N sources at both light intensities. At subsaturating light, growth rates were similar in the presence of NO_3^-, NH_4^+ and urea. Under saturating light, when energy was not limited, cells grew faster with NO_3^- than with either NH_4^+ or urea. In exponential growth phase, the particulate C:N ratio of the cells varied with N source but was independent of light. Conversely, the particulate N:P ratio seemed to be influenced by light more than by N source. These results provide preliminary information on the sensitivity/resilience of the quality of organic matter to changing environmental conditions in the Arctic Ocean.

Exploring the biology of the freshwater diatom *Asterionella formosa* and its interactions with bacteria using a combination of physiological, cellular and genomic approaches

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Diatoms are central to marine and freshwater environments and can interact with bacteria in either synergistic or antagonistic interactions. To improve our understanding of diatom biology and the interactions between diatoms and bacteria, we have been combining physiological, cellular and genomic approaches to study a widespread pennate freshwater diatom, *Asterionella formosa,* and its interactions with bacteria.

A single colony of *A. formosa* was isolated from Esthwaite Water in the Lake District (UK) and was maintained in laboratory conditions. Fluorescence microscopy observations showed that *A. formosa* grows in the presence of multiple types of bacteria that are either free-living or attached to the diatom. Attempts to remove bacteria from the cultures resulted in *A. formosa* death, suggesting that at least a subset of bacteria are essential to the diatom. To improve our understanding of *A. formosa* biology, to identify associated bacteria and to predict possible modes of interactions, we performed metagenomic sequencing of the *A. formosa*-bacteria community. A draft genome of *A. formosa* (total size ≈ 57 Mb) was obtained (Illumina technology) and is currently being improved by long-read PacBio sequencing. Furthermore, metagenomics sequencing revealed the presence of about 30 cohabiting bacterial species (mainly Proteobacteria and Bacteroidetes). Using 16S rRNA barcoding (Illumina technology), we found that relative abundance of these species varies depending on *A. formosa* growth stage, indicating complex dynamics within the microbial community. To characterize this community, cellular, physiological, and molecular investigations on modified *A. formosa*-bacteria communities are in progress (addition of bacterial species isolated from the community or depletion of specific bacterial species using targeted antibiotic treatments).

In conclusion, within this study, the draft genome of *A. formosa* has been obtained. This draft will be completed shortly and will represent an invaluable source of information not only for investigations on *A. formosa* but also for the overall understanding of diatom biology, as it will be one of the first freshwater diatom genome sequenced to date. Bacteria cohabiting with *A. formosa* have been identified and their dynamics established. These data pave the way for deeper physiological, cellular and molecular investigations on *A. formosa*-bacteria interactions and will widen our knowledge on diatom-bacteria interactions.

Legacy effects of Arctic gold mining: Assessing the influence of past arsenic emissions on subarctic diatom assemblages

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The Giant Mine, located in the city of Yellowknife (Northwest Territories, Canada), is a dramatic example of subarctic legacy contamination from mining activities, with remediation costs projected to exceed $1 billion. The Giant Mine was operational between 1948 and 2004, and the roasting of arsenopyrite ore to obtain gold released large quantities of arsenic into the environment. Recent limnological surveys indicate that arsenic concentrations in lakes within 15 km radius of the roaster stack exceed the maximum allowable concentrations for drinking water. However, the effects of the Giant Mine operations on aquatic environments, specifically on aquatic biota, are poorly understood. Using paleolimnological approaches, we examined the long-term ecological effects of roaster emissions on lakes near the Giant mine by tracking changes in diatom assemblages and other paleolimnological proxies. For example, in Pocket Lake, a small lake at the edge of the Giant Mine lease boundary, we record striking ecological changes, coeval with mining operations. By examining diatoms in a broad spatial scale of lakes at differing distances from the Giant mine point source, we attempt to assess the ecotoxicological effects of arsenic and other contaminants on diatoms in this subarctic environment.

A new Paleocene centric diatom genus with a complex wall design from a freshwater locality in Northern Canada

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Marine diatoms began to invade freshwater habitats in the early Cenozoic, becoming well established by the Eocene. However, because of a sparse fossil record, little is known about the earliest diatom representatives that signaled this important evolutionary event. We describe a new centric diatom genus from lake sediments in the Canadian Arctic deposited during the Paleocene. This organism, one of the oldest known freshwater diatoms reported to date, has a unique and highly complex frustular wall structure composed of areolae with large, bulbous, spherical-shaped chambers that are open to the external environment, rest on a solid siliceous surface referred to as the solum, and are surrounded by an open space, or hypocaust. The solid solum structure largely isolated the protoplast from ambient conditions and hence limiting exchange; this may have represented an adaptive response to living in freshwater. Given the complement of microfossils found in the fossil locality, the lake was a soft-water, slightly acidic limnic system of moderate nutrient content. Although the exact taxonomic position of the new diatom remains uncertain, it appears to be most closely allied to *Actinocyclus* given a range of synapomorphies.

Biotic condition of rivers in the southeast United States

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Species composition and abundance of diatoms in streams and rivers are a crucial measure of biotic condition, as diatoms are sensitive to impacts caused by human activities such as urbanization, flow alteration, and the loading of contaminants, nutrients and sediment. Regional surveys of rivers by the U.S. Geological Survey (USGS) National Water Quality Assessment Program (NAWQA) are designed to evaluate the effects of these stressors on aquatic organisms, including diatoms. The Southeast Stream Quality Assessment (SESQA) study characterized watershed and water quality parameters, with the goal of determining the factors that have the greatest potential to alter biotic condition across the region.

Samples were collected from 115 sites in 2014, from streams representing gradients in chemical and physical alteration across the southeast region. Over 450 species and infraspecific taxa were identified during analysis for species composition and abundance, many of which have not been formally described or are rare and poorly known. We examine the differences in diatom composition between designated reference sites and sites impacted by urbanization, altered flows and agriculture. This study is part of a broader effort to improve taxonomic consistency in federal, state and local programs by accessible identification resources and inter-lab comparisons.

Long-term diatom changes during the past 85 ka from tropical lowlands of Northern central America

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The prevailing paradigm, explaining changes in the tropical hydrologic cycle, is attributed to the displacement of the Intertropical Convergence Zone (ITCZ), controlled by a temperature gradient across both hemispheres. However, northern Neotropics could have been the theatre of feedback mechanisms that could have impacts to the North Atlantic freshwater budget. Otherwise, changes in the rates of meridional overturning ocean circulation, tropical production of carbon dioxide and mode of tropical ocean-atmosphere interaction have been posited as sources of intrinsic climate variability.

Lake Petén Itzá (16°55'N, 89°50'W), a closed-basin lake located in the Neotropical lowlands of Petén, northern Guatemala, provides an ideal site for investigating hydrological changes to both abrupt and long-term climate changes. Located in a climatically sensitive region, today the amount of rainfall is related to the seasonal migration of the ITCZ.

Here we present a continuous, high-resolution paleoenvironmental record from a long sediment sequence collected in the lake. The composite core (PI-6) was dated using radiocarbon and tephra stratigraphy and spans the last ~85 ka. We inferred past conditions using aquatic bioindicators (diatoms, ostracods) that are abundant in sediments. The diatom flora is dominated by planktonic species, from which 4 species are newly described (see Paillès et al., this congress) and by benthic species. Sharp transitions from low- to highstands are evidenced, suggesting large hydrological changes during the last 85 kyr. Lake-level highstands occurred during the intervals 80-72 ka, 43-29 ka, 22-16 ka, and with a lower-amplitude episode between 58 and 48 ka. Hydrological changes seem to be driven primarily by precession, but not always. For instance, during MIS 4 (*ca*. 82-71 ka) and the Last Glacial Maximum (*ca*. 22-16 ka), lake level was high, implying moister conditions, whereas a low lake level would be expected because of the southerly position of the ITCZ. Fresher sea surface temperature, or atmospheric mechanisms are needed for explaining these highstands. We conclude that forcing mechanisms shifting through time triggered water-level changes in Lake Petén Itzá. Prior to 50 ka, oceanic conditions control most of the precipitation variability and consequently lake level changes, whereas before, Yucatan lowlands climate apparently flipped from being dominated by insolation dynamics and atmospheric mechanisms.

Changing gene expression linked to extracellular polymeric substance (EPS) production pathways in the diatom *Fragilariopsis cylindrus* during simulated sea ice formation

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Diatoms and their associated extracellular polymeric substances (EPS) are major constituents of the microalgal assemblages present within sea ice. The sea ice environment is physiologically challenging, with low temperatures and high salinity. EPS are thought to provide protective functions enabling diatoms to survive, and thrive, in this environment. We compared changes in yields and chemical composition of soluble and cell-associated EPS, cell physiology and gene expression (RNA transcriptome) in the globally distributed sea-ice diatom *Fragilariopsis cylindrus* across six different treatments simulating conditions found during the progressive formation of sea ice. With decreasing temperatures (from 0°C to -8°C) and increasing salinity (from 34 to 52), *Fragilariopsis cylindrus* reduced growth rates and photosynthetic potential, but increased yields and changed the chemical composition of different EPS components. There were significant changes in the whole cell transcriptome (GO. analysis) and in expression patterns of 195 genes associated with carbohydrate metabolism (identified using CAZy). Using known canonical pathways of carbohydrate metabolism, we assembled a putative EPS production pathway containing 42 identified genes/enzymes leading to the formation of nucleotide sugars and polysaccharide assembly. Multivariate analysis of cell physiology, EPS-biochemistry and gene expression data revealed three different patterns of expression within this pathway; during early ice formation, with cell growth and active glucose-rich and fructose-mannose pathways; developing temperature stresses with altered EPS production, upregulation of galactose and uronic acid metabolism; and elevated salinity (greater yields, increased mannose content) and temperature responses (-4°C to -8°C), suggesting increased mobilisation of intracellular carbohydrate resources (glucan mobilisation, glycolysis) and increased glycosyltransferase and membrane transporter expression. The identification of clear changes in the transcriptome associated with EPS production, freezing and cell survival, supports the hypothesis that EPS production is a strategy to assist polar ice diatoms to survive the conditions present in sea ice. This is important because EPS production is a ubiquitous feature of diatoms; EPS is an important part of carbon cycle in polar ocean and the atmosphere, and the production of EPS will change with polar warming.

Freshwater diatom biogeography and the genus *Luticola*: An extreme case of endemism in Antarctica

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Historic views on levels of endemism in the Antarctic region have characterized the region as a frozen desert with little diversity and low endemism. More recent studies however have uncovered an endemism in this region that may be much greater than previously expected in several groups. Assessing levels of endemism in the Antarctic region has become particularly important for microbes, in the light of the ongoing debate regarding the possible cosmopolitan nature of small species.

In order to analyze the degree of endemism of the limno-terrestrial genus *Luticola* in this region, all taxonomical results based on a modern fine-grained taxonomy have been synthesized for *Luticola* in the entire Antarctic region, as well as southern areas of South America. We examined recent and historical taxonomic treatments of freshwater diatoms for the Antarctic region, and compiled data for the number of endemic species and their distributions. Over 200 species of *Luticola* are currently known worldwide. Almost 20% occur in freshwater habitats in the Antarctic region. Of these 43 species, 42 are endemic to the region, with maritime Antarctic localities being the most species and endemic-rich (28, 23, respectively), followed by continental Antarctica (14, 9 respectively) and the sub-Antarctic islands (8, 6, respectively). *Luticola* has one of the highest percentages of endemism in Antarctica of any known diatom genus, in terms of total number of species (=taxon endemism) as well as a percentage of the entire genus (=phylogenetic endemism). These numbers of endemics for *Luticola* are compared with other groups of terrestrial and freshwater organisms, showing that the genus has one of the highest, if not the highest levels of endemicity in Antarctica. The timing of the diversification of *Luticola* has not been established, but the oldest known fossils of the genus date only to the Holocene, suggesting that diversification processes in *Luticola* are rapid, and that single or multiple invasions of the region may have occurred over a very short geologic timescale. Understanding the origin and evolution of endemic species in Antarctica will allow a better understanding of the baseline and impacts during a time of large-scale environmental changes in southern latitudes.

Diatom nomenclatural rules and best practices

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New diatom taxa are being described and nomenclatural changes are being made every week. The ICN rules are crucial for correctly describing new species or creating new names. Despite the complex language, the main articles pertaining to diatoms are relatively clear. Nonetheless, many minutely specific rules that affect the validity of new taxa and names are occasionally overlooked. In addition, following ICN rules does not necessarily lead to good publishing practices because many rules lack specific detail or instructions. As the Diatom Herbarium crew who maintains the New Species File at the Academy of Natural Sciences, we continually encounter issues that arise from the flexibility of the ICN rules. This talk aims to briefly summarize requirements by ICN for a valid taxon publication as well as discuss best practices in describing new diatom taxa and creating nomenclatural changes, from naming species to depositing types in a collection. A practical guide to facilitate taxonomic work will be presented.

The diatom flora of Lake Kinneret (Israel) – New insights into Holocene climate change and human impact in the southeastern Mediterranean

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Although the Eastern Mediterranean and especially the southern Levant are key regions for paleoclimatological and paleoenvironmental research, our understanding of Holocene environmental variability and its possible drivers is still limited. As diatoms remain one of the least-exploited proxies in paleoclimate research in the Mediterranean region, we would like to present results of new, high-resolution diatom analysis of an 18 m sediment sequence from Lake Kinneret (Israel). The study forms part of multi-proxy research into Holocene climate change and human impact in the southern Levant (http://www.sfb806.uni-koeln.de). Results are compared with other proxy data including pollen, geochemical data and with output data from regional climate modelling, to strengthen interpretation of environmental change during the Holocene.

Remarkable shifts in the diatom flora over the last ca. 9,000 years can be mainly interpreted in terms of productivity shifts, with a clear trend from oligotrophic at the base to hypereutrophic in the modern lake. The eutrophication trend accelerates after ca. 2,500 cal. yrs. BP, indicating the influence of increased human activity in the catchment, identified previously by analysis of the vegetational history.

The results are particularly important in improving reconstruction of Holocene lake-level variation in Lake Kinneret, which was previously very poorly understood. Diatom-inferred lake-level oscillations correlate well with the output from the climatic models from the Levant region, representing changes in moisture availability, although the signal is obscured in the last 2,500 years by the effects of anthropogenic eutrophication.

A Holocene history of the Little Belt region, Baltic Sea

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The Baltic Sea has experienced a complicated series of changes with respect to nutrients, salinity, and water stratification resulting from the retreat of the Scandinavian ice sheet since the beginning of the Holocene, ~12,500 years before present. These shifts have resulted in changes to the Baltic's ecology. In addition to a complex background of natural change, the Baltic Sea has been influenced by human activity in Northern Europe since large-scale deforestation began in the Middle Ages. The modern Baltic has been heavily influenced by human activity, and is characterized by increasing bottom water anoxia and eutrophication. This is significant, in that the Baltic is a major economic and recreational water body for the nations which neighbor it. International Ocean Drilling Program Expedition 347 cored the Baltic Sea with the goal of generating basin-wide reconstructions of Baltic climate, ecology, and anoxia from the beginning of the Holocene to present. Site M0059 cored the Little Belt region, one of the three major connections between the Baltic and the North Atlantic. This study provides a diatom-based reconstruction of the ecology and climate of the Little Belt region for the Holocene. Diatom assemblage zones reveal a shift from fresh to brackish to marine conditions, before finally reaching the modern Baltic brackish salinity. In addition, changes to significant ecological factors such as nutrient availability, sea ice cover, primary productivity, photic zone depth and wind speed are documented. While some shifts are seen in Baltic ecology starting with the colonization of Scandinavia, eutrophication and anoxia are not seen to be prevalent until after the onset of the Industrial Revolution.

Pliocene diatom record of Baringo Basin, Kenya

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The Hominin Site Paleolakes Drilling Project (HSPDP) has obtained sediment cores from several important hominin fossil and artifact sites in Kenya and Ethiopia in an effort to investigate the role of environmental forcing in shaping human evolution. Kenya's Baringo Basin and Tugen Hills site comprises the most complete late Neogene section known from the African rift. The Chemeron Formation (3.2-2.35 Ma) contains ~100 fossil vertebrate localities, including three hominin sites, within 0.5-3km of the drill site that can directly linked to the drill sequence. At this time in East Africa we also observe the diversification of *Paranthropus* and *Homo* and the earliest evidence for stone toolmaking.

The 227-meter long Baringo Basin sediment core is highly variable, with sands and gravels alternating with sequences of silts and clays, as well as periodic diatomites. While we observe no diatoms in the bottom section of the core, there are at least six distinct sections with abundant, preserved diatoms in the upper 132 meters. Based on sedimentology, we interpret the environment as alternating between lake and alluvial fan. When diatoms are present, *Aulacoseira* and *Cyclostephanos* dominate, suggesting a deep lake. Benthic diatoms are also present but at very low abundances.

Aulacoseira is abundant in all diatom sequences. Several species are observed, but the dominant *Aulacoseira* taxon appears most closely related to *Aulacoseira granulata*. While *Cyclostephanos* is present in all sections, it becomes more abundant in the younger sections. The longest and one of the best preserved sequences is characterized by alternating dominance between *Aulacoseira* and *Cyclostephanos*. This pattern is repeated in other sequences within the top 20 meters of the sediment core.

Ecological and taxonomic studies of terrestrial diatom communities and the search for linkages with river regimes

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Soils are home to a vast and still poorly known diversity of diatom species. Terrestrial communities (as freshwater) also respond to and can reflect ecological gradients and perturbations, including direct and indirect human impacts. The dynamics of these communities can be related to the hydrological connectivity between different landscape units. Surface water flow paths from the hillslope, through the riparian zone to the stream can be traced via these terrestrial species. The latter are flushed in considerable amounts to the stream during rainfall events. Hydrological connectivity is often strongly non-linear and controls runoff response and stream chemistry, and tracer applications are often limited in scale or by the number of available tracers. Due to these limitations, fast flow path connectivity in the hillslope-riparian-stream (HRS) continuum is still difficult to decipher. In order to assess the full potential for aerial diatoms to serve as tracers of hydrological connectivity, there is a pressing need for characterizing these diatoms, along the development of extraction methods and in-depth taxonomic analysis to study the ecology of soil diatoms. We used seven nested sub-catchments (0.45 km^2 to 250 km^2) with single-lithology and mixed geologies and land-use types within the Attert River basin (Luxembourg). We categorized the prevailing diatom communities based on their habitat in the HRS continuum. Automatic samplers were installed at every catchment outlet and sampled several storm events (at high frequency) for diatom communities during distinct seasons. The documented changes in diatom assemblages during flood hydrographs serve as a proxy of increased connectivity of fast flow paths at all investigated spatial scales. Diatoms proved to be a valuable scale independent tracer to detect fast flow path connectivity in the HRS system. Further, they indicate temporal variability of contributions from different physiographic units. We intend to generate detailed diatom habitat descriptions for linking the occurrence of individual species to representative source areas – paving the way for species assembly dynamics modelling. This in turn, will help to investigate how terrestrial diatoms can qualify as a potential tracer for overcoming the spatial limitation that most conventional geochemical and isotopic tracers are currently constrained by.

Ulnaria: Synapomorphies and the Science of Systematics

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In 1986 I made an attempt at characterising, rather than simply describing, the genus *Synedra*, with *Synedra ulna* as a typical representative, if not its presumed type. Since that time nomenclatural details dictate that the genus name *Synedra* should apply to a handful of marine species (such as *Synedra gaillonii*) and any taxon which includes, or is typified by, *Synedra ulna* should rightly be called *Ulnaria*. Regardless of these nomenclatural changes, from a taxonomic point of view *Ulnaria ulna* (=*Synedra ulna*) and its associated species were then characterised by the following three synapomorphies:

1. The basal siliceous layer (that is the topological relationship between the ribs, interconnecting struts and closing plates).
2. All bands in the cingulum are closed.
3. Modification of the ocellulimbus, with a larger, denser inset plate, of 12–14 porelli per row and 20–25 rows per plate.

Of these three, the closed bands of the cingulum have proved the most enduring and have yet to be refuted as an appropriate synapomorphy (defining character). Yet there still seems to be some doubt over its utility, and various definitions of the genus *Ulnaria* have since been proposed, most, if not all, including one or another absent character, such as “the absence of spines”. With reference to all species described in either *Synedra* or *Ulnaria* since my 1986 paper, this presentation will address the issue of synapomorphies as defining characters by demonstrating their power in picking out natural taxonomic groups, in adding some much needed precision to molecular taxonomy results and in providing a predicative dimension to systematic conclusions rendering it a valid scientific enterprise rather than just an exercise in description.

Structure of the *Didymosphenia geminata* stalks as a biomaterial

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Didymosphenia geminata is a freshwater diatom composed of siliceous cells and extracellular polymeric fibrous stalks. These stalks may attach to any substrate in water, such as stones, plants, debris. Their massive reproduction has negative ecological impact of *D. geminata*. The species is able to dominate surfaces of streams by generating of 90% of biomass and covering up to 100% of substrates with the thicknesses higher than 20 cm, greatly altering physical and biological conditions within the streams. Therefore, this invasive diatom has huge ecological impact on rivers in several parts of the World.

The structure and chemical composition of the diatom *Didymosphenia geminata* stalks have been recently a subject of extensive investigations results of which are given in [1]. The current report provides details of microscopic studies (light and electron scanning and transmission), X–ray spectroscopy (EDS), X–ray photoelectron spectroscopy (XPS) and X–ray diffraction (XRD). The results provide insight into the structure and chemistry of the species in question.

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GBOL2 – "Environmental DNA in the water framework directive context (diatoms)"

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The GBOL2 project (German Barcode of Life 2, https://www.bolgermany.de/) funded by the BMBF (Federal Ministry of Education and Research) is the second project phase of GBOL, running from 2016-2018. Its focus is the extension of the thitherto erected DNA barcode reference library (21,000 species, 34 % of the German flora and fauna) to integrate all frequent, common and indicator organisms, those in the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna/Flora (FFH) and the German Red Lists, as well as health-relevant, invasive organisms.

The project part located at the Botanic Garden and Botanical Museum, Freie Universität Berlin, is focussing on compiling a diatom DNA barcode reference library, as diatoms are very important bioindicator organisms implemented within the EU Water Framework Directive.

Hitherto, no concerted strategy for the molecular registration of diatom species exists in Germany and the quality as well as the taxonomical validation of the deposited diatom sequences in the International Nucleotide Sequence Database Collaboration (INSDC) is often not adequate. Therefore, it is planned to DNA barcode 400 diatom species of the 1700 species expected to live in Germany waters. The prime objective will be to concentrate on the relevant diatom taxa for water quality assessments in fresh waters.

Clonal cultures are established to obtain enough DNA for Sanger sequencing and to be able to document the taxa morphologically and physically and make this information publicly available. The DNA stocks will be deposited in the BGBM DNA Bank connected to taxonomically validated voucher specimens deposited at Herbarium Berolinense (B) following specific standardised requirements.

As a best practice use case for documenting and displaying environmental and environmental DNA (eDNA) data, the diatom DNA barcode reference library will use the EDIT platform for cybertaxonomy and provide the possibility to assign environmental sequences gained from eDNA metabarcoding to the taxonomically validated reference sequences in the database as well as the complete automation of the eDNA metabarcoding data evaluation. Both are crucial prerequisites for developing a sequenced-based time and cost efficient method to analyse the diatom community composition in environmental samples via eDNA metabarcoding for water quality assessments.

Poster Session Presentations

Morphological diversity of the rimoportula

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As part of an on-going review of diatom valve features, we herein focus on the morphological diversity of the rimoportula in both living and fossil marine diatoms.

Number and Position: Most centric and araphid diatoms possess at least one rimoportula, although in some genera (e.g., *Corethron*, *Chrysanthemodiscus*) it is seemingly lacking, while the raphe in raphid diatoms appears to be derived from an ancestral rimoportula. Many diatoms possess one (e.g., *Thalassiosira*) or more (e.g., *Actinocyclus*) marginal rimoportulae, while others have one (e.g., *Chaetoceros*) or more (e.g., *Stellarima*, *Stictocyclus*) in the central area, or many scattered across the valve face (e.g., *Podosira*). In many araphids a single rimoportula is often located at one (e.g., *Licmophora*) or each pole (e.g., *Hyalosynedra*), but in some it may be more centrally placed (e.g., *Tabellaria*).

Size: In *Coscinodiscus* and *Palmeria*, two or more macro-rimoportulae are situated in the marginal ring of micro-rimoportulae, while in *Asteromphalus* the narrower (median) ray usually has a larger rimoportula than the other rays.

Shape: Externally, rimoportulae may be tubular (e.g., *Thalassiosira*, *Ditylum*), cap-like (e.g., *Aulacodiscus*) or simple pores (e.g., *Shionodiscus*, *Thalassiothrix*), whereas internally they may exhibit a diverse range of shapes and structures – from simple slits (e.g., *Odontella*) to raised or stalked (e.g., *Roperia*), ear- or kidney-shaped (e.g., *Asteromphalus*, some species of *Actinoptychus*), E- or C-shaped (e.g., *Aulacodiscus*) structures and even as snake-like slits (e.g., *Glorioptychus*).

Orientation: Most marginal rimoportulae lie parallel to (e.g., *Coscinodiscus*) or perpendicular to (e.g., *Thalassiosira*) or tilted at an angle to (e.g., *Actinocyclus*) the valve margin, while those in the centre are often oriented radially (e.g., *Stellarima*).

Evolution and structural diversity of the fultoportula

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The Thalassiosirales are a monophyletic group of centric diatoms, possessing a unique structure, the fultoportula. In this study we report on its structural diversity in living and fossil marine species, notably in *Thalassiosira*, *Shionodiscus* and Paleogene and Mesozoic ancestral forms.

The fultoportulae are usually marginal, but some may be present on the valve face and/or at the valve center, and may be arranged in lines or groups. Externally the fultoportula may be tubular or a simple pore, but internally it is often a short buttressed tube surrounded by satellite pores which only exit internally and vary in number from two to nine. Special terms (e.g., trifultate, operculate) have been applied to some of the variations. Over geological time there has been a general reduction in the most frequent satellite pore number but with an increase in diversity. For instance, during the Eocene only fultoportulae with six satellite pores have been found, whereas in the Middle Miocene fultoportulae with four satellite pores are common, with those bearing six and five satellite pores being less common. In the Quaternary the commonest types of fultoportulae bear two or three satellite pores although others with four to nine satellite pores exist.

Prior to the Eocene, there are no diatoms with fultoportulae, but similar structures exist in *Praethalassiosiropsis*, *Thalassiosiropsis* and allied forms. The annular process of the Early Cretaceous genus *Praethalassiosiropsis* has been viewed as a precursor to the fultoportula, while Late Cretaceous-Eocene diatoms lumped under the name of *Thalassiosiropsis wittiana* have buttressed short tubes surrounded by pores which are remarkably like true fultoportulae. If so, then the first appearance of the Thalassiosirales could be pushed back at least to the Late Cretaceous.

Development of a diatom-based, cost-effective biomonitoring tool for the Saudi Arabian Red Sea coastline

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Diatoms are diverse group of single-celled algae with siliceous cell walls that are resistant to dissolution. Different species of diatoms are adapted to different environmental conditions. These properties make them useful indicators of environmental conditions, such as the Saudi Arabian Red Sea coastline, which has habitats that span a range of impacts. Diatoms can be used there to monitor nearshore environments and provide early warning of possible harmful or undesired water quality affects, or as monitoring tools that can be used to help provide objective goals for any efforts that might be implemented to mitigate water quality issues in a cost-effective fashion. Obstacles to utilizing diatoms in this way are: 1) the diatoms, particularly the benthic diatoms of the Red Sea are not well known taxonomically, 2) there is little information on the distribution of Red Sea diatoms in relationship to environmental parameters, and 3) identifying diatoms can be a time-consuming effort requiring highly specialized training. We hope to overcome these obstacles with an international collaboration to build a database of benthic marine diatoms and their habitats, in one of the first studies of marine benthic diatom tolerance and distribution in relationship to coastal pollution in a tropical region. This poster reports on our progress so far in collecting and cataloging hundreds of benthic diatoms, including dozens of undescribed taxa, from the reefs and harbors of the Red Sea.

Effects of arsenic in periphytic diatoms after a short-term exposure

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Diatoms are cosmopolitan aquatic organisms and are a major component of periphyton. They are also the basis of the trophic chain, thus they can respond quickly to environmental changes such as water metal contamination. Effects of metals on diatom communities have been extensively studied in field and laboratory experiments, underlying their high potential for metal contamination assessment. Arsenic (As) pollution is a global problem. Water (both surface and groundwater) is the main route of arsenic contamination. We conducted an experiment to investigate the effects of this metal on functional and structural descriptors. Specifically, we analyzed changes in photosynthesis-related endpoints and diatom community structure (species relative abundances) and cell size of each species. Thus, by combining ecological and ecotoxicological descriptors, we expected to better characterize toxic impact of arsenic on periphyton. Results showed that arsenic exposure caused inhibition of periphytic algal growth, as well as community adaptation especially in diatoms. We identified 52 diatom taxa of which *Achnanthidium minutissimum* (Kützing) Czarnecki was the most abundant species, representing almost the 77% of the total abundance of diatoms: 75% in control and 79% in arsenic exposure, showing a tolerance to arsenic. Moreover, arsenic reduced diatom species richness ($p=0.051$). Diatom average cell biovolume was clearly reduced by arsenic ($p=0.003$). Individual cell biovolume (or cell size) in some species also changed with arsenic exposure. A general trend in biovolume decrease was observed, but *Fragilaria*-species biovolume increased under arsenic exposure, due to greater cell and/or higher cell numbers in the arsenic treatment. Measured biovolumes were compared with theoretical biovolume data for each species and were poorly correlated, suggesting that the real measurements are recommended to better assess impacts. In conclusion, both functional and structural algal parameters were affected by arsenic exposure. The strongest effect of arsenic on diatom community is the decrease in real cell biovolume, but arsenic also selected for species like *Achnanthidium minutissimum* (tolerant to metal exposure) and reduced diatom species richness. Considering how low arsenic concentration and exposure time are in this experiment compared with reality, the results call into question the limits of arsenic concentration established for environmental-quality assessment, which are higher.

Holocene diatom paleoclimatology along the western margin of North America

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This study analyzed the evolution of Holocene diatom assemblages in sediment cores collected from the margins of southeastern Alaska and California, as well as from the Gulf of California. The cosmopolitan diatom, *Thalassionema nitzschioides*, is an important member of Holocene diatom assemblages in all three regions. It is a proxy indicator of warm oceanic waters off southeastern Alaska, of the cool-water California Current off California, and of background productivity in the Gulf of California. The subtropical diatom *Fragilariopsis doliolus* is associated with warm waters from the productive edge of the North Pacific gyre in California assemblages. In the Gulf of California, increased abundances of *F. doliolus* indicate an enhanced presence of subtropical Pacific waters that appear to coincide with the development of the North American Monsoon during the middle part of the Holocene. *Thalassiosira* species (*T. angulata, T. pacifica, T. nordenskioeldii*) dominate the assemblage from the southeastern Alaskan margin, while the subarctic oceanic diatom *Neodenticula seminae* is also an important contributor. Two of the cooler water diatoms, *T. pacifica* and *N. seminae*, are present in reduced numbers off northern California during the Holocene. The tropical diatom, *Azpeitia nodulifera*, is an important contributor to Gulf of California assemblages but is very rare in California assemblages. Diatom assemblages in all three regions undergo distinct changes at about 3000 calendar years before present, with increased relative abundances of *T. nitzschioides* in assemblages off southeastern Alaska, an increased contribution of F. doliolus to the California assemblages, and decreased abundance of *F. doliolus* in the Gulf of California. These changes likely are due to increased seasonality and a general warming of fall and winter sea surface temperatures in the North Pacific. The 3000 yr BP transition appears to reflect both an enhanced expression of El Niño Southern Oscillation (ENSO) cycles and the development of modern North Pacific oceanography.

Eutrophication homogenizes diatom assemblages in tropical reservoirs

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Beta diversity is a measure of variation in species composition among sites and it may be the result of two different processes: nestedness and turnover. There is a growing evidence that environmental disturbances, such as anthropogenic eutrophication, can decrease turnover rates and, as a consequence, in loss of species and simplification of communities. We hypothesize that cultural eutrophication homogenizes diatom assemblages in tropical reservoirs. Thus, we predicted that diatom beta diversity (and their nestedness component) will increase along the increase of differences in productivity among reservoirs. On the other hand, total richness of diatom assemblages will decrease along the productivity gradient. We sampled 11 reservoirs with different trophic states (oligotrophic to hypereutrophic) located in the southeastern region of Brazil. Chlorophyll-a (mean value for the water subsurface in summer and winter) was used as a proxy of productivity. Diatoms from surface sediment were sampled with a gravity corer in the deepest site of reservoirs during the austral winter. Besides species richness (number of diatom species in each site), we calculated diatom beta diversity and their turnover and nestedness components using Sørensen dissimilarity index, Simpson dissimilarity index and Baselga nestedness-resultant dissimilarity, respectively. Then, we determined the relationship of beta diversity, turnover and nestedness with the differences in productivity (i.e. difference between mean value of chlorophyll-a between two reservoirs). We also evaluated the species richness variation along the productivity gradient. We found positive correlation between beta diversity and productivity difference (R^2adj.=0.31; P<0.01). In the same way, nestedness component also showed positive correlation (R^2adj.=0.31; P<0.01). However, the turnover component of beta diversity was not correlated with productivity difference. Finally, species richness showed an exponential decrease along productivity gradient (R^2adj.=0.64; P<0.01). These findings confirm our predictions and suggest that a simplification in the diatoms assemblages is occurring along the eutrophication gradient. Our results have implications for the aquatic biodiversity since cultural eutrophication is one of the most spread and pervasive anthropogenic impacts worldwide.

Modern and Late Quaternary diatoms of Africa - Quantitative palaeoenvironmental reconstructions: Examples from Tunesia, Kenya and Angola Basin

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In Tunisia, 74 samples from diverse biotopes with salinity between 0,4 to 74 gl^{-1} contain more than 600 taxa. In Late Quaternary sequences from Wadi El Akarit and the Chott region (Palaeohydrology in Africa program, Site I), about 60% of fossil diatoms are observed in modern habitats. A transfer function for conductivity is applied (Gasse, Juggins, Ben Khelifa, 1995). Detailed fluctuations are proposed: in Wadi El Akarit, 3 major humid phases are distinguished. An optimum Holocene occurs before 8700 yr BP with salinity around 2 to 5 gl^{-1}. In *Cardium* bearing sediments from the Chott, salinity is 2 to 30 gl^{-1}. No thalassic species are observed therefore continental origin is confirmed.

In Kenya, high-altitude lakes show continuous deposits spanning the last 100 000 yr BP (Street-Perrott *et al*., 1997). In Sacred Lake, 142 fossil taxa are mainly benthic. Before 30 500 yr BP, an optimum humid episode is suggested by the abundance of the planktonic species *Aulacoseira.* Calibration of fossil samples from Sacred Lake with 171 modern African samples (F. Gasse database) and using 889 modern species show a pH fluctuation of 9 to 6 (Juggins, pers. comm.) since 115 000 yr BP to present. In Lake Nkunga, three zones are observed. Around 100 000 yr BP, laminated diatom sequences show an alteration of *Aulacoseira* and *Nitzschia*. Zone 2 is rich in epiphytic species such as *Cymbella*, whereas, the upper core is poor in diatoms. Thus, productivity was high only around 100 000 yr BP.

In the Angola Basin, relation between Continent-Ocean is highlighted (Jansen *et al.*, 1994). Allochthonous continental diatoms in quaternary marine sequences may reflect Quaternary humid or arid periods. 822 samples from 350 m sediment between 0°N and 25°S spanning the late 700 000 yr BP show around 30% allochthonous continental diatoms. In 60 modern surface-sediments and 25 samples from the Congo River, 250 allochthonous species are studied. Maximum modern eolian transport is between 13°N and 15°N whereas, maximum modern fluvial input is around 6°S. An attempt of calibration is made to distinguish eolian from fluvial input within the late Quaternary in core16, at the embouchure of the Congo River. Calibration with the modern allochthonous distribution show a brief arid period from 12 000 to 11 000 yr BP corresponding to the Younger Dryas.

Application of taxonomic free sorting to *Fragilariophyceae* of the southeastern United States

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Taxonomic consistency is a persistent issue in the identification and analysis of freshwater diatoms. Species concepts can vary considerably among individuals, labs, and communities of researchers. This is particularly problematic for morphologically plastic species complexes (e.g. *Gomphonema parvulum* or *Fragilaria vaucheriae*). For this study, our objective was to gauge how similarly taxonomists sort a set of *Fragilaria* images into morphological groups, implementing a method commonly known in other disciplines as "free sorting". We asked 18 analysts from multiple labs and with varying degrees of experience to sort 175 images, which were collected from a recent USGS survey of wadeable streams in the southeastern United States, into species. We found that analysts strongly disagreed on the number of species found in the image set, reporting between 15-40 groups. We found that for images of particular subgeneric groups (defined *a priori*), analysts were much less in agreement than for other images. We also asked individuals to complete an optional survey about their experience and found little correlation of grouping structure with identifying experience. Our results indicate that in certain situations, some species complexes may be too difficult to consistently sort morphologically, if more than one analyst is involved. This exercise highlights ever present issues of taxonomic inconsistency in our community and demonstrates the importance of rigorous quality assessment and standardization of taxonomy both regionally and internationally.

Structure of the phytoplankton (diatom) assemblage in the northeastern Gulf of Mexico during 2011-2012

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In 2011 we began a study of the phytoplankton assemblage in the vicinity of DeSoto Canyon, Northeastern Gulf of Mexico. Our primary goal was to survey the phytoplankton in the area in order to gain a better understanding of changes in community structure along temporal and spatial scales and to establish a reference data for comparison in case of future disasters similar to the Deepwater Horizon blowout of 2010. Phytoplankton samples were collected during 14 cruises between January 2011 and December 2012 at pre-determined stations along a transect extending ~80 km southward from Pensacola Bay, Florida, USA. Here we report on the structure of the diatom assemblage collected in vertical tows of up to 100 m with a 25-µm mesh net. Samples were concentrated by sedimentation, digested with nitric acid and potassium dichromate, and mounted in Naphrax for light microscopy. Additional samples were mounted on aluminum stubs and sputter-coated with gold-palladium for scanning electron microscopy. 300-600 valves were counted for each sample at 1000x (LM) and identified to the lowest practical taxonomic level. Selected taxa were also photographed in SEM to verify identifications. Approximately 80 taxa have been observed. Bray-Curtis cluster analysis indicates seasonal changes, with distinct fall-winter (September, January, February) and spring-summer (March, June) assemblages. Within a month near-shore stations and off-shore often cluster separately; this may depend on changes in the strength of river outflows and the strength and position of the Loop Current. We also observed a strong difference between 2011 and 2012 which may have been caused by changes in the regional ecosystem brought about by the Horizon blow out, by differences in the strength of the spring outflow from the Mississippi River, or a combination of the two. The high degree of variation in the assemblage illustrates the need for long-term continuous monitoring of phytoplankton assemblage.

Uncovering the sex determining locus in diatom *Seminavis robusta*

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The life cycle of most diatoms involves a cell size reduction during mitotic cell divisions and cell size restoration through sexual reproduction. Vegetative diploid diatom cells divide mitotically and due to the constraints of their silica cell walls, one of the daughter cells is smaller than the mother cell during each mitotic cell division. As a result, the average size of a proliferating diatom population decreases. Cell size restoration typically occurs through sexual reproduction. The capability to enter into generative reproduction is strictly size-dependent: only cells under a particular size threshold can become sexualized.

In our work, we focus on the elucidation of the mechanisms underlying sex determination and the regulation of sexual reproduction in the pennate diatom *Seminavis robusta*. The life cycle of this specie displays characteristics typical for pennate diatoms: size reduction during mitotic cell divisions, strict dependence of sexual reproduction capability on cell size and the presence of two mating types (heterothallism). An advantage of using *S. robusta* for sexual studies in diatoms is that under laboratory conditions, cells below the sexual size threshold can be easily induced to sexual reproduction.

Recently, the *S. robusta* mating type locus (MTL) was identified using an AFLP-based sex specific linkage map [1]. It was determined that the MTL segregates as a single locus, with MT+ being the heterogametic sex and MT- the homogametic sex.

We are using a combination of sequence analysis of the *S. robusta* draft genome and the PCR-based genome walking technique to obtain the sequence of the MTL. Preliminary data suggest that the MTL of *S. robusta* spans several tens of kilobases and that repetitive sequences tend to accumulate on the sex determining allele specific for MT+. At the congress, I will present our latest progress on the characterization of the *S. robusta* mating locus and further steps planned for the identification and characterization of genes involved in mating type determination.

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Seminavis aegyptiaca sp. nov., a new epilithic diatom species from the estuary of the Damietta Branch of the River Nile (Egypt)

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A new species of *Seminavis* is described from the brackish waters of the estuary of the Damietta Branch of the River Nile (Egypt) on the basis of light and scanning electron microscopy. Morphologically, it shares some diagnostic features with *S. insignis*, *S. robusta*, and *S. ventricosa*. Its main differentiating characters are the ventral central striae that are more or less straight in the smaller frustules and less radiate in the larger ones. SEM revealed that the central nodule is less prominent, and the central raphe endings are externally more distant. This is the first *Seminavis* species that will be described from Egypt, and contributes to the diversity of this relatively poorly known genus.

Observations on some rarely-recorded *Navicula* species from Egyptian inland waters including the recently-described *N. flandriae*

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During the seasonal survey and routine monitoring of benthic diatoms of the Damietta Branch of the River Nile (Egypt), in the period spring 2015 - winter 2016, five epilithic *Navicula* species rarely-recorded in Egyptian fresh/brackish waters were found: *N. erifuga* Lange-Bertalot, *N. flandriae* Van de Vijver et A. Mertens, *N. recens* (Lange-Bertalot) Lange-Bertalot, *N. symmetrica* Patrick, and *N. tripunctata* (O.F. Müller) Bory. Morphological diagnostic features of all species were described in detail using light and scanning electron microscopy. Physical and chemical measurements confirmed that the habitats studied are N and P enriched and eutrophic. This study provided the first records for the Egyptian diatom microflora for the two following species: *N. flandriae* and *N. tripunctata*. The most interesting finding is the first record outside Europe of *N. flandriae* which was recently described from high-conductivity, nutrient-rich canals in Belgium.

Diatom colony lengths: Biomechanics and statistical modelling

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In some diatom species, cells remain attached to each other after cell division, forming exponentially-lengthening chains of cells. These linear colonies are subject to mechanical forces in the water, tensile stress, bending and torsion, which can cause them to break. Colony length has impacts on sinking rates and grazing by zooplankton and is impacted by both biotic and abiotic factors. This study investigates the biomechanics of diatom chain breakage and the resulting statistical distribution of chain lengths, to better understand the relationship between colonial diatoms and their physical world. The simplest model considered begins with a cohort of colonies of uniform length, subjected to uniform probability of breakage that is independent of colony length and location within the chain. This model might be taken to represent breakage due to simple tensile stress, for example, and results in a uniform distribution of colony lengths. If, in contrast, the cohort is subjected to breakage described by a probability function that is a linear function of colony length or distance from chain end – which, based on simple beam theory, represents breakage due to bending – the result is a unimodal piece-wise linear distribution of colony lengths. If this is iterated so as to represent populations subjected to repeated biomechanical challenges, the result converges on a distribution of colony lengths that resembles the log-normal distribution observed in measurements presented of *Fragilaria* and *Aulacoseira* populations collected from Lake Phalen, Minnesota, and others. This result is intriguing in view of the similarities in both theory and observation to classic ecological models describing species relative abundance, particularly MacArthur's 'broken stick model' and Sugihara's 'sequential niche breakage model', in which 'breakage' was taken metaphorically rather than literally, as in the case of diatom chain lengths.

Has geographic expansion of *Didymosphenia geminata* impacted diatom community structure in rivers of central-southern Chile?

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Geographic expansion of invasive species could drive significant changes in diatom community structure; however, *Didymosphenia geminata* (DG) effects in benthic diatom communities' composition in rivers of central-southern Chile hasn't been statistically assessed yet. The biotic resistance hypothesis predicts that more diverse communities would be less susceptible to being invaded by exotic species. Therefore, and in the frame of an extensive biological and environmental sampling (2014: spring-summer and 2015: autumn) to explore persistence and expansion of the invasive DG; 13 watersheds were monitored (185 sites) in central-southern Chile (34°-48°S). The results of this study offered an opportunity to investigate if during spring-summer the diatom community structure and composition change or not, in response to relative abundances (> < 50%), or absence of DG. We quantified benthic diatom species fingerprints by using species diversity (H'), and from the 13 watersheds studied, including sites with and without DG, higher maximum values (H'> 2) were found in 1 central and 3 southern basins. These watersheds match with those where DG relative abundances were >50%. When considering only the sites where DG was present, a highly significant ($p<0.01$) correlation between H' with the relative abundance of DG > <50% was found with lower values of H' at higher DG abundances, thus possibly supporting the biological resistance hypothesis for these benthic riverine diatom communities. Moreover, higher relative abundances of DG are strongly correlated ($r^2= 0.82$) with higher benthic total diatom abundances suggesting favourable conditions for the whole community during spring-summer. Our results highlight that spring-summer effects are also good predictors of increasing DG abundances in central-southern Chilean rivers as is the behaviour of regional diatom diversity (beta diversity). In summary, we suggest that invasive species such as DG impact the benthic diatom community in rivers of central-southern Chile, highlighted by an increase in the homogenization of H' in basins where *Didymosphenia geminata* abundances are higher than the mean abundance (50%) of the total diatom community.

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Use of diatoms as a bioindicator of water quality (The case of Lake Tonga, El Tarf, Algeria)

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Diatoms are present in all aquatic environments, from the top of the rivers to the oceans. These organisms have adapted to all possible environments of the planet, on condition of course that there is water. Nevertheless, these algae have adapted to their environment and have evolved with the environment in which they live (there are estimated to be 200 000 species in the world). Upon colonizing a new medium these species may adapt and evolve into new species. These microalgae may be relevant indicators for water bodies.

Certain diatom species are sensitive to pollution and are present exclusively in environments with good water quality. Others, on the contrary, are pollution tolerant and can grow in polluted environments. Diatoms are thus indicative of the quality of an environment and are referred to as bioindicators. This is why the assemblage of diatoms can be used to assess the quality of water courses. There is a biological index based on the assemblage of benthic diatoms: biological diatom index (IBD) that assigns a score out of 20 to the studied environment. The ecological state of the environment is then evaluated from this score and the values from the analysis of the other biological and physico-chemical parameters measured from the site. Many species of benthic Diatoms are very sensitive changes in chemical water parameters and each species has its own requirements. The species present reflect the quality of the water and in particular the level of pollution.

Our study takes place at Lake Tonga (wetland - Ramsar site), in El Tarf province, Northeastern Algeria. It consists of taking samples of diatoms in the field, followed by analysis at the laboratory and finally a determination of the biological diatom index (IBD) to describe the state of the studied environment.

Hippodonta fujiannensis sp. nov. (Bacillariophyceae), a new marine diatom from China

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A new species, *Hippodonta fujiannensis*, has been found in the low intertidal zone, Fujian province, China. The morphology of this species was investigated by means of light and scanning electron microscopy. *H. fujiannensis* is characterized by a unique combination of morphological characters, including elliptic-lanceolate to rhombic-lanceolate asymmetrical valves, non-protracted apices, the absence of fascia, relatively coarse, uniseriate striae, and the presence of one rows of lineolae around the valves apices. The differences between this new species and several related *Hippodonta* taxa are briefly discussed.

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The marine benthic diatom flora of western tidal flat, Korea

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We studied the marine benthic diatom flora in the western tidal flat (35°02´N, 126°24´E ~ 36°44´N, 126°09´E) of Korea from April 2014 to March 2016. During the study period, the temperature of the surface sediments varied from 2.4℃ to 33.4℃ and salinity of the surface sediments (*in situ* porewater salinity) fluctuated between 15.2 and 35.9. Grain size of the surface sediments varied between sandy mud and silt clay. Light microscopic and scanning electron microscopic examinations were performed on the marine benthic diatoms. Among the observed benthic diatom species, small *Navicula* taxa were dominant but they were very difficult to identify them. *Nitzschia* species may be newly reported from this study. We need to study further on marine benthic diatoms of Korean tidal flats.

Unravelling the drivers of diatom evolution in ancient Lake Ohrid: ecosystem resilience and species resistance; a link between geology and biology

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Ancient lakes act as "evolutionary cradles and reservoirs" as their prolonged isolation has resulted in high biodiversity and number of endemic lineages. Their great age, high biodiversity and potentially well-preserved fossil records make ancient lakes prime targets for evolutionary palaeoecological research. A ~600 m long continuous sediment sequence retrieved from Europe's oldest lake, Lake Ohrid (Macedonia, Albania) as part of the ICDP deep drilling campaign, Scientific Collaboration on Past Speciation Conditions in Lake Ohrid, is unique in the preservation of diatoms (Bacillariophyceae) over the last ~2 million years. Here, we present the first results of diatom analysis of the complete sequence at a resolution of ca. 1500 years, comparing with geochemical data to assess the influence of environmental change on evolution of the dominant diatom lineages.

The preliminary biostratigraphic data from core catcher analysis show evidence for evolution within the dominant genus, *Cyclotella*. Ongoing, morphological and taxonomic analyses reveal extraordinary morphological variability within some of the endemic species lineages (e.g., *Cyclotella fottii*, *C. cavitata*). A remarkable example occurs at the penultimate interglacial-glacial transition, ~190−185 ka, 80 m depth, when rhombic-elliptic forms, ultra-structurally similar to *C. fottii*, which dominate between ~290−190 ka, are gradually replaced by elliptic forms and, ultimately, by the typical, round valves of *C. fottii*, which occurs in the modern flora. The bio(geological) data indicate cold, arid conditions and a lake-level low-stand of ~60 m below the present water-level of Lake Ohrid that occurred during the penultimate glacial. This event in the diatom record can represent: i) speciation, ii) extinction or iii) presence of different *C. fottii* eco-phenotypes. Under the third hypothesis, the high morphological plasticity can be further related to high species adaptability, which may promote its resistance to climate and environmental change. This scenario is further supported by the bio(geological) data which shows high ecosystem stability during the last interglacial-glacial period, demonstrating Lake Ohrid's high resilience may be important in mitigating external disturbances, and ultimately, maintaining its biodiversity. Further analyses of the complete sequence are needed to test the hypothesis for the role of high species resistance and ecosystem resilience in preventing major extinction events in Lake Ohrid.

Diatom diversity and ecological status of Mediterranean rivers in central Italy

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Characterization of communities of benthic algae for all types of river water body in order to assess the ecological quality status is one of the requirements of the European Water Framework Directive 2000/60/EC (WFD). The Umbria Region in central Italy belongs to the Mediterranean area and is included in three hydro-ecoregions (Tuscan Hills, Appennines Centre and Italian Vulcanics). According to national methodologies, regional river waterbodies were grouped in five main Mediterranean macrotypes defined in the European Intercalibration exercise: small mid-altitude streams (macrotype M1), small and medium lowland streams (macrotype M2), large lowland rivers (macrotype M3), small and medium mountain streams (macrotype M4), and small, lowland, temporary streams (macrotype M5). Data on diatom community composition were collected in the five macrotypes (M1-M5) throughout a diatom-based river monitoring network composed by 52 sampling stations in 36 watercourses. The ecological status evaluation was based on Intercalibration Common Metric Index (ICMi). The main aim of this study was to characterise and analyse diatom diversity across different regional river macrotypes. Specifically, we investigated if: i) there were differences in species diversity (richness and Shannon index) among macrotypes, ii) there was difference in ICMi value among sites, iii) there was a relationship between the observed ICMi value and diatom diversity. Two-hundred diatom species and varieties were identified in about 100 collected samples, and the number of species per samples ranged from 10 to 38. The most frequent and abundant species were *Amphora pediculus*, *Achnanthidium minutissimum, Navicula cryptotenella*, *Nitzschia dissipata*, and each macrotype showed some peculiar species. The ICMi classified 69% of water bodies in high or good class. Significant differences in diversity and ICMi value among macrotypes were found, with M4 and M5 typologies showing the lowest species richness and with M5 the lowest Shannon index, while M2 and M5 showed the highest ICMi value. Lastly, a significant negative correlation between Shannon Index and the ICMi Index was found. This study represented a contribution to diatom-based river quality assessment following the WFD in Italy and to evaluation of differences in diversity of diatom communities in Mediterranean river types.

Navicula salinicola/N. perminuta species complex in New Jersey coastal wetlands

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The genus *Navicula* is extremely diverse in coastal wetlands, with many taxa that are poorly known, taxonomically unresolved, or possibly representing complexes of cryptic or semi-cryptic species. While investigating the flora and ecology of coastal diatoms in New Jersey, we encountered several small-celled *Navicula* species that did not fit descriptions of any established taxa and that could be easily confused with one another and some previously described species. In addition to *N. salinicola* Hustedt and *N. perminuta* Grunow, which are commonly reported from coastal marshes around the World, seven other undescribed *Navicula* species of comparable size and shape were common in our study area, especially in the marshes. We studied autecology of these diatoms and found that their distributions along the gradients of salinity, nitrogen and phosphorus concentrations were considerably different among the nine species. These *Navicula* species were also found in the sediment cores collected from New Jersey marshes and dating back to ca. 1000 years BP. Some species reached their highest abundances prior the onset of intense eutrophication in 1940s and 50s, while others proliferated later, apparently benefitting from nutrient enrichment. Clarifying taxonomy and quantifying ecology of these diatoms is critical for their successful use in biological assessments and paleoecological reconstructions.

Probing PSI protein pools for evidence of photoinhibition in *Thalassiosira* species

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An overabundance of light energy can harm the protein machinery of the photosynthetic apparatus of oxygenic photoautotrophs, including diatoms, if photodamage outruns counteracting repair processes. Research has generally focused on the dynamic Photosystem II complex, where studies are elucidating FtsH-mediated removal and recycling of integral protein components. Photosystem II inactivation and repair is thought to preempt more generalized photoinhibitory damage to other complexes. Here we attempt to widen our understanding of the relatively less studied Photosystem I complex, using the model coastal diatoms *Thalassiosira pseudonana* CCMP 1335 and *Thalassiosira punctigera* CCAP 1085/19.

To track potential damage to the Photosystem I complex, we exposed the diatom cultures to two light levels (75 uE and 300 uE), as well as two day lengths (4 hours and 16 hours). At repeated times through the diel cycles a subset of culture was also treated with lincomycin, an inhibitor of chloroplast protein translation inhibitor to block the Photosystem II repair cycle, and any synthesis of other chloroplast-encoded proteins. Using quantitative immunoblotting, we tracked the *in vivo* pools of Photosystem I protein components including the soluble PsaC and the integral membrane PsaA in the presence and absence of lincomycin to estimate their rates of synthesis and degradation. We also explore how these protein pools are related to the functional pool of Photosystem I.

Semiorbis in North America

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The genus *Semiorbis* was erected by Patrick in 1966 as monotypic based on the relatively rare taxon *Semiorbis hemicyclus*. Although once considered an araphid taxon, scanning electron microscopy showed that *Semiorbis hemicyclus* had short subterminal raphe branches on the valve mantle that clearly placed the genus within the Eunotiales with additional defining characters of strongly arcuate valves, well developed external costae with spine-like projections on the interstriae, lack of rimoportulae, and a broader dorsal mantle. Recent work by Reid and Williams (2010; *Diatom Research* 25:355) recognized two additional taxa within *Semiorbis* including a new species from the eastern United States, Canada, and Japan called *Semiorbis rotundus*, and a species transferred from *Eunotia*, *Semiorbis catillifera*, that was earlier described from Florida. The generitype, *Semiorbis hemicyclus*, was suggested to be limited in distribution to northwest Europe and Greenland. Populations of *Semiorbis* were found in the central US on Outer Island, Apostle Islands National Lakeshore, along southeast Lake Superior, and from a small arctic lake in Nunavut, Canada. The population in Outer Lagoon, a shallow embayment cut off from Lake Superior by a longshore bar, provided documentation of living cells and colonies of *Semiorbis*. We further consider the taxonomy of these new populations using light and scanning electron microscopy, Relative Warps shape analysis, and examine historical population dynamics of *Semiorbis* with dated sediment cores.

The genus *Delicata* in the United States

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The genus *Delicata* was erected by Krammer in 2003 to accommodate the cymbelloid taxa around *Cymbella delicatula*. *Delicata* is characterized by asymmetry about the longitudinal axis, lack of apical pore fields and stigmata, dorsal deflection of the terminal raphe ends, and relatively fine striae. To date about a dozen taxa have been transferred to or described within the genus. Most of these are based on European collections; however, a few taxa have been described from disparate and tropical locations (e.g., New Caledonia, Celebes). Based on various survey efforts in the United States (New York, Lake Superior, Arkansas, Montana), many collections had abundant *Delicata* populations that could not be readily assigned to known taxa. We examined these US *Delicata* populations, documented their morphology, compared them to known taxa, and examined evidence for high intraspecific morphological variation that has been attributed to this group. Results suggest that several of the US taxa should be recognized as new species.

Haslea nusantara sp. nov., a novel species of blue diatom from Indonesia

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A new species of blue diatom belonging to the genus *Haslea* has been found as epiphyte on *Padina* sp. in the Bay of Jakarta. Until now, most of the blue *Haslea* were discovered in the Northern Hemisphere, with the notable exception of a perennial population of *Haslea ostrearia* living on the Australian shores. The new species, *Haslea nusantara*, singularizes itself from other species of blue diatoms by the presence of a thin central bar parallel to the raphe, which is usually found on non-blue species like *H. pseudostrearia*, but also to a lesser extent in the blue species *H. silbo*. This morphological similarity is congruent with the multigene phylogeny established, which locates *H. nusantara* at the basis of the cluster of blue species along with *H. silbo*. Illumina sequencing allowed retrieving the full chloroplastic and mitochondrial genomes, whose maps have been established.

Modeling climate-driven lake level change in a southwest Greenland lake using the sedimentary diatom record

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Planktonic and benthic diatoms live in different habitats within lakes, hence the relative abundance of planktonic to benthic (P:B) diatoms can provide information about the availability of diatom habitat type in basins with simple morphometries. In the Arctic, lake level change is influenced by variables like permafrost and groundwater flow, which fluctuate seasonally and are also amplified by climate change. Changes in lake level can thus reflect regional water balance and temperature changes. The objective of this study was to reconstruct lake level change for SS32, a nunatak lake in southwest Greenland, to learn more about climate-driven changes in this area over the last several hundred years. The P:B diatom ratio from an SS32 sediment core remained low from 1750 until 1850, when a small peak in the P:B ratio appeared. The P:B ratio declined again until 1880, and then increased steadily until reaching a maximum value around 1950. Since 1950, the P:B ratio has declined to levels consistent with the 1850 peak. These results indicate a relatively low water balance in this area of southwest Greenland, with a small increase occurring around 1850, and a longer period of higher water balance around 1950. In recent decades, water balance has steadily declined. Surface air temperatures in southwest Greenland have rapidly increased during this time period, likely magnifying the effects of evapotranspiration and causing reductions in regional water balance.

Diatom assemblages in the western Pacific and eastern Indian Ocean

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Diatoms are one of the most important microalgal primary producers in the oceans, and although many papers have been written about their morphology, ecology, and physiology, there are relatively few on their biogeographic distribution, especially in tropical regions. An opportunistic sampling programme (R/V Hakuhomaru cruise KH96-5) during the winter of 1996/7 resulted in the collection of 153 underway surface water samples and samples from 7 CTD vertical profiles. The filtered water samples were observed in a scanning electron microscope, and the phytoplankton counted and identified, and their absolute abundance (cells/l) and diversity (H': Shannon-Wiener index) calculated.

In the Pacific Ocean, the open water diatom assemblages were dominated (>70%) by *Nitzschia* or *Mastogloia*, whilst in the coastal assemblages the dominant genus varied (e.g., *Chaetoceros*, *Bacteriastrum*, *Minidiscus*, *Skeletonema*) but represented no more than 40% of the total assemblage. The diversity was highest in these latter samples. In the Indian Ocean the assemblages were dominated (>80%) by *Nitzschia*, except near the Subtropical Front, there were many *Rhizosolenia* and *Proboscia* due to mixing with cooler waters. In general, absolute abundances were much higher in coastal waters than in open ocean waters (7×10^5 vs 2×10^4 cells/l, respectively).

In addition to diatoms, tropical species of Parmales were present in the Sulu Sea and South China Sea phytoplankton assemblages – perhaps the first time to be recorded outside of the Gulf of Mexico and California. The Parmales community composed of six taxa contains at least three new species.

Photoprotection of Arctic ice algae from low and high snow sites during spring

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In Polar Regions, bottom ice algal communities, which are mostly composed of pennate diatoms, are submitted to a wide range of irradiance from the onset of spring until the melt period. Algae have developed a suite of photoprotective mechanisms to prevent photoinhibition and oxidative stress caused by excess or fluctuating light conditions. Changes in light conditions will be intensified in the future due to the decrease in snow and ice thicknesses, so it is essential to better understand the mechanisms employed by ice algae to photoacclimate to higher irradiances. During the 2015 Green-Edge project near Qikiqtarjuak (Davis Strait, Nunavut), we monitored the photosynthetic properties of ice algae at sites of low (< 20 cm) and high (> 30 cm) snow cover, using pulse amplitude modulation (PAM) fluorometry, a rapid and non-invasive method. We also experimentally investigated the photoprotective mechanisms developed by bottom ice algae in response to relatively high irradiances (i.e. non-photochemical quenching (NPQ) and xanthophyll cycle). To do so, ice algae collected under low or high snow covers were incubated for 3 h under four different irradiances (10, 50, 100 and 200 µmol photons m-2 s-1) and thereafter placed at low light level (< 5 µmol photons m-2 s-1) for two hours. Preliminary results show no difference in effective quantum yield (initial slope of Rapid Light Curves; 0.2-0.6) and relative transport rate (rETR; 1-20 µmol electrons m-2 s-1) between algal communities collected under different snow covers. During the light experiment, the algal community from the high snow cover site showed a lower maximum quantum yield (Fv/Fm ratio) suggesting a higher photosensitivity, but a higher resilience during the recovering period. In addition, both algal communities react to high irradiance, but the minimum Fv/Fm was reached after 30 min or 2 h of light exposure depending of the communities. This suggests that the activation of xanthophyll cycle was mostly sufficient to dissipate most excess light energy. The responses of the algal communities will be discussed taking into account environmental and biological factors, such as nutrient availability and taxonomic composition.

Species diversity and geographic distribution of the diatom genus *Skeletonema* along the coast of China

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Recent studies have showed the high diversity of *Skeletonema* species in the world. But the species diversity and ecological distribution of *Skeletonema* in China seas remains poorly known. In this study, field samples were collected from different waters along the coast of China and *Skeletonema* strains were isolated. Morphological identification and cell enumeration were made with light microscopy (LM) and electron microscopy (SEM and TEM). The results have showed the high diversity of *Skeletonema* in China seas. A total of nine *Skeletonema* species were identified. They are *S. tropicum*, *S. menzelii*, *S. marinoi*, *S. dohrnii*, *S. ardens*, *S. costatum*, *S. subsalsum*, *S. greville*, and *S. pseudocostatum*. Morphological comparison with previously described *Skeletonema* species was made.

The geographic distribution and seasonal variation of *Skeletonema* along the coast of China wereinvestigated. The results showed that the most dominant *Skeletonema* species in China seas were *S. marinoi, S. dohrnii* and *S. costatum*. This in contrast to the previous studies which reported *S. costatum,* was present in all seasons and in all sampling stations. In the Bohai Sea and the Yellow Sea, the *Skeletonema* species was almost warm water species and that *S. tropicum* was not present. The peak of the cell density appeared in autumn and winter in the Bohai Sea, and that in spring and winter in the Yellow Sea. Both species numbers (7 species) and cell density (av.3.9x10^4cells/L) are highest in the East China Sea and the peak of cell density appeared in autumn. In the South China Sea (SCS), tropical and subtropical species are most abundant and *S. pseudocostatum* is only found in SCS, the peak of cell density appeared in autumn. For the whole coast of China, the average cell density is relatively higher in autumn (av.4.0x10^4cells/L) and winter (3.8 x10^4cells/L), and the species numbers is higher in summer and autumn with 8 and 6 species respectively than that in spring and winter (4 and 3 species respectively).

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Environmental DNA preserved in lake sediments: Calibrating a new tool for paleolimnology using diatoms

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Applying molecular methods to environmental DNA (eDNA) has the potential to greatly advance aquatic biodiversity science as these methods may allow for more efficient and reproducible quantifications of biodiversity. In paleolimnology, eDNA utilization has the potential to widen the range of possible target taxa. However, more calibration is needed to elucidate the advantages and the limitations of using molecular tools in paleolimnology. The objectives of this project are: (1) to evaluate to the degree to which eDNA from sediment extracts preserve the biological dynamics apparent in the water column, and (2) to quantify the congruence between molecular approaches and traditional tools to identify taxa. To address these objectives, water samples were collected and sediment traps have been deployed on a monthly basis since July 2014 in Cultus Lake, British Columbia. Diatoms are being targeted as they generally preserve well in lake sediments and thus are suitable for calibration purposes. To compare techniques for quantifying diatoms, we are identifying diatoms morphologically from sediment trap samples that were spiked with microsphere. These results will then be contrasted with qPCR analyses of water and sediment trap samples, for which we will target a short region of the ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit (rbcL) gene. Diatom community composition identified morphologically will also be compared with next-generation sequencing results. Preliminary results show that the diatom communities identified from subfossils are mostly dominated by *Lindavia intermedia* (in winter) and *Aulacoseira subarctica* (in summer). The sedimentation rate of diatom valves was also found to be 10 times higher during the winter (in this warm monomictic lake) relative to summer. This study has the potential to provide great insights into the limitations and the advantages to use molecular methods to reconstruct past community dynamics as well as how the water column dynamics of diatom communities are preserved in sediments.

Inter-annual variability of the occurrence and severity of *Didymosphenia geminata* throughout the Restigouche River watershed

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Under optimal conditions, *Didymosphenia geminata* (didymo) can produce thick nuisance growths covering the entire streambed surface which may persist for several months. In order to gain a better understanding of the underlying processes controlling its distribution, abundance and seasonal dynamics, a systematic monitoring program was initiated to assess didymo extensiveness throughout the Restigouche River watershed in eastern Canada. Over the course of six monitoring seasons, more than 1200 observations of *D. geminata* extensiveness were reported in 20 sub-catchments of the Restigouche River drainage basin. These observations were mapped illustrating the yearly severity of *D. geminata* throughout the watershed. Metrics were extracted from the spatial data to assess inter-annual variability of mat severity. Maximum annual discharge explained 66% of mat severity whereas water temperature defined the spatial distribution of the severity: in warmer, lower water years, *D. geminata* mats were more prevalent in smaller order streams. Gaining knowledge on the spatial and temporal variability of *D. geminata* proliferations is necessary to assess future direct and indirect impacts to ecosystem function.

Monoraphid diatoms genus *Schizostauron* Grunow: the preliminary data on its diversity and a review of the life cycle

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Schizostauron Grunow is a monoraphid diatom genus commonly reported from the marine littoral temperate and tropical zones. Habitats particularly rich in *Schizostauron* species are tropical coral reefs. Many of these taxa are evidently unknown to science. Indeed, most *Schizostauron* species have until recently been included either in *Achnanthes s.l*. or in *Cocconeis,* and the general diversity of the genus has been underestimated. *Schizostauron* as a genus has not been assigned to any of the established higher taxonomic ranks. Molecular markers and morphological characters exclude *Schizostauron* from both Achnanthaceae and Cocconeidaceae. Use of molecular markers places them instead in Stauroneidaceae, although neither morphological nor cytological characters support this conclusion.

Here we report research on the sexual reproduction of *Schizostauron* spp. Our observations are based on 29 monoclonal cultures isolated from natural populations from the coral reefs of Saudi Arabia (9), Mozambique (8), South Africa (4), Namibia (3) Madagascar (2), China (1), Portugal (1) and Texas, USA (1). In two isolated clones from Saudi Arabia and Mozambique almost all stages of auxosporulation have been observed, including gametogenesis, zygote formation followed by auxosporulation, and initial cell development. In order to establish sexual compatibility, clones were inoculated in pairs to initiate interclonal reproduction (38 pairwise crosses). Among the Saudi Arabia diatom isolates, auxosporulation was observed in 5 clones, whereas, in the diatoms isolated from Mozambique, sexual reproduction involved 4 clones. Mating pairs were examined every day. The sizes of representative cells from each clone as well as the sizes of the initial cells derived from successful sexual reproduction were measured. Mating experiments between clones from Madagascar and Texas were unsuccessful. Allogamous reproduction of the clones suggests a heterothallic mode of reproduction in the species. The cardinal points of the life cycle (maximum size of gametangial and initial cells) were determined.

Valve morphogenesis in a multipolar diatom genus *Hydrosera*

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Hydrosera is a large multipolar centric diatom found in brackish to freshwater environments, often attaching to red algae, such as *Bostrychia simpliciuscula* Harvey ex J. Agardh. Cells are attached to each other to form chains by mucilage pads secreted from pseudocelli located at the poles. The type species of this genus, *H. triquetra* Wallich is doubly triangular in valve view and rectangular in girdle view. The valve has an almost flat face and a deep mantle. At the summit (pole) of each of the three parabolic outer extensions is a well-defined field of small pores (pseudocellus). The remainder of the valve face and mantle is constructed of loculate areolae with large apertures (foramina) to the exterior and small pores internally. Internally, each parabolic extension is separated off from the valve face by a prominent pseudoseptum. The valve has one set of conspicuous stalked labiate processes with an S-shaped slit and a 'triptych' internally. The triptych appears internally as three cavities arranged parallel to the valve margin, subtended by a crescent-shaped ridge. Externally, on the other hand, the central cavity of the triptych is less obvious than the other two, having a smaller or almost nonexistent external opening but being raised as a slight mound-like projection.

Valve morphogenesis of two *Hydrosera* species, of *H. triquetra* var. *triquetra* and *H. triquetra* var. *hexagona* Hustedt was studied by LM, SEM and TEM. Samples containing *Hydrosera* were collected from small rivers on islands located in the south of Japan. The specimens studied were from clonal cultures and non-clonal material. We were able to observe the formation of the various valve structures, including the pseudocelli, loculate areolae, pseudosepta, and labiate processes. Interestingly, a ring-like pattern center like that found in the earliest stage of the morphogenesis in other centric diatoms was not observed. The basal siliceous layer of the central area of the valve is deposited almost simultaneously in the first stage, followed by the formation of the marginal area.

What happened to my plastids? – Persistence of functionality in diatom plastids stolen by grazer intertidal benthic foraminifera

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Some benthic foraminiferal species are known to sequester chloroplasts from their food source, and store them in their cytoplasm in a process known as kleptoplasty. After ingestion, kleptoplast functional times inside the grazer can vary from days to month, depending on the foraminiferal species. *Haynesina germanica* and *Ammonia tepida* are two species of benthic foraminifera from intertidal mudflat environments that feed mostly on pennate diatoms, which are the dominant microalgae in the sediments. The chloroplast functionality was studied in these two foraminifera exposed to different irradiance levels (0, 25, 70 µmol photon m^{-2} s^{-1}) using spectral reflectance, epifluorescence observations, oxygen evolution and pulse amplitude modulated (PAM) fluorimetry. Our results clearly showed that kleptoplasts kept some functionality for more than one week in *H. germanica* while in *A. tepida*, kleptoplastic ability was very limited, with maximum photosystem II quantum efficiency (*Fv/Fm* = 0.4), much lower than in *H. germanica* and decreasing to zero in only one day. Kleptoplasts showed net oxygen production only in *H. germanica*, with a compensation point at 24 µmol photon m^{-2} s^{-1} and a production up to 1000 pmol O_2 $cell^{-1}$ day^{-1} at 300 µmol photon m^{-2} s^{-1}. In *H. germanica, Fv/Fm* slowly decreased from 0.65 to 0.55 in 7 days when kept in darkness; however, it quickly decreased to 0.2 under high light. Kleptoplast functional time was thus estimated between 11 and 21 days in darkness and between 7 and 8 days at high light. These results emphasize that studies about foraminifera kleptoplasty must take into account light history. Additionally, this study showed that the kleptoplasts are unlikely to be completely functional, thus requiring continuous chloroplast resupply from foraminifera food source.

A new Naviculoid diatom genus from an Inselberg in Western Australia

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Inselbergs (Monadnocks) or rock out crops are very common in the arid zone of Australia, the most famous being Uluru or Ayers Rock rising abruptly upright above the flat surrounding in Central Australia. Sandford rock is an inselberg in Western Australia located in the remote country town of Westonia 314 km from Perth (the capital of Western Australia) in the Sanford Rock National Park. There are many "gnammas" – depressions or pits which collect water during the rainy season on this rock. A series of surveys was conducted in 1994, 2010 and 2011 to determine the diatom diversity. The pH in these water pits ranged from 4–6 and conductivity from 200 to500 µS/cm. The diatom communities were dominated by *Eunotia, Pinnularia, Stauroneis* and Naviculoid species. Among these an undescribed Naviculoid species was found. The life cycle and morphologic features were investigated by LM and SEM studies.

The valve view of this new species is naviculoid ranging from rhomboid to rhomboid-lanceolate with acute rounded apices. In girdle view it is linear-rectangular. The valve surface is dominated by thick transverse costae intervened by striae. The striae consist of two rows of oval or circular areolae. The axial area is broad with longitudinal siliceous strands. The proximal raphe ends are inclined to the primary side are distantly arranged. The distal ends curve to the secondary side before reaching the apices. The copulae are furnished with granules without any striae, the mantle has a single longitudinal row of areolae arranged like a "cat's paw." Length: 15–20 µm, width: 3–4 µm, striae 20–22 in 10 µm.

At the end of the wet season, several spores were found each emerging from a pair of cells. It is interpreted that this species is adapted with thick siliceous costae to survive in dormant stage and contribute their gametes to a zygospore at the end of the wet period. There has been a decline of total diatom species number in the interval of 16 years. The rain fall has declined during this period.

A new species of *Eunotia* from the thermal springs in Australia - a relic species in Refugia

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As part of the research into the diatom flora of Australia, I studied the distribution pattern of diatoms in the Thermal springs of the arid zones of Australia - some of the driest parts of the continent. In the Witjira National Park at the edge of the Simpson desert, a species of *Eunotia* was found in a few thermal springs whose temperature ranged from 35–38ºC, with a pH of 7.5 and electrical conductivity more than 1000 µS/cm. The Light and Electron microscopic structure of the diatom is illustrated in this paper.

The most marked features of the species are its giant size, large areolae and highly thickened cell wall. The frustule in girdle view is rectangular and biconvex. The valve view is semi- elliptic, semi-lanceolate to almost cylindrical, dorsiventral with a convex dorsal side and slightly concave ventral side with a wide ranging length: 50–180 µm and a narrow range of width: 20–25 µm. The sternum is located close to the ventral margin. The raphe originates from the ventral edge of the valve at each end and diagonally crosses to the edge of the valve surface some distance from the apex on each side. The striae consist of large areolae arranged in transverse rows some fragmented, with several incomplete rows on the dorsal side. The striae are more compactly and radially arranged towards the apices.

The vast majority of the cells were in the 50–75 µm size range and bulbous. But cells with a length up to 180 µm were very rare. However, the long cells of this species were located in another thermal spring in tropical Queensland over 1000 km away.

The presence of this *Eunotia* species in relatively high electrical conductivity and high temperature in a desert environment in the thermal springs is unusual considering the normal environmental preference of *Eunotia* species. This species is appropriately named *Eunotia thermophila* and is recognized as a refugia species considering the past geological changes of the arid zones of Australia.

Molecular phylogenetic analysis of diatoms (Bacillariophyta) from ancient Lake Ohrid: A species flock perspective

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Ancient Lake Ohrid, the oldest extant European lake, harbors an extraordinary endemic richness in various groups of organisms. However, age and origin for most of its endemic lineages remain largely unknown. A recent molecular phylogeny of the largest gastropod species flock from Lake Ohrid suggested an intra-lacustrine origin for most of its taxa. More importantly, diversification rates did not change significantly over time. These findings likely reflect the lack of catastrophic environmental events and/or a high ecosystem resilience to environmental disturbances. As dated phylogenies are currently available only for animal groups, we aimed at including non-animal taxa in order to avoid a potential taxonomical bias while unravelling the factors driving endemic richness in Lake Ohrid.

Here, we present a multilocus phylogeny of selected diatom genera from Lake Ohrid that contains a high proportion of endemic taxa. We reconstruct the intra-generic relationships and test the monophyly of the endemic lineages in order to identify suitable candidate taxa that meet the criteria for an ancient lake species flock. Moreover, our phylogenetic data is compared with the fossil record from the DEEP-5045-1 sediment core (567 m.b.l.f, covering 2.0 My) provided by the Scientific Collaboration on Past Speciation Conditions in Lake Ohrid - SCOPSCO deep-drilling project. Thus, we tested whether the relative time-calibrated phylogenies reflect the fossil data and vice versa (e.g., old lineages are found in the lowermost parts of the core). Furthermore, we explored linking speciation events with dated environmental events from the sediment record of Lake Ohrid.

I'll have the red pill please: visualizing diatoms and their environment in the virtual universe

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Light and electron microscope observation of microbes, including most algae, present a two-dimensional rendering of three-dimension organisms. Even when observers mentally or digitally reconstruct the three-dimensional morphology, much is lost in the mental of physical presentation of this aggregate data. Emerging technology allows observers to view true three-dimensional renderings in virtual reality. This experience allows the observer to acquire a more accurate and satisfying estimate of microbial morphology. To generate this three-dimensional rendering, multiple microscopy techniques must be used to create the virtual specimen. In this presentation, multiple three-dimensional renderings are presented in a virtual reality landscape for select diatom species. The images include atomic force and confocal microscope image mergers constructed by an interdisciplinary team of artists, biologists, and digital engineers. The products represent one of the most detailed and accurate single representations of microbes to date. Import to this technique is that while constructing the three-dimensional renderings requires significant infrastructure, disseminating and viewing the specimens does not. Low cost visualization can be performed with consumer mobile devices and extreme low cost virtual reality headsets, making the opportunity to experience these images available to most.

New records of diatom flora from Bangladesh coast, Bay of Bengal

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A diatomic study along Bangladesh coast of the Bay of Bengal, having significant influence of fresh water discharge and mixing within water column, was carried out from surface water for a period of winter (November-February) 2013 to pre-summer (March-June) 2015. A total of 96 diatom species have been identified within four studied zones (western, northern-mid, eastern and south-eastern) along Bangladesh coast during two winter and two pre-summer seasons. These numbers of diatom were recorded from 15 different sampling stations, 4 from each except eastern zone, during the study. Among the recorded 96 diatoms, most were marine and a few were of freshwater origin. On the basis of the study, a total of 39 diatom species were newly recorded from the coastal area of Bangladesh. None of these planktonic diatoms has been described before. The taxa are *Coscinodiscus radiatus* Ehr., *C. argus* Ehr., *C. centralis* Ehr., *C. concinnus* Wm. Smith, *C. concinniformis* Simonsen, *Thalassiosira lineata* Jouse, *T. leptopus* (Grun.) Hasle, *T. hyperborea* (Grun.) Hasle, *T. perpusilla* Kozlova, *T. punctigera* (Castracane) Hasle, *T. angulata* (Gregory) Hasle, *T. gracilis* var. *expecta* (Karsten) Hustedt, *Rhizosolenia styliformis* Brightw., *R. hebetata* f. *semispina* (Hensen) Gran., *R. acicularis* Sundstrom, *Bacteriastrum furcatum* Shadbolt, *Odontella mobiliensis* (Bailey) Grun., *O. aurita* Agardh, *O. longicruris* Agardh, *Haslea trompii* (Cleve) Simonsen, *Lioloma pacificum* (Cupp) Hasle, *L. elongatum* (Grun.) Hasle, *Plagiotropis gausii* (Heiden) Paddock, *Anisonema prosgeobium*, *Chaetoceros similis* Cleve, *C. denicus* Cleve, *C. constrictus* Gran, *Pleurosigma normanii* Ralfs, *P. directum* Ralfs. Besides, one species of *Coscinodiscus*, *Hemiaulus* sp. Greville, *Eucampia* sp. (Cleve) Grunow, *Lioloma* sp. (Cupp) Hasle, three of *Planktoniella* sp. and *Chaetoceros* sp. were also recorded during the study. These newly recorded diatom taxa from Bangladesh coast have been described and illustrated.

A palaeolimnological reconstruction of the nature and timing of Lateglacial – Holocene environmental change, Shetland, UK

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General temperature trends for northern Europe have been developed using pollen, macrofossil and beetle records and compared with the Greenland ice cores. However, these records are sometimes inconsistent with regional records of Northern Europe and the timing of major events, such as the Bølling-Allerød, appears to be regionally determined and diachronous. Previous reconstructions of environmental change on Shetland have focused on vegetation change and overlook the sensitivity of lacustrine ecosystems to environmental change. This paper will examine the relationship between diatom, pollen and geochemical records from two lochs on Shetland, UK to determine the timing in their response to change together with published pollen records to allow for more robust inferences concerning the drivers of environmental change in the North Atlantic region.

A 2m core was retrieved from the Loch of Clumlie on Mainland Shetland (N59°56’21.5”, W001°16’35.9”) and a 5.68m core from Loch of Grimsetter on the island of Bressay (N60°08’22.2”, W001°04’10.9”). The cores were sampled for diatoms, organic content, and pollen. Elemental content and magnetic susceptibility was analysed using an ITRAX µ-XRF core scanner with Bartington MS attachment. The chronology of the two sites will be determined when AMS radiocarbon have been processed.

The Loch of Clumlie record incorporates the Late Glacial through the Holocene based on the diatom and pollen evidence. The diatom record indicates a dynamic past that begins with a typical *Fragilaria* (*sensu lato*) late glacial record and progresses into an assemblage dominated by *Pinnularia biceps, Achnanthidium helveticum, Naviculadicta digitulus* and *Stauroneis anceps*. This is followed by a return to *Fragilaria* (*s.l.*) dominated assemblage with evidence of a hiatus near the top of the core.

Loch of Grimsetter is a Holocene record consisting entirely of gyttja. The changes in the diatom record observed in Grimsetter are more subtle, however a change in the catchment occurs at ~100 cm core-depth is reflected in the diatom record with an increase in dominance of small *Fragilaria* (s.l.) species compared with a *Fragilariforma exigua* / *Cyclotella stelligeroides* dominated assemblage in the earlier part of the record.

Assessing distribution patterns of planktonic diatoms in Lake Superior

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Increasing average global air temperatures have resulted in increased water surface temperatures in many lakes around the world. Little is known about how diatoms are responding to climate-driven changes in large lakes. The relationship between recent physical and biological changes remains unclear even in a well-studied system such as the North American Great Lakes. We assessed the distribution patterns of four diatom species that are indicators of thermal structure in smaller lake systems: *Discostella stelligera* (Cleve & Grunow) Houk & Klee, *Lindavia comensis* (Grunow) T. Nakov et al., *Lindavia bodanica* (Eulenstein ex Grunow) T. Nakov *et al*., and *Lindavia ocellata* (Pantocsek) T. Nakov *et al*. We examined relationships of these indicator species to various environmental variables using long-term monitoring data collected from multiple offshore sites in Lake Superior from 2001-2012. We found relationships with nutrients, conductivity, and measures of thermal structure. Results are a first attempt to link changes in contemporary Great Lakes planktonic diatom species to environmental drivers.

Automated diatom image analysis with SHERPA

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Increasing demand for mass screenings and current possibilities of automated image acquisition lead to an accumulation of large amounts of image data in diverse fields of biology, so that the manual measurement and handling of such image data sets is often no longer feasible. The authors' work in diatom analysis represents one of the areas that are impacted by this trend.

The newly developed tool SHERPA offers a versatile image processing workflow focused on the identification and measurement of diatom outlines, handling all steps from image segmentation over object identification to feature extraction, and providing interactive functions for reviewing and revising results. Special attention was given to the ease of use, applicability to a broad range of data and problems, and the minimization of manual intervention by extensive automating and internal quality control of the results. Though it was developed for analyzing images of diatom valves originating from automated slide scanning microscopy, SHERPA can also be useful for other object detection, segmentation and identification problems.

Tested with several datasets from different sources and of various compositions, SHERPA proved its ability to successfully analyze large amounts of diatom micrographs depicting a broad range of species. It identifies relevant valve shapes and extracts features suitable for detailed morphometric analysis and classification. Ranking of results by template matching and quality criteria helps focusing manual inspection upon difficult cases, allowing for minimum user intervention as well as for maximum output, providing a helpful tool for high-throughput analyses of image data. By applying a workflow using digital imaging and automated diatom analysis large amounts of data can be processed, and morphometric trends can be detected easily.

Findings on morphological variation of *Fragilariopsis kerguelensis* between glacial and interglacial periods

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Our software SHERPA enables the automated mass-analysis of diatom shapes by offering a versatile image processing workflow focused on the identification and measurement of object outlines. It handles all steps from image segmentation over object identification to feature extraction with minimal user interaction, extracting of a wide range of outline shape descriptors widely used in diatom studies and elsewhere.

Targeting a classical system in polar paleo-oceanography, we analyzed the morphometric variability of *Fragilariopsis kerguelensis* valves throughout a Southern Ocean sediment core, representing glacial and interglacial periods. Commonly only few features are actually measured for this kind of analysis, whilst e.g. the valve-area is just estimated from the valve's length and width by applying a correction factor. SHERPA however accurately measures the valve-area, and from these measurements we can identify morphological trends in *Fragilariopsis kerguelensis* in glacial/interglacial periods more precisely than was previously possible. These analyses also showed that in the last glacial maximum, two clearly distinct morphotypes of *F. kerguelensis* coexisted. These morphotypes differ in shape-characteristics, thus resulting in different area-correction factors, which are equivalent to the morphometric descriptor "rectangularity" as it is derived by SHERPA from actual measurements. These novel findings in a heavily studied system nicely illustrate the potential gains that can be reached by automated image analyses in diatom morphometrics.

Taxa of the Orthoseiraceae (Orthoseirales) from Patagonia, Argentina, with comments on the circumscription of the group Arctic

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The Orthoseirales Crawford in Round et al. was described for radially-symmetrical diatoms with elongated valve mantles, which have an unusual set of processes in or near the center of the valve, mostly heavily silicified and quite distinct from the areolae. These processes were given the name 'carinoportulae' and were suggested to be diagnostic for the Order Orthoseirales and Family Orthoseiraceae. Members of this group have been assigned to a single genus, *Orthoseira*, which also lacks rimoportulae, coarse areolae and usually has thick marginal spines serving in the formation of straight-chain colonies. The genus is rather species-poor and, includes several species that show small internal depressions along the valve margin, giving the appearance of a scalloped-shape outline. *Orthoseira* species are well-known in aerophilous habitats and found on several islands.

The genus *Cavernosa* Stidolph, conversely, lacks carinoportulae and possesses rimoportulae, but like some *Orthoseira* species has scalloped-shaped margins. *Cavernosa* is chain-forming, may have marginal spines and was described from aerophilous habitats, originally from New Zealand and later reported from sub-Antarctic islands. Its placement among other members of melosiroid diatoms has not been settled, though its lack of carinoportulae precludes its placement within the Orthoseirales.

The diatom flora of Patagonia is not well known although floristic studies began in the early 20th century and continued sparsely up to date. Among them Frenguelli's surveys stand out due to their detailed taxonomic analyses. Specimens from Frenguelli's collection at the Museum of Natural History at the University of La Plata, Argentina, and more recent collections have yielded specimens with features of chain-forming frustules with thick marginal spines and presence of carinoportulae (as in *Orthoseira*) and rimoportulae (as in *Cavernosa*). We present light and scanning electron microscopic observations of these species from Patagonia, and discuss the circumscription of the Orthoseirales. We suggest that depending upon the phylogenetic position of a taxon, it might not be required to have all the features of a group to be included in it. We cite examples of this phenomenon amongst the raphid diatoms, and discuss impacts on the classification of diatoms generally.

New species, new taxon reports and biogeography of the diatom genus *Gomphoneis* Cleve (Bacillariophyceae) in Patagonia, Chubut Province, Argentina

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The diatom genus *Gomphoneis* Cleve was initially established with 3 species, *G. elegans* (Grunow) Cleve, *G. herculeana* (Ehrenberg) Cleve and *G. mammilla* (Ehrenberg) Cleve, and has grown to currently be comprised of over 75 species worldwide. Kociolek and Stoermer suggested there were two subgroups within the genus, one, including the generic type *G. elegans*, has either multiple stigmoids or lacks isolated pores in the central area. In addition, the 'Elegans" subgroup has undifferentiated apical pore fields and, if longitudinal lines are present, they are formed by laminae of silica covering the margins and mantle area of the valve. The other subgroup, the Herculeana subgroup, has a single stigma, longitudinal lines formed by an axial plate and differentiated apical pore fields.

Gomphoneis has not previously been widely reported in South America. Rivera and colleagues reported *G. "herculeana*" *G. herculeana* var. *robusta* (Grunow) Cleve and *G. herculeana* var. *septiceps* M. Schmidt from several rivers in Chile, and *G. 'herculeana'* and '*G. minuta'*, both from the Herculeana subgroup, have been previously reported from Argentina. Aside from the cosmopolitan species *G. olivacea* no other species from the Elegans subgroup have previously been reported. Among the diatoms reported from Argentinean Patagonia, no species of *Gomphoneis* have been previously reported.

A recent (November 2015) expedition to Chubut province, Patagonia, to document the presence of the invasive diatom *Didymosphenia geminata* (Lyngbye) M. Schmidt, resulted in collections in the western portion of the province, and along the Chubut River. We report the presence of 3 species of *Gomphoneis* from this region, 2 of the Herculeana subgroup, one of which is new to science, and a new species from the Elegans subgroup. *Gomphoneis* species may be introductions into the region, potentially associated with *Didymosphenia*, another alien species in the Patagonia region.

Ecological stoichiometry of juvenile Atlantic salmon diet in eastern Canadian rivers experiencing nuisance growths of *Didymosphenia geminata*

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Unprecedented benthic mats of *Didymosphenia geminata* (didymo) in Atlantic salmon rivers from eastern Canada have generated concern since first observed in 2006. Paleolimnological research from the region suggests that didymo is not invasive to eastern Canada and that the timing of its proliferation is consistent with indirect effects of climate warming. Regardless of the specific controlling mechanism/s, didymo now poses an additional threat to historically-low salmon populations because of the following: didymo mats develop in habitat used by juvenile Atlantic salmon (JAS), mats alter the benthos and thus JAS diet, and didymo traps sediments that may create favorable conditions for salmonid parasites. We hypothesize that the most likely effect of nuisance growths of didymo on JAS is through changes to benthic habitat resulting in shifts in diet quality and quantity. To assess this, we will study the elemental stoichiometry of river primary producer and invertebrate biomass. The macromolecular composition that underlies this stoichiometry will be quantified to determine the diet quality of JAS. In July of 2016, 3 rivers in the Restigouche River watershed, each representing differences in water chemistry (e.g. TP, TN, DOC) and disturbance regimes, will be sampled at sites with and without didymo growths. At each site, biomass consisting of invertebrate drift, benthic invertebrates, periphyton, and didymo mats will be collected. The elemental (C:N:P) and macromolecular (e.g. carbohydrates, lipids, proteins, RNA, DNA, pigments) content of these samples will be determined. We are interested in understanding how shifts in the macromolecular composition at the base of the food web affects JAS diet across rivers experiencing nuisance growths of didymo. Our prediction is that JAS prey associated with didymo will have a higher C:N and C:P and higher carbohydrate content relative to other macromolecules due to the carbohydrate-rich nature of didymo biomass. This analysis provides preliminary data to guide future investigations, including the direct study of JAS gut contents, planned for summer 2017.

Diatom teratologies in bioassessment and the need for understanding their significance: are all deformities equal?

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Numerous diatom-based indices are commonly used in routine monitoring, such as the Biological Diatom Index (IBD), the Polluo-sensitivity index (IPS), the Trophic Diatom Index (TDI), and the Eastern Canadian Diatom Index (IDEC). These indices were developed based on the relative abundance of taxa present in a sample and, although they integrate multiple stressors, they mostly reflect the level of nutrient enrichment (eutrophication). Teratologies (deformed diatom valves) have also been linked to environmental degradation (e.g., metal, pesticides) and have been included in numerous studies as a biomarker of contamination. However, the relationship between the occurrence of abnormal valves and degree of contamination (e.g., metal concentration) is not always predictable. High percentages of deformed valves are not always observed in the most contaminated conditions. Further, different types of deformities often occur (e.g., abnormal valve outline, irregular striation pattern, deformed raphe), and it is unclear what are the contributing factors to each deformity. The type of teratology reflects development of deformities at different stages in cell division; therefore, are all deformities equal? Could a deformity occurring early during valve morphogenesis reflect a stronger response to a stressor? As a general observation, the presence and frequency of abnormal valve shape seems to be more common than other teratologies; could the cascading effect of daughter cells copying valve deformities account for enhanced shape deformities? Are genera, such as long and narrow araphid forms, more prone to deformities? Are certain stressors associated with a specific type of deformity? The successful use of teratologies as biomarkers in stream water quality assessments is contingent on understanding the significance of deformity types. The objective of this poster is to initiate discussion around the occurrence of teratologies; hypotheses on why, where, how they occur and how they are passed along during cell division.

Biodiversity of stream periphyton in response to environmental drivers along a latitudinal gradient in the eastern Canadian Arctic

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Ecological structure and function of Arctic rivers are expected to be modified significantly by climate change. Variability with increased temperature, nutrient availability and sediment input are likely to be key drivers of this change. We established an extensive sampling network of 58 rivers (90 sites) along a large latitudinal gradient in Canada's Eastern Arctic (i.e., 58° to 81° N). Our aim was to determine baseline information for physical-chemical characteristics and benthic algal community structure of these rivers. Trends in biodiversity along the latitudinal gradient were assessed relative to patterns in environmental drivers to determine whether stream periphyton assemblages reflected large-scale shifts in the abiotic template at northern latitudes, or whether they responded to small-scale differences in habitat characteristics. Diatoms were the most diverse algal group at all latitudes, followed by cyanobacteria. Average algal richness was highest at 63°N, and did not show a clear decline along the sampling gradient, in part due to variability within latitudes. Diatoms and cyanobacteria were the most abundant algal groups at all latitudes, whereas other algal groups declined in abundance or were absent at the two highest latitudes. Community structure of stream diatoms was strongly associated with site-specific environmental drivers that were related to water chemistry, which suggested that small-scale habitat characteristics were more important in shaping these communities than large-scale shifts along the latitudinal gradient. These findings represent the first detailed bioassessment of rivers along this latitudinal gradient and will serve as a baseline to which future biological change can be compared.

Pseudo-nitzschia simuloris sp. nov. (Bacillariophyceae), the first domoic acid producer from Chinese coastal waters

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The genus *Pseudo-nitzschia* H. Peragallo is a group of pennate chain-forming diatoms, widely distributed in marine waters (Hasle 2002). It has attracted considerable attention because of the production of the toxin domoic acid (DA) causing 'Amnesic Shellfish Poisoning' (ASP). The number of species in the genus has increased abruptly during the past two decades, currently comprising 46 species, of which 19 have been reported to produce the neurotoxin DA. *Pseudo-nitzschia* blooms have been found frequently along the Chinese coast, and DA has been detected in some types of seafood, such as ivory clams, pearl shells, clams, scallops and crabs. But presently no *Pseudo-nitzschia* strains from Chinese waters have been proved positive for DA production, even after the testing of nearly 200 *Pseudo-nitzschia* strains. In this study, monoclonal *Pseudo-nitzschia* strains were established from Chinese coastal waters. Each strain was examined using light microscopy, electron microscopy and phylogenetic analyses of two molecular markers: the D1-D3 region of the large subunit rRNA encoding gene (LSU) and the internal transcribed spacers (ITS), as well as the secondary structure of ITS2. Four established strains were identified as the same species, because of identical morphology and identical LSU and ITS sequences. But the four strains differed from other reported *Pseudo-nitzschia* species morphologically and phylogenetically, and the cells are considered to represent a new species for which the name *Pseudo-nitzschia simuloris* sp. nov. is proposed. The production of DA by the strains was examined using a single liquid chromatography tandem mass spectrometry (LC-MS/MS) injection. DA was detected in one of four strains. This is the first toxigenic *Pseudo-nitzschia* species reported from China, even the first DA producer found in Chinese coastal waters.

Various lipid accumulation profiles under different nutrient limitations in the diatom species *Thalassiosira weissflogii* and *Chaetoceros muelleri*

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Biofuel from microalgae has received considerable attention as an economically and environmentally feasible alternative to fossil fuels. It is well known that the lipid accumulation profile varies in accordance with culture conditions, most markedly nutrient availability. The investigations related to the effects of nutrient availability on lipid accumulation have been substantially performed in numerous species or strains of various algal taxa. However, most of the reports are concerned with single or pairs of nutrient variables on one species rather than systematically evaluating several essential nutrient variables together for one species under the same experimental design. Outlining an overview of lipid accumulation profiles induced by different fundamental nutrient stresses in the same microalgal species may facilitate a suitable parameter selection for further large scale lipid production. In this study, the comprehensive lipid accumulation profiles in response to a set of crucial nutrient stresses, including N-, P-, Si- and their combined limitations, were explored in the diatoms *Thalassiosira weissflogii* and *Chaetoceros muelleri*. In *T. weissflogii*, although the highest neutral lipid accumulation and total lipid content were induced in combined limitation cells, the highest lipid productivity was recorded under P-limitation, indicating that P-limitation could be the best condition to promote lipid production in *T. weissflogii*. For *C. muelleri*, both the highest lipid and the maximum lipid productivity were recorded in N-limited cells, even though the highest neutral lipid accumulation was achieved under a combined limitation. Therefore, N-limitation would be the most desirable stimulant for *C. muelleri* to improve lipid accumulation. For both species, nutrient limitations have led to a lower percentage of polyunsaturated fatty acids and an appropriate ratio of saturated fatty acids to unsaturated fatty acids. *C. muelleri* could be a potential biodiesel feedstock due to its more suitable fatty acid composition and higher lipid productivity compared to *T. weissflogii*. Overall, high species-diversity was exhibited in *T. weissflogii* and *C. muelleri,* in their lipid accumulation profiles and in their responses to different nutrient limitations.

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First exploration of diatom biodiversity in rivers and streams in the Man and Biosphere Reserve of Yangambi, Tshopo Province, DR Congo

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Algal works are limited for the Democratic Republic of the Congo (DR Congo). The diatoms from the Man and Biosphere Reserve of Yangambi, located in Tshopo Province (part of the formerly Oriental Province) and bordering the Congo River, have never been the subject of any investigation till recently. The first samples for diatom analyses were taken in the North-Western part of the Reserve during the Belgian-Congolese Boyekoli Ebale Congo 2010 expedition. Following the frame work of a Belgian research project (COBAFISH), in 2012 and 2013, a sampling campaign was conducted in the Lobilo River in the South Western part. In 2015 a more detailed sampling plan and monitoring was established covering nine rivers and streams as PhD thesis topic of the first author (VLIR-UOS project). Preliminary results of the diatom analyses are given for a selected number of rivers: Lobilo, Isalowe and Bosambila. The studied samples were all taken near the bridges over the rivers on road R408 Kisangani-Isangi. The sampling site of the Lobilo is located at 5 km from its mouth, while the sampling site of the Isalowe and Bosambila was within about ten meters from their entrance into the Congo River. The diatom flora in the three acid rivers (pH 5.5 - 5.9) was dominated by *Eunotia*, represented by large species diversity. *Encyonema*, *Eolimna*, *Frustulia*, *Gomphonema* and *Navicula* were also relatively well represented. More than 80 species belonging to 31 genera were observed during the preliminary diatom analysis. Besides a large number of cosmopolitan species, pantropical species such as *Encyonopis frequentissimum* and tropical African species such as *Cavicula lilandae* were sporadically observed. Among the large diversity of *Eunotia* we can mention *E.* cf. *rhomboidea*, some new large celled taxa (Taylor *et al.* submitted) and *Eunotia zygodon*. The species composition and presence of numerous cosmopolitan species point to an organic pollution. Indeed, the studied samples were all taken downstream close to the month into the Congo River and have been exposed to human impact. Notwithstanding the rivers flow in a Reserve, they are running through small villages and are subject to the impact of local palm oil production.

Long-term and short-term responses by planktonic and epibenthic diatoms to changing flood patterns and nutrient composition in a Midwestern hardwater stream (USA)

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The Cedar River in Northeast Iowa transports silt derived from stream bank erosion and agricultural land-use in the glacial till of its headwaters and floodplain. During floods, both silt load and nutrient level increase but have opposite influences on diatom growth. Attached diatoms entrained into the water column by increased discharges are then deposited along with plankton diatoms as flows decline. Sampling for this study commenced 1 July 2013; these diatom assemblages are compared with samples from the same sites collected for other purposes since 1973.

Assessing the relative influences of a continuing long-term reversal of N:P in the water from N below to N above the Redfield ratio relative to P and of long-term increased flood frequency and intensity on these diatom patterns reveals long-term changes in diatom frequency and abundance in this hardwater stream. Taxa such as *Diatoma* moniliformis have increased dramatically; others that were once abundant, such as *Skeletonema potamos*, have almost disappeared.

Short-term effects of seasonally irregular floods drive changes in diatom abundances during both the onset and also the termination of high discharges in the watershed. Timing of late summer rainstorms shifts plankton dominance among Stephanocyclus meneghiniana, *Stephanodiscus hantzschii*, and *Stephanocyclus invisitatus*.

Such changes in diatom distribution and abundance are biotic indicators of climate change and of the changes in agricultural practices in the upper Midwestern USA over the past half-century.

Three new epizoic *Achnanthes* species (Bacillariophyta) living on marine turtles and manatees

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Marine mammals such as whales and dolphins have been known for a long time to host a very specific epizoic community on their skin. Several typically epizoic-endemic genera such as *Bennetella* and *Tursiocola* have been described. Less known however is the presence of a similar community on the carapaces of sea turtles and the skin of manatees. Recently, several studies describing new species found on turtles and manatees were published (Frankovich et al. 2015, Majewska et al. 2015).

The present study continues this research in investigating several unknown taxa belonging to the genus *Achnanthes* sensu stricto. Morphological observations based on detailed scanning electron microscopy and comparison with the type material of *Achnanthes groenlandica* var. *phinneyi* McIntire et Reimer and *A. pseudogroenlandica* Hendey resulted in the description of three new epizoic *Achnanthes* taxa. Two taxa, *Achnanthes* sp1 and *Achnanthes* sp2 were found on the carapace of nesting olive ridley sea turtles (*Lepidochelys olivacea*) in Ostional Beach on the Pacific coast of Costa Rica, whereas the third new taxon, *Achnanthes* sp3, was found on the skin of West Indian manatees (*Trichechus manatus*) in Florida.

The three taxa clearly belong to the same complex characterized by long, slender valves, absence of terminal orbiculi at the apices, large cribrate areolae and absence of typical costae on the internal virgae of both valves. They can, however, be separated based on the number of areolae per stria, the position of the pseudoraphe, differences in their length/width ratio and differences in colony formation.

This poster discusses the three species, their unique habitat, morphological features and their separation from other *Achnanthes* taxa.

References:

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Majewska R., De Stefano M., Santoro M., Bolaños F., Chaves G. & Van de Vijver B. (2015) Two new gomphonemoid diatom genera (Bacillariophyta) living on marine turtles from Costa Rica. Phytotaxa 233 (3): 236–250.

The effect of nutrient limitation on the response of *Cyclotella sensu lato* taxa to light in Arctic lakes

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Lakes in the Arctic are dilute and their primary production is constrained in part by low nutrient concentrations. There is now evidence that nutrient limitation patterns vary spatially across arctic landscapes. Rapid environmental change occurring in high-latitude regions may alter nutrient and light availability in lakes. The interactive effects between these resources are likely to shape how phytoplankton in these lakes respond to environmental changes. Broadly, one of the phytoplankton groups most strongly affected by interactive environmental conditions is *Cyclotella sensu lato* taxa. Changing environmental conditions in the arctic have caused widespread changes in *Cyclotella* species since 1850 across arctic lakes. To better understand the mechanisms behind these species changes, we investigated how the nutrient limitation status of a lake alters the responses of three common *Cyclotella sensu lato* taxa to light. To assess this, we collected source water with the natural phytoplankton assemblages from lakes in southwest Greenland with different nutrient limitation status. The responses of these assemblages to light levels (low, moderate, or high) and nutrients (limiting or replete) were tested using a factorial design. We found that light affected *Cyclotella* cell densities differently depending on nutrient limitation status of lake. *Lindavia bodanica* and *Lindavia radiosa* cell densities were highest under low and medium light respectively in phosphorus (P)-limited lake. Whereas they were highest under high light in nitrogen + phosphorus (N+P) co-limited lake. However, *Discostella stelligera* cell densities were highest under medium light in P-limited lake and under low light in N+P co-limited lake. This study provides further information on the critical role of resource availability and interactive environmental effects on diatom ecology, and will improve our ability to assess variable changes in diatom communities across lakes.

Diatoms as a quality food resource for zooplankton in a subtropical shallow lake

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An epiphyton summer succession was investigated over 60 days in a subtropical shallow lake in southern Brazil under natural conditions and considering zooplankton as potential grazers. Macrophytes were cleaned in the field with soft sponges, identified, and randomly sampled at short-term intervals. Taxa were classified into six categories of life forms and also based on the largest linear dimension axis (GALD). Additionally, zooplankton was sampled and identified; species and groups were also classified relative to the size of particles that they are able to ingest, cross-referencing data with algae GALD aiming of understanding the relationship between zooplankton feeding behavior and epiphyton. Quantitative data and biomasses are provided for both groups. Epiphyton richness and total density peaks were registered after two weeks of succession and this characterized the end of the early successional phase, coincident with the zooplankton biomass peak. Diatoms dominated the advanced successional phase; they were correlated with increases in biomass (r = 0.91) and were responsible for more than 70% of total biomass after day 20. Summer storms (high precipitation 46.7 mm and wind 29.5 m s^{-1}) favored both the prostrate diatom biomass (mainly *Epithemia* spp.) and TP input. Diatoms were also shown to be well adapted to high mean wind velocity (15 m s^{-1}). Algal abundance was negatively correlated with zooplankton richness (r = -0.80) but diversity increased with zooplankton abundance (r = 0.74) revealing feeding preferences, once zooplankton and diatom biomasses were correlated (r = 0.95). Adnate and prostrate diatoms increased with grazing because predators prefer loosely attached diatoms due the ease of gathering. Large motile diatoms were correlated with the availability of TP in the biofilm (r = 0.95), which also favored zooplankton density. Recent studies on the phytoplankton and zooplankton relationship in Mangueira Lake showed that diatoms were not dominant in the plankton, leading zooplankton to rely on other sources of food such bacterioplankton and, as is shown here, epiphyton. Because of that, Copepods and Cladocerans increased in the water when diatom biomass increased; diatoms acted as a quality food resource for zooplankton handling bottom-up control.

Morphological and geographical studies of *Terpsinoe americana* (Bailey) Ralfs

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Terpsinoe americana (Bailey) Ralfs (Synonym: *Tetragramma americana* Bailey) was collected from the sediments of the mouth of Hudson River and described in1854.

We found the species from coastal bottom sediments at Shioya Bay in Okinawa (Okinawa island), southern Japan and examined the specimens using light and scanning electron microscopy.

The cells form short chains (two to four cells) were connected by mucilage pads secreted from pseudocelli and attached to sand grains in a coastal waters. Each Valve is divided into three compartments by two septa across internally. Valves have three compartments and are inflated; the central one being the largest. In valve view, about 60 µm in length and rectangular in girdle view. The valve face is flat, but bears numerous tiny projections. The pseudosepta extend across the bases of the two parts. Internally the valve has no rimoportulae, which is a characteristic feature of the species, whereas *Terpsinoe musica* has a conspicuous rimoportula with S-shaped lips similar to the genus *Hydrosera* spp.

We will also discuss geographical distribution of *Terpsinoe americana* and *T. musica* in Japan.

Diatoms assemblages as bioindicators of water quality in a transboundary river system: A case study of the Limpopo River Basin, Southern Africa

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Diatoms are extremely diverse ubiquitous microalgae, widely used as indicators of the quality of aquatic ecosystems throughout the world. This study will investigate the use of diatom assemblages for water quality assessment in the Limpopo River basin, a Trans-boundary River System of the Southern African region, shared between South Africa, Botswana, Zimbabwe and Mozambique. Physicochemical environmental variables of the waters will be determined. Diatom samples will be collected, prepared, counted and identified up to species level. Diatom community structures will be related to environmental conditions at each sampling station across the basin. The OMNIDIA software package will be used to calculate foreign diatom-based indices developed for water quality assessment in temperate region, in order to test their applicability in this semi-arid river basin of Southern Africa. The relationship between foreign diatom-based indices and physicochemical environmental variables will be determined by means of Pearson Correlation using CANOCO software package.

Phylochips: a tool for routine monitoring of toxic algae and pathogens in aquatic ecosystems

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A microarray consists of sequences that are applied to the surface of a glass slide in an ordered array. rRNA sequences applied to the microarray can identify organisms. This is termed a phylochip, which is a relatively new, innovative microarray application. Phylochips can facilitate monitoring for any micro-organism in any environment and visualize its changes in abundance over time for long-term records. In our study we developed, in two different EU projects, a phylochip for the detection of toxic algae in marine waters and for freshwater pathogens in freshwater. We tested the phylochips with environmental samples in 5 countries for the toxic algae and in 6 countries for the freshwater pathogens. Water samples were filtered until they clogged or concentrated into one litre using a kidney dialysis filter. Total RNA was extracted using TriReagent and then labelled with a fluorescent dye and hybridised to the phylochip. The pattern is captured via fluorescent excitation in a microarray scanner. The results are exported as an excel file and analyzed based on presence/absence of the probe signals in a hierarchical fashion. Where calibration curves have been made, the microarray signal can be converted into cell numbers. For a species to be present, probes for higher taxa, viz., genus to kingdom must also be present.

Metacommunity structure and community-environment relationships in the Delaware River Watershed: implications for bioassessment using diatoms

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The Delaware River Watershed Initiative (DRWI) is a long-term, collaborative water quality monitoring effort aimed at eight sub-watershed clusters in the Delaware River basin. The DRWI collects biotic communities (fish, macroinvertebrates and diatoms) and associated environmental factors at streams targeted for restoration (e.g. agricultural or stormwater BMPs) or habitat protection using a Before-After Control-Impact (BACI) design, as well as baseline conditions at "integrative" control sites.

We analyzed Elements of Metacommunity Structure (EMS; coherence, turnover, and boundary clumping) from diatom samples collected by the DRWI from 2013-2015. We determined the environmental gradients most strongly related to EMS along the primary and secondary axes of a detrended correspondence analysis (DCA) using canonical correspondence analysis (CCA). Diatom communities were organized in a Clementsian structure along the primary axis, indicating distinct community types most strongly correlated with pH and conductivity gradients within the drainage basin. Along the secondary axis, sites were organized in nested subsets along a gradient of habitat quality. Notably, it appears that the observed Clementsian structure may be an artifact of uneven sampling distribution along pH and conductivity gradients, despite no significant outliers.

One of the major goals of the DRWI, like many other watershed bioassessment programs, is to use bioindicators to monitor changes in water quality by quantifying species' response to environment. An artificial Clementsian structure has important implications for describing species' environmental optima. EMS are important factors to consider in experimental design, sampling effort, and developing water quality metrics.

Novel *Aulacoseira* and *Stephanodiscus* from the Pliocene Hadar Formation, Afar Depression, Ethiopia

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The Paleolimnology laboratory at Indiana State University presents novel species placed in *Aulacoseira* and *Stephanodiscus* from the Pliocene Hadar Formation, Afar Depression, Ethiopia. Specimens were collected from drill core material as part of the Hominin Sites and Paleolakes Project (HSPDP), an interdisciplinary investigation of the climate and environmental context of East Africa during human evolution. Five newly described species and preliminary environmental interpretations are presented herein. The Hadar Formation diatom assemblage also represents a newly revealed excerpt of the evolution of *Aulacoseira* and *Stephanodiscus* from freshwater lakes in Africa. The Hadar Formation diatom assemblage is compared to previously reported diatoms from Lake Malawi and fossil material from the Gadeb region of Ethiopia as well as extant species. Several other taxa from HSPDP material that remain unclassified are also presented.

Epiphytic diatoms on a red alga *Laurencia nipponica* Yamada from Hokkaido, Northern Japan

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We are conducting a morphological investigation of the most abundant diatom species in the framework of a research project focused on the species composition, structure, succession and ecology of the epiphytic microflora on the seaweed. The attached diatom flora on a red alga, *Laurencia nipponica* Yamada from the Zenibako coast, Otaru-shi, Hokkaido, Northern Japan, were studied using light and electron microscopes (SEM and TEM). A total of 15 species in 10 genera were recorded from all samples; the following 9 taxa were recorded with the common relative frequency rank, viz., *Cocconeis californica* Grunow, *Falcula* sp., *Gomphoseptatum aestuarii* (Cleve) Medlin, *Licmophora dalmatica* (Kützing) Grunow, *Navicula directa* (W. Smith) Ralfs, *Navicula* sp. 1, *Pseudogomphonema kamtschaticum* (Grunow) Medlin, *Rhoicosphenia marina* (Kützing) M. Schmidt, and *Tabularia investiens* (W. Smith) D.M. Williams & Round. The overall species composition in this area appeared rather similar to the flora data observed in the Gulf coast of St. Lawrence, Québec, Canada. In addition, morphological and taxonomical comments were given for the dominant and novel taxa.

Actinocyclus setanensis a new freshwater diatom from Early Miocene sediment, located in Setana Town, Hokkaido, Japan

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Actinocyclus selanensis sp. nov., is described from an Early Miocene freshwater sediment of the Futoro Formation located in Setana Town southwestern Hokkaido, Japan. The species has a relatively small round valve face with radial to vague fasciculate areolae rows, pseudonodulus located on valve face/mantle boundary and two to three (rare cases four) stalked rimoportulae, thick and bulged externally with small round openings. The taxon is described as a new species with accompanying light and scanning electronic microscope photographs.

The diatom genus *Coscinodiscus*: further observations on *C. alboranii* Pavillard using scanning and transmission electron microscopy

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We have been working on a systematic evaluation of the diatom assemblages in the northeastern Gulf of Mexico for a number of years, most recently as part of a larger project investigating impacts of the Deepwater Horizon blowout of 2010. A common, but not abundant, member of the net plankton of the region is *Coscinodiscus alboranii* Pavillard, previously reported from southeastern Gulf of Mexico as "*Porosira* sp." by Saunders & Glenn (1969). Pavillard's (1925) original description of the species, based on Mediterranean material, is inadequate for a positive identification. We have examined the lectotype material (designated by von Stosch 1986) and additional archived material available at the Hustedt Collection using light microscopy. The populations observed in our samples conform to the descriptions provided by von Stosch. von Stosch (1980, 1986) described several features of this species that distinguish it from other members of the genus *Coscinodiscus*, most notably: 1) the presence of three types of areolae, poroid areolae on the valve face occluded by one of two types of vela, and locular areolae on the valve mantle, with an external cribrum and a large internal foramen; and 2) a ring of specialized processes known as "endochiastic areolae" near the margin of the valve. Our observations revealed additional information concerning the structure of the valve, including the presence of narrow channels connecting marginal areolae to edge of the valve mantle; we propose the term "*microchannels*" for these structures. These features confirm the anomalous position of this species in the genus. The taxonomic implications of these observations are discussed in light of recent changes in the circumscription of the genus *Coscinodiscus* and of new descriptions of other members within the family Coscinodiscaceae/order Coscinodiscales.

Epilithic and aerophilic diatoms in the artificial environment of Kungsträdgården metro station, Stockholm, Sweden

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The Kungsträdgården metro station is an artificial and urban subsurface environment illuminated with artificial light. Associated with seeping water on the granite walls, secondary minerals (speleothems) are formed as flowstones, coralloids and stalactites. This underground metro station houses a complete ecosystem with cyanobacteria, diatoms and mosses as primary producers. The top predator in this ecosystem is the spider *Lessertia dentichelis*, a species first reported in Sweden from this locality.

As a first step towards a better understanding of the biology and rock wall habitats, the diatom flora was investigated. A total of 11 species were found growing on the rock walls of Kungsträdgården metro station. The results show the diatom flora in Kungsträdgården to be dominated by the aerophilic taxa *Diadesmis contenta, Pinnularia appendiculata, Caloneis* cf. *aerophila, Halamphora normanii* and *Diadesmis perpusilla*. Other present taxa include *Nitzschia amphibia, Grunowia sinuata, Caloneis* cf. *bacillum, Cymbella laevis* and *Diploneis ovalis*.

Our findings fit the commonly observed pattern that species richness in such undesirable flora growth (lampenflora) is poor in comparison with cave entrances characterized by sun light. Even so, Kungsträdgården shows a higher species richness than most other studies of lampenflora, which can conceivably be explained by its urban location; the constant flow of people might contribute to dispersal. Further, the metro station is illuminated 24 hours a day which is distinctly more than a show cave that might be illuminated a few hours a day or a few days a week.

A spatial distribution of different communities of diatoms, characterized by different species composition, could be observed in Kungsträdgården metro station. This indicates a heterogeneous environment providing different microhabitats, similar to some natural subterranean habitats. Diatoms are known to dissolve carbonates by excreting organic acids, thus, it is possible that they are actively involved in the persistence of the calcareous ooze in which they were found to thrive. The calcareous ooze is a small and specialized niche in this ecosystem and it is likely that the diatoms are involved in the formation of this microhabitat.

Tracing environmental changes in the Baltic Sea coastal zone during the last 2000 years

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The Baltic Sea is an ecosystem suffering heavily from eutrophication manifested in changed biodiversity, cyanobacterial blooms, decreased secchi-depth and increased sea bottom hypoxia.

This ongoing project aims to increase our understanding of how climate change and human impact have affected the Baltic Sea. Our focus is on how the distribution of hypoxia and the nutrient loading in the coastal zone have varied during the last 2000 years. This time frame comprises two periods with extensive areal distribution of hypoxia in the open Baltic Sea. The first time period 1000-700 years BP corresponds to the medieval climatic anomaly and coincides both with an increase of water temperature and a suggested increase of human population. The second time period from 1950 to present caused by eutrophication has led to a rapid expansion of hypoxic sea bottoms, and the Baltic Sea now constitutes one of the largest hypoxic areas worldwide.

In the coastal zone, in contrast to the open Baltic Sea, data on long-term trends of hypoxia are lacking. In order to increase our understanding of human impact on the Baltic Seas ecosystem, coastal sites should be more carefully studied as land-based human activities will probably influence the coastal zone first, before the effects are registered in the open Baltic Sea.

Laminated sediments are used as a proxy for hypoxic events, and diatom analysis followed by statistical analyses using transfer functions, will be used to reconstruct historical nutrient levels. Further, we will compare results from the coastal zone with the open Baltic Sea in order to explore if there is a synchronicity in registered environmental changes.

Several sediment cores have been sampled along a selected part of the Swedish east coast using piston and gravity corers. These cores are being studied using a multi-proxy approach. Lithologies, age models and sedimentation rates will be presented together with results from diatom analysis and geochemical analyses including total organic carbon content (TOC), C/N-ratio, stable nitrogen ($\delta^{15}N$) and carbon isotopes ($\delta^{13}C$).

Stephanodiscaceae succession from Pleistocene sediments of Lake Peten Itza (Guatemala, Central America): new fossil genus and species

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A sediment core from site PI-6 in Lake Peten Itza (composite depth of ~75.9 m) provided a continuous record of hydrological change for the last ~85 cal ka (Hodell et al. 2008). The fossil diatom flora is diverse and represented by 153 species belonging to 42 genera. Ninety-six species are extant and are present in diverse waterbodies of the Yucatan peninsula. Throughout the sedimentary sequence, Stephanodiscaceae is mainly represented by *Cyclotella* and *Discotella* genera, which are abundant and alternate as the dominant genera of the family. Amongst them, three new species were found and described: *Cyclotella petensis*, *Cyclotella cassandrae* and *Discotella bradburyi*. *C. petensis* is characterized by a tangentially undulated central area with 2 to 20 valve face fultoportulae (vffp) in a semicircular position and a marginal striation crossed circumferentially by a ring. *C. cassandrae* has elliptical valves, slightly transversally undulated central area with 10 to 25 scattered vffp and coarse striae. The flat valves of *D. bradburyi* are characterized by a central area with 5 to 30 scattered pori.

Stephanodiscaceae specimens with tangentially undulated valves and internal strong dychotomic ribs, never observed before, were attributed to a new genus *Cyclocostis* (type species *Cyclocostis rolfii*). All new species are considered extinct except for *D. bradburyi*, which is still present in a cenote from the Yucatan peninsula.

A review on the studies of Microphytobenthos in and around the Korean tidal flats

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A historical review of microphytobenthos (MPBs) studies in and around the Korean tidal flats has been made with emphasis on the recent findings of ecology and taxonomy of marine benthic diatoms. Assemblages, dynamics, production, and food web etc. have been found to be internationally recognized topics relating to the tidal flat MPBs, accordingly the review on the Korean MPBs studies was provided in the given topics with highlights of pros and cons of individual scientific efforts and data. In particular, brief summary from the several representative works related to the corresponding topics were provided as for comparison, where applicable. While approximately 50 years of scientific gap between Korea and the European countries were clearly identified, rapid scientific advancements in recent 10 years would be noteworthy. A classical topic of diatom assemblages has been steady issue in Korea, with documented MPBs of >400 species (ca. 10 new species) from the Korean tidal flats. As part of review, selected data from the previous and current MPBs works encompassing above 4 topics have been reanalyzed. In conclusion, future MPBs studies in Korea would contribute to the proper appreciation of biodiversities as well as ecological functions of marine benthic diatoms in and around Korean tidal flats.

The Miocene freshwater diatom flora of the Antarctic Continent

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In contrast to the rich marine fossil record that extends to the late Mesozoic, records of pre-Quaternary lacustrine diatom deposits are relatively scarce, particularly from the high latitudes. Such records provide information concerning paleoenvironmental change, as well as new insights concerning the evolution of freshwater diatom floras. Here, we report two well-preserved lacustrine diatom assemblages from the Transantarctic Mountains in Continental Antarctica dating back to the Middle Miocene (ca. 14 – 17.5 Ma): Mount Boreas in the Olympus Range in the western Dry Valleys, and the Friis Hills adjacent to the Asgard Range in the southern Dry Valleys.

In total, 17 samples of Mount Boreas and 9 samples of the Friis Hills were investigated. Diverse diatom floras were revealed, represented by at least 131 taxa (38 genera) and 128 taxa (36 genera) from Mount Boreas and the Friis Hills, respectively. Both floras are dominated by small colonial fragilarioid taxa and a large diversity of benthic taxa belonging to the genera *Eunotia*, *Gomphonema*, *Pinnularia* and *Brachysira*. Detailed counts of the Mount Boreas sediments suggest that the Mount Boreas lake persisted for several thousands of years and underwent progressive natural acidification. Extensive bryophyte growth suggests an initial shallow water phase, followed by deepening and the occurrence of tychoplanktonic taxa including *Aulacoseira*.

Many of the observed Miocene genera and species groups are currently not found in Continental Antarctica, suggesting that the extant Continental Antarctic diatom flora became established after the Mid Miocene cooling event (ca. 14 Ma), when Antarctic glaciation became intensified. In contrast, the Miocene flora shares compositional affinities with the present-day flora of the Arctic region (e.g., high diversity with eunotioid and cymbelloid diatoms), as well as marked biogeographical links with the Gondwanan continents of South America and Australasia, as evidenced by the occurrence of marker genera such as *Veigaludwigia*.

Together, these new fossil diatom localities shed a unique light on the evolution of Antarctic lake ecosystems and taxonomic and biogeographic aspects of the Antarctic freshwater flora. Moreover, as the fossil assemblages are extremely well preserved, they provide valuable temporal constraints for time-calibrated molecular phylogenies of modern congeneric diatom taxa.

Cryopreservation of diatoms: tips & tricks

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Diatoms are an ecological and evolutionary important group of microalgae and hold much value for aquaculture and overall biotechnological potential. In contrast to many other groups of micro-organisms, long-term maintenance of diatom strains by repeated re-inoculation is impossible due to the gradual reduction in cell size of most species, eventually resulting in cell death. Therefore, cryopreservation is the preferred strain preservation method. Cryopreservation success varies strongly with species and differs systematically between marine and freshwater diatoms. Based on previous experiences in the BCCM/DCG culture collection (Laboratory of Protistology and Aquatic Ecology, Ghent University), 80% of the tested marine species (n=50) could be cryopreserved successfully, while this was the case only for 25% of tested freshwater species (n=20). Here we formally compare different cryopreservation protocols tested for a panel of model freshwater and marine species of the genera *Pinnularia*, *Seminavis*, *Cyclotella*, *Cylindrotheca*, *Thalassiosira* and *Opephora*. Here, strategies to optimize cryopreservation procedures for diatoms and possible alternatives for the long-term maintenance of diatom species in culture collections will be discussed.

FTIR imaging analysis of cell content in sea-ice diatom taxa during a spring bloom in the lower Northwest Passage of the Canadian Arctic

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Ice algae are light limited at the start of their vernal bloom, and can respond by changing the cellular production of saturated lipids and proteins. This study examines the phenotypic effects of seasonal light limitations on biomass composition at the species and individual cell scale. We used Fourier Transform Infrared Spectroscopy (FTIR) to quantify the relative composition of saturated lipids and proteins within algal cells from low and high light conditions of thick and thin snow covered sea ice, respectively. Samples were collected within the lower Northwest Passage, just west of Cambridge Bay, Nunavut, Canada during the ICE-CAMPS field campaign, between 11 March to 30 May 2014. The analyzed diatom species included *Nitzschia frigida*, *Attheya* spp., and pennate ribbon colonies. We found that FTIR spectrochemical imaging proved to be a successful and efficient analytical technique for determining relative biomass composition of individual ice algal cells. Saturated lipids (CH_2+CH_3) and the lipid-driven ratio (CH_2+CH_3: protein) were inversely related to light transmittance through the snow-covered sea ice. Relative saturated lipids increased significantly, whereas cell protein content either remained stable or decreased over the bloom period. By means of observation and utilization of the FTIR technique it was found that of the three species analyzed, *N. frigida* displayed the greatest and most rapid increase in cellular CH_2+CH_3 content and CH_2+CH_3:protein cellular ratio. These results suggest a more rapid and distinct phenotypic acclimation strategy of *N. frigida* to various light regimes and could support why this species tends to dominate ice algal communities in the Arctic.

Species of *Gomphonema* with wide axial areas from North America

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This study presents an account of several *Gomphonema* taxa from North American rivers that are similar morphologically and have caused identification problems during diatom assessments. These taxa are characterized by narrow cells with a wide axial area, short marginal striae composed of a single or double row of areolae, and the presence or absence of a stigma. Two new species of *Gomphonema* with linear-lanceolate valves, narrow cells (width ≤ 6µm), wide axial areas, short uniseriate striae, and one stigma are presented: *G. caperatum* sp. nov. is a common and often abundant species in rivers across Eastern North America, especially in the Appalachian region, but is also found on the West Coast. This diatom has narrow, almost linear valves with short marginal striae. *G. obstipum* sp. nov. has lanceolate, slightly bent valves and it has only been found in two Virginia rivers. We report here for the first time the occurrence of *G. incognitum* Reichardt, Jüttner & Cox in North America. In addition, we provide data on the morphology, ecology, and distribution of poorly known but widespread North American species such as *G. amerhombicum* Reichardt, *G. stoermeri* Kociolek & Kingston, and other species with linear-lanceolate valves and wide axial areas such as *G. freesei* Lowe & Kociolek, *G. applalachianum* Kociolek & Thomas and *G. apuncto* Wallace. This study underscores the insufficiency of our knowledge of diatom diversity even from relatively well-studied geographic regions of North America and the need for more detailed taxonomic investigations.

Environmental history of southeastern Pennsylvania valley bottom wetlands and streams reflected in composition of their diatom assemblages

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As part of a project aimed at charting environmental history of valley bottom wetlands and streams in the mid-Atlantic region of the United States, we conducted a preliminary study of transformations of diatom assemblages over the last 3,000 years. We present the results of diatom analysis of a stream bank section collected at the Big Spring Run research site located in the Conestoga River watershed in southeastern Pennsylvania. At the base of this section, diatom assemblages are dominated by several large-celled species of *Pinnularia* and indicate a shallow valley bottom wetland throughout the late Holocene until the 1700s; this is consistent with previous stratigraphic and sub-fossil seed evidence. Historic sediment immediately overlying this wetland soil marks a transition from wetland to mud flat. The large-celled diatoms disappear and the assemblage is dominated by *Gomphonema drutelingense*, thus pointing to the possibility of modification of the valley bottom wetland by European settlers. We then analyzed recent diatom materials collected from the Conestoga River and its tributaries from 1948 to 2010. Almost no diatom species that were present in the 1700s remained in these streams by 1948 and, until recently, the assemblages have been dominated by eutraphentic and sediment-tolerant *Navicula, Nitzschia, Mayamaea, Eolimna,* and *Fistulifera* species. These observations confirm that human impact on the valley bottoms was not just in the form of chemical pollution, but also in drastic modifications of stream channel and wetland morphology. The anastomosing shallow channel and riparian wetland systems that existed in the region throughout the Holocene were transformed by dams built in the 1700s and 1800s into reservoirs that were rapidly filled by sediment flushed from surrounding farmland. After dam removal or failure in the 20th century, the channels incised into this accumulated sediment and formed steep, easily erodible banks. The aim of the current restoration experiment conducted on Big Spring Run is to rehabilitate the “pre-1700” wet meadow ecosystem by removing legacy sediment from the valley bottom. Comparison of diatom assemblages before and after the restoration shows an increase in diatom diversity in the restored reach, which we explain as a consequence of enhanced microhabitat diversity.

Observations of the diatom genus *Minidiscus* Hasle (Thalassiosirales, Bacillariophyta) in the northeastern Gulf of Mexico

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The genus *Minidiscus* Hasle (Thalassiosirales) comprises a cluster of extremely small forms characterized by the presence of a subcentral rimoportula and a small number of fultoportulae, generally restricted to the valve face. Currently at least 8 species have been described in the genus. Several of these are frequent members of the nanoplankton of the Gulf and Atlantic coasts of Florida, including *M. trioculatus* (Taylor) Hasle, *M. chilensis* Rivera and *M. comicus* Takano. Here we document three additional morphotypes, herein referred to by their primary collection sites: the Panacea morphotype, the St. Andrew morphotype, and the Apalachee morphotype. All three are similar to *M. comicus* in the absence of a marginal hyaline area and in the presence of fultoportula surrounded by three satellite pores. The Panacea & St. Andrew morphotypes were abundant in collections from Apalachicola Bay and Rookery Bay, Florida, and from the coast of Massachusetts, suggesting both are widely distributed. The Apalachee morphotype has only been observed in the Econfina and Fenholloway estuaries of Apalachee Bay. The Panacea morphotype is characterized by the prominent, evenly spaced, turbinate external tubes of the 3-5 fultoportulae and by the presence of a single row of pores, 30 in 10µm, in an otherwise hyaline marginal area. The St. Andrew morphotype is distinguished by extremely small cells, 1.5–4.4 µm in diameter, a deep mantle, fultoportulae with simple external tubes, and by scapulate extensions of the areolar walls. The Apalachee morphotype has denser areolae than other two morphotypes. We believe these differences provide sufficient basis for describing each of the morphotypes as a distinct species. Our observations suggest that members of *Minidiscus* may represent an important source of primary production easily overlooked due to their small size.

Predominance of the potentially harmful centric diatom *Thalassiosira mala* Takano (Thalassiosiraceae) in plankton net hauls collected from the east coast (Bay of Bengal) of India in December 2015

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Net phytoplankton samples were collected from several coastal localities in Odisha (formerly, Orissa) State on the east coast of India (Bay of Bengal), including Chilka Lake (near Satpada), Chandrabaga Beach (Konark) and Puri, in December 2015. Our investigations of the Chilka Lake samples, using both scanning and transmission electron microscopy, revealed massive concentrations of the diatom *Thalassiosira mala*, a nanoplanktonic, bloom-forming and potentially toxic diatom. It was also a dominant nanoplankter in the net hauls collected from nearby coastal areas, including Chandrabhaga Beach near the city of Konark and Puri, suggesting its widespread distribution on the east coast of India. The large numbers of cells allowed us to observe details of the cingulum not previously reported. Takano (1965) described the diatom as a bloom-forming species harmful to marine bivalves in Tokyo Bay (Pacific Ocean), where it was often found in gelatinous colonies; it has since been widely observed in warm coastal waters from around the world. Based on previous reports of its occurrence on the west coast of India (SW Arabian Sea) and our current findings, *Thalassiosira mala* appears to be a common, frequently encountered and widely distributed, but often overlooked, source of primary production in the nutrient rich Indian coastal waters. The absence of reports of this diatom from other areas of the Indian coastal waters may reflect the difficulty of conducting detailed investigations using light microscopy alone for identification. The presence of morphologically similar and taxonomically related species, especially of those <20 µm in diameter emphasizes the importance of reliable identification at the species level using transmission and scanning electron microscopy for any meaningful ecological and biogeographic considerations.

Millennial-scale variability of diatom paleoproductivity during the last 70 kyr: an equator-to-subtropics comparison along the western African coast

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Upwelling accounts for ~50% of the global export production in eastern boundary upwelling ecosystems (EBUEs). In these areas, diatoms deliver a substantial part of the ocean's primary productivity and strongly affect to the marine silica cycle. Although productivity variations in EBUEs are usually attributed to wind stress-forced changes in upwelling intensity, the dynamics of primary production along the western African coast is less straightforward due to the complex atmospheric and hydrographic settings. In this study, we compare high-resolution diatom records encompassing the last 70 kyr, which were generated at three hemipelagic sites drilled along the western African coast between 20°N and 25°S. The studied cores are: GeoB3606-1 (SE Atlantic, off Namibia), GeoB4905 (Guinea Basin), and GeoB7926-2 (NE Atlantic, off Mauritania). Though the three sites are within EBUEs, the processes and mechanisms behind the preserved signal differ. This is clearly mirrored in both the variations of total diatom concentration and the species-specific composition of the community at each core site. While the inflow of silica-rich waters of Southern Ocean origin played a significant role off Namibia, precipitation-controlled riverine input of dissolved silica was decisive in the Guinea Basin. Off northwestern Africa, changes in wind intensity, the subsequent upwelling of dissolved silica and the seaward extension of the chlorophyll filament were responsible for diatom production. The implications of our observations for the late Quaternary productivity and the nutrient dynamics from low-latitude ocean areas, the possible effect of abrupt climate changes as well as interhemispheric teleconnections at both Milankovitch and millennial time-scales are discussed.

A new extant species of the genus *Pseudopodosira* (Pseudopodosiraceae, Bacillariophyta) from coastal waters of Argentina

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A new extant marine diatom belonging to the genus *Pseudopodosira* (Pseudopodosiraceae, Bacillariophyta) is described with light and scanning electron microscopy from material collected in Argentinean coastal waters. The new taxon is a morphologically distinctive species with the following combination of characters: 1) cells with numerous discoid chloroplasts, 2) frustules commonly heterovalvate, 3) valves with concave central area generally occupied by one to several bulges, rarely without bulges, 4) oblique striae placed on a horizontal, convex shelf of the valve surface, 5) valve mantle unperforated internally and with variable number of rimmed pores placed below the flange externally, 6) one ring of rimoportulae irregularly spaced, not visible externally. Taxonomic-nomenclatural analysis of the genus *Pseudopodosira* and its type species is conducted and nomenclatural changes are proposed. *Pseudopodosira calyciflos* is formally designated as the generitype and a new name is proposed as replacement name for *P. pileiformis* based on the fact that both taxa are not conspecific. Comparisons between the new species and morphologically allied extinct species *P. modesta*, *P. wittii*, *P. bella*, *P. westii*, *P. hyalina* and *P. himilis* are conducted. Although most of *Pseudopodosira* species are extinct, *P. westii*, *P. calyciflos* and *P. echinus* (= *P. kosugii*) were mentioned as extant. Nevertheless, according to the literature it is necessary to check whether *P. westii* still lives on European coastal sediments. *Pseudopodosira calyciflos* was only mentioned in the protologue as living in the Sandwich Islands (an old name for the Hawaiian Islands, North Pacific Ocean) but illustrated by a figure that only shows one valve. As far as we can determine *P. echinus* and the new *Pseudopodosira* species from coastal waters of Argentina are the only species found in recent habitats and able to grow in cultures. Morphologic differences between both taxa are established.

Systematics and Biodiversity: an international peer-reviewed journal

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Systematics and Biodiversity is devoted to whole-organismal biology. Numerous algal papers have been published in the journal. It is an international, peer-reviewed, life science journal, without page charges, which is published by Taylor & Francis for The Natural History Museum, London. The journal is published six times a year online and two printed copies per year. The criterion for publication is scientific merit. *Systematics and Biodiversity* documents the diversity of organisms in all natural phyla, through taxonomic papers that have a broad context (not single species descriptions), while also addressing topical issues relating to biological collections, and the principles of systematics. It particularly emphasizes the importance and multi-disciplinary significance of systematics, with contributions which address the implications of other fields for systematics, or which advance our understanding of other fields through taxonomic knowledge, especially in relation to the nature, origins, and conservation of biodiversity, at all taxonomic levels. The journal does not publish single species descriptions, monographs or applied research, nor alpha species descriptions. Taxonomic manuscripts must include modern methods such as cladistics and/or phylogenetic analysis. The 2014 Impact Factor was 2.191 and the 2014 5-year Impact Factor was 1.988. It is ranked 15/43 in Biodiversity Conservation ©2015 Thomson Reuters, *2014 Journal Citation Reports®*.

Examination of the type specimens for *Odontella* and *Zygoceros*, evidence for a new family *Odontellaceae*, and the description of two new genera

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Using scanning electron microscopy (SEM), Ross and Sims (1971) clarified relationships in the Biddulphiaceae and Eupodiscaceae. They identified characters that could be used to separate Biddulphioid genera finding that there were two types of valve structure, poroid and loculate (alveolate), and two types of structure at the summit of the valve elevations, an ocellus and a pseudocellus; the ocellus characterised the Eupodiscaceae, its absence the Biddulphiaceae. The former is thus monophyletic. Subsequently, Ashworth et al. (2013) re-investigated the relationships of the Biddulphiaceae and Eupodiscaceae primarily using molecular evidence and showed that while the monophyly of Eupodiscaceae was supported, the species they examined currently placed in *Odontella* inhabit a non-monophyletic array of clades having relationships with species in genera other than *Odontella*. They described the new genus *Trieres* to include three species previously placed in *Odontella*, *Zygoceros*, *Biddulphia* or *Denticella* and they drew attention to the family Parodontellaceae as a possible synonymous collection of species. This poster presents further evidence on the relationships amongst the Eupodiscoids, particularly the fossil representatives of members of the family Parodontellaceae, and the type specimens of both *Odontella* and *Zygoceros*. We will present information relevant to a new family *Odontellaceae* and two new genera.

Phaeodactylum tricornutum co-cultured with *Bacillus* sp. displays enhanced growth

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The marine diatom *Phaeodactylum tricornutum (Pt)* has emerged as a model organism for diatom study due to its sequenced genome, developed set of molecular tools and simple culturing conditions. In this work, we discovered a *Bacillus* sp. that when co-cultured with *P. tricornutum*, resulted in a 3-5 fold increase of *P. tricornutum* cells when compared to growth in axenic conditions. A variety of experiments were performed to investigate the basis of this growth promoting effect of *Bacillus* sp.. Our results suggest that bacterium sporulation and lysis in the *Pt* culture may have provided a substance that can be readily taken up and used by *P. tricornutum*, leading to culture growth enhancement. Preliminary data suggests that the compound is a heat labile metal-organic complex that facilitates rapid increase in *Pt* cell number. Interestingly, we found that the growth-promoting compound is not common to all *Bacillus. Phaeodactylum tricornutum* cultures inoculated with the more comprehensively studied *Bacillus subtilis* did not exhibit the enhanced growth phenotype. Methods of promoting *Pt* growth may be of significance in increase biomass yield for renewable energy production.

Evolution of *Lindavia* (*Pliocaenicus*) species in the Late Pliocene and Pleistocene record from Lake El'gygytgyn, Far East Russian Arctic

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The Lake El'gygytgyn sediment core (ICDP 5011-1) contains a near-continuous record of diatoms extending to approximately 3.46 Ma, providing an opportunity to explore the evolution of diatoms across numerous climate events. From 3.4 to 1.2 Ma, several unique species of *Lindavia* (*Pliocaenicus*) are the dominant planktonic diatoms in the sediment record. These species are systematically investigated for morphometry and ultrastructure characteristics, including scanning electron microscope observations from approximately fifty core levels. During core intervals with a consistent abundance of planktonic diatoms, observed variations in valve ultrastructure are relatively minor. The record is punctuated by usually short-duration declines in plankton abundance that correspond to significant changes in valve ultrastructure, including rimoportulae, fultoportulae, and alveolae. These events are analyzed in the context of other aspects of the diatom assemblage and additional proxy records. Planktonic diatoms may be responding to different climate-driven lake-system changes during different portions of the lake's history.

Experimental determination of the role of iron on the growth of *Didymosphenia geminata*

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Fe has been suggested as an important factor in the growth of stalk-forming populations of Didymosphenia geminata (Lyngbye) M. Schmidt. Previous work proposed that polysaccharide stalks produced in response to low P also have high affinity for Fe. Furthermore, a positive feedback was proposed in which P is bound to oxidized Fe in oxic zones of the stalk and released in anoxic microzones. As a result, Fe adsorption by stalks promotes greater adsorption of P by Fe hydroxides, which upon subsequent solubilization fuels high cell growth rates.

Experimental mesocosms next to the Kootenai River, downstream of Libby Dam, Montana were used to conduct a series of experiments to test the above hypothesis. The experimental treatments were designed to disrupt the Fe-P interactions in the mat to evaluate its impact of D. geminata growth. Sixteen channels were lined with open-cell styrofoam and allowed to colonize before the start of treatments. Three channels were each treated for control, Fe, P, Fe + P, and alum. One channel was treated for ferrozine, which binds with reduced iron and prevents its re-oxidation. The experimental treatments ran for 12 weeks, with samples collected weekly until week 20. Samples were analyzed for D. geminata, with quantitative measures of live cells, dividing cells, dead cells, and qualitative measures of stalk abundance and stalk branching.

The abundance of live cells and cells in division were greatest in the P and ferrozine treatments, where P availability was higher due to external additions and by weakening the Fe-P coupling by adding ferrozine, respectively. Addition of Fe and alum that trap P in a non-bioavailable form had the lowest abundance of live cells. In these treatments the presence of high amounts of oxidized Fe and non-redox sensitive Al in the mats, reduced P availability. Throughout the experiment, high numbers of dead cells were present in all treatments, possibly indicating a continuous drift of cells from upstream sources.

Variations in Holocene precipitation across the western United States

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Holocene climate patterns across the western US are controlled by complex ocean/atmosphere dynamics including (i)strength and position of the Aleutian Low and North Pacific High pressure systems which determine the magnitude, duration, and position of winter storm systems, and (ii) the North American Monsoon which is driven by Northern Hemisphere summer warming. On annual-to-decadal time scales, ENSO- and PDO-controlled precipitation variability is expressed as a north-south dipole in the western US, with a transition zone that separates a wet Pacific Northwest and a dry Southwest.

Favre Lake (2899 masl), located in Nevada filled gradually between 7625 and 5600 cal yr BP, after which lake level remained relatively stable for the remainder of the Holocene. Medicine Lake (2033 masl; northeastern California), filled to a maximum level between 11,400 and 6000 cal yr BP and then fluctuated by several meters during the remainder of the Holocene. The lowest elevation lake, Swamp Lake (1545 masl), exhibited the strongest record of changes in seasonality over the Holocene, beginning with a transition to warmer conditions ~10,800 cal yr BP, maximum drying between 7400-5500 cal yr BP, followed by a gradual increase in moisture for the remainder of the middle Holocene succeeded by a major shift to wetter conditions at about 3100 cal yr BP. Lower Bear Lake (2065 masl; southern California) is most strongly influenced by marine conditions. The overall Holocene trend is a gradual increase in salinity, suggesting drying conditions, but is also punctuated by several centuries-long pluvial events.

Pliocene diatom record of Paleolake Hadar in the Afar Depression, Ethiopia

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Sediment cores were collected from long boreholes at two paleolake locations in the Northern Awash, Osi-Isi (NAO, 11.31518°N, 40.73689°E) and Woranso (NAW, 11.32535°N, 40.76491°E). These sites targeted both buried sediments and sedimentary sequences exposed in outcrops related to a Pliocene lake (Paleolake Hadar) in the lower Awash Valley of Ethiopia's Afar Depression, as one component of the Hominin Sites and Paleolakes Drilling Project (HSPDP). Regional geological studies combined with outcrop, seismic, and core data suggest that the coring sites sampled sediments from the lacustrine depocenter of the Hadar Basin, which has been bracketed by $^{40}Ar/^{39}Ar$ dating and tephrastratigraphy to ages spanning from approximately 3.22 to 2.93 Ma.

The sedimentology of the cores is dominated by fine-grained materials, with intervals of paleosol development. Fossil diatom assemblages are diffusely distributed throughout the cores, with a few highly concentrated diatomite horizons. Diatomites in the upper sections of the cores have been documented from outcrops and used for regional correlation, but have not been examined in detail previously. Here we present a preliminary reconstruction of the diatom stratigraphy, including some high-resolution (continuous 2-cm sampling) of the diatomite units. Our initial results indicate that the diatom history is dominated by a few large *Aulacoseira* species, some of which are undescribed. Where diatomites occur in the core stratigraphy, they likely indicate that Paleolake Hadar was a fairly deep, well-mixed lake, but that this environment was not present consistently through the 300,000-year history preserved in the core. Some core sections include poorly preserved fossil diatoms adjacent to interspersed basalt units that may indicate evidence of hydrothermal alteration.

Holocene diatom assemblages from section JPC/JTC17 (Maxwell Bay, King George Island, South Shetlands)

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Antarctic Peninsula (AP) is one of the areas that experience the most rapid modern warming in the world. Explicit reasons for this noticeably faster temperature rise around the AP are not fully understood. This modern changes also seem to be isochronic over a large area, which contrasts sharply with the earlier Holocene climate changes, which were mostly diachronic.

Fjord and near-shore settings in Antarctica provide some of the best archives of paleoenvironmental Quaternary records, as they contain both marine and terrestrial signals and frequently provide extensive and high-resolution sedimentary records of recent climate change. Section JPC/JTC17 (Collins Harbor, Maxwell Bay, South Shetlands), includes 16 meters of sediments with stable sedimentation rates dated from Recent back to 6300 years ago, reaching the end of the Holocene Climatic Optimum. Its location is very important in the ongoing discussion about modern climate change as it is in the center of the area with the highest rate of current warming.

So far, studies were competed on benthic foraminifera (Majewski *et al.,* 2012), which are affected by local glacial system, rather than changes in the surface water. Some intriguing planktonic foraminiferal repeating events were also noted, hinting presence of paleoenvironmental events. Diatom analysis on the JPC/JTC17 section is still in progress. Here we present first results of parallel studies using diatom assemblages from the highest 5 m of the core. The assemblages consist of planktonic and sea-ice related diatoms, as well as benthic and epiphytic species. *Chaetoceros* resting spores dominate, however there are noticeable changes in their relative abundances which may indicate changes in past primary production (Świło *et al*., 2016). These first results provide new information to the existing interpretations based on data from other cores from Maxwell Bay and in future will contribute to environmental and climate change reconstruction in west coast of AP.

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Diatom types of REM Archibald from Lake Sibaya, South Africa

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Natural lakes are rarely found in South Africa and are usually restricted to coastal regions. One of the larger costal lakes is Lake Sibiya which is situated in North-Eastern Kwa-Zulu Natal, a subtropical summer rainfall region. The lake is 65.2 km^2 and is landlocked and cut off from the ocean by a 122 m and 0.8 km wide sand dune running parallel to the coast. In 1966 a survey of this and other smaller lakes connected to the Lake Sibiya system was conducted and diatom samples were collected, of which three were examined by R.E.M Archibald, from which nine new species were described. Archibald illustrated these new taxa using line diagrams and the interpretation of such illustrations is sometimes difficult. For this reason, we have re-examined the type material with the aim of producing light microscope (LM) and scanning electron microscope (SEM) micrographs of the species in question. All nine taxa described and illustrated by Archibald were found again in the type slides and photographed using LM. Unfortunately, the type material was stored in un-buffered formalin and had degraded to a point where it could no longer be used for SEM. Additional samples collected during the 1966 expedition were selected based on similarity of locality and substratum and used in order to obtain SEM micrographs. Again, all taxa could be documented from material in these additional samples. Of the nine taxa described, six need to be transferred to more appropriate genera as they were originally described as species of *Achnanthes*, *Navicula* and *Cocconeis*. Although the line drawings of Archibald were detailed and accurate it was necessary to document these types using LM and SEM in order to make accurate designations at generic level and to facilitate identification of these taxa if found in other localities.

Toxic spill monitoring using diatoms and the implications for cell retention in biofilms

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One of the prevailing questions in diatom-based river biomonitoring revolves around cell retention after death within the biofilm. The number of cells within a sample is of importance as the interpretation of the prevailing environmental conditions at the time of sampling is dependent on sampling living or very recently dead cells. The interpretation of environmental conditions could be flawed if the majority or even a significant proportion of cells were dead at the time of sampling. Several methods have been put forward to mitigate the effects of cell retention within the biofilm, including gently washing the substratum prior to removal, enumerating the percentage of dead vs. living cells immediately after sampling etc. However, the question still remains – after an impact what proportion of the biofilm remains behind and for how long. A recent study of a diesel spill in a stream may hold some clues as to the extent of cell/empty frustule retention. A diesel spill occurred in a small stream in Kwa-Zulu Natal South Africa. Four diatom samples were collected immediately after the spill; upstream of the spill, at the spill site and two downstream sites. The spill site had no intact diatom frustules in the biofilm, only a few scarcely recognizable fragments. The site immediately downstream of the spill had only two dominant species and the community composition differed completely from the site upstream of the impact. The last downstream site had the same community composition as the upstream site. From this we can conclude the following: 1) That the diesel spill killed all the diatoms present at the impact site and that these cells were almost completely washed from the biofilm. 2) That tolerant diatom species survives within a biofilm while other species die and are washed out of the biofilm with almost no cells remaining behind, and 3) That in running waters dead diatom cell retention may occur but the turnover and washout of cells may be far more rapid than previously thought.

A Method for the evaluation of the ecological Integrity of temperate Lakes in Quebec

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The lakes of southern Québec are under increasing human pressure. Consequently, increased eutrophication often generates an increase of cyanobacteria. Based on the ecological preferences of diatoms, diagnostic and biomonitoring tools were developed to document baseline conditions of total phosphorus in the water column of lakes and the evolution of trophic status. Our series of lakes represent a range of trophic states representing different levels of eutrophication. We have demonstrated that the composition of diatom assemblages in the study sites was mainly influenced by the water chemistry and lake morphometry, and changes of these factors caused by eutrophication transformed the community of diatoms. The similarity or discrepancy among the diatom assemblages allowed for the separation of several groups of assemblages corresponding to different trophic states. A typology of lakes has been developed for both modern and fossil diatom communities. The comparison between the two typologies was used to assess the maximum distance between assemblage groups representing oligotrophic and hypereutrophic conditions. In this way, we estimated the extent to which trophic changes occurred over time in a lake. It has also been possible to develop inference models to document historical changes in total phosphorus concentrations in lake water columns. Finally, the monitoring tools developed and the knowledge acquired as part of this thesis were used to create "MILQ": A Method for the evaluation of the ecological Integrity of temperate Lakes in Quebec.

The Japanese 'endemic' freshwater diatom taxa and its appearance in neighboring nations

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Japan is one of the biodiversity hotspots in the world. To be listed in the hotspot category, two criteria must be met: There should be at least 1500 species of vascular plants out of which > 70% of its original native habitat lost.

Many freshwater diatom taxa have been described from Japan. Some of these taxa have been reported from Europe and/or North America, and should not be considered endemic but cosmopolitan. Many taxa, including most of Skvortsov's taxa, have only been reported in the original description, and it is difficult to evaluate the distribution. Other taxa, which have only reported from Japan, can be considered 'endemic' to Japan.

However, it is very important to assess these possible 'endemic taxa' with the flora of other countries in East Asia. In this study, we have made a probable list for Japanese endemic taxa, and compared it with the monographs from China, Korea and Taiwan.

Only limited taxa in this list for Japanese endemic taxa, were found in these monographs from the countries in East Asia, and most of taxa in the list are still only found in Japan.

There are two possible reasons for this result: The first is There might be a very high rate of endemism in Japanese freshwater diatoms, and the second is the problem of identifications. Therefore, more research to assess the endemism in Japan and East Asia is required.

Diatoms from Bodoquena karstic system, Brazil

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The Serra da Bodoquena is one of the most extensive continuous Brazilian karst areas, located in central-western Brazil, state of Mato Grosso do Sul. The local average annual air temperature varies between 20 and 22°C and rainfall between 1300 and 1700 mm. The karst aquifer is recharged mainly by autogenic waters, promoting the intense deposition of carbonates as tufa deposits, as a consequence of the resurgence of saturated waters. The hydrography of the region is characterized by limestone rivers with high alkalinity, low temperature and crystalline waters. Periphytic diatoms were sampled during November 2015 from tributaries along Formoso river basin. The available substrates were bryophytes, macrophytes, sand and fragments of tufas. Phytoplankton was also sampled. We also measured conductivity, pH and water temperature at each sampling site. Altogether, 98 taxa belonging to 30 genera were identified and examined using light and electron microscopy. Some taxa were regarded as new and are an important focus of this study. The unique character of the Bodoquena karstic system made it possible to obtain valuable new informations about floristic diversity of diatoms in alkaline waters.

The ultrastructure of the apical pore field in raphid and araphid diatoms

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Several genera of araphid (e.g., fragilarioid genera, *Diatoma*, *Grammatophora*) and raphid (e.g., cymbelloid genera, *Gomphonema*, *Rhoicosphenia*) possess well-defined groups of small pores at their apices. These areas, termed apical pore fields, play a clear role in the secretion of mucilage and thus the attachment of the frustules to the substratum or in the formation of colonies. In the past several terms, including ocellulimbus (Williams 1986), have been proposed for these structures in araphid taxa.

Using high resolution scanning electron microscopy, the structure and diversity of apical pore fields in a range of araphid and raphid diatom genera have been investigated. The results reveal several differences between the pore fields of araphid and raphid diatoms. In araphid diatoms, apical pore fields are usually clearly delimited, often by thickened rims, whereas in raphid genera such as *Cymbella*, *Gomphonema* and *Didymosphenia*, the apical pore field is formed of a series of rows of small simple pores lacking any physical separation from the rest of the valve face. The latter usually have a more complex internal structure, with narrow ribs between the rows of pores, whereas in araphid genera such as *Fragilaria* or *Diatoma*, only simple, unoccluded pores are observed internally.

The poster illustrates the different types of apical pore field that can be observed in selected araphid and raphid genera in relation to their suprageneric relationships. The morphology of the different apical pore fields is investigated in the light of the life form of the relevant genera.

This study is part of the DIATERM working group programme, which is collating and revising the terminology used to describe the morphology of the diatom valve.

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Psammothidium germainii in the Antarctic Region

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Psammothidium germainii (Manguin) Sabbe is a widespread limno-terrestrial monoraphid diatom species in the Antarctic Region. Originally described as *Achnanthes germainii* by Manguin in 1954 from the sub-Antarctic Iles Kerguelen (Bourrelly & Manguin 1954), the species was later found in almost all investigated localities of the Antarctic Region (including the Antarctic Continent, Maritime Antarctica and the sub-Antarctic Islands) (Kellogg & Kellogg 2002). It is a typical aerophilic diatom, mainly found in wet to semi-dry soils and dry mosses but almost absent in aquatic conditions such as lakes and pools.

Detailed analysis of the *P. germainii* populations in the different parts of the Antarctic Region showed a highly variable morphology, most likely reflecting the presence of several taxa that were lumped under the name germainii. To unravel the correct identity of *P. germainii*, the type material of both *Achnanthes germainii* Manguin and the apparently closely related *Achnanthes ninckei* Guermeer & Manguin has been investigated. Together with the morphological analysis of all Antarctic *P. germainii* populations, this type material analysis allowed a better morphological delimitation of both taxa and a better characterization of the new taxa. Two new taxa are proposed: a first new taxon has typical rostrate apices and a rather distantly spaced stria pattern whereas the second new species was formerly identified as *Achnanthes ninckei*. Both new taxa are illustrated using light and scanning electron micrographs and are compared with similar taxa worldwide. Additionally, two populations of *Psammothidium germainii* lacking a raphe on both valves are illustrated and discussed.

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Middle and Late Holocene climate forcing on the open Baltic Sea: a diatom stratigraphical investigation from Integrated Ocean Drilling Program (IODP) Expedition 347 sediment core M0063 Landsort Deep

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This project aims to investigate the role of climate-driven processes on the open Baltic Sea from the Middle Holocene to the present. The objectives are to determine history, timing and duration of Middle and Late Holocene Baltic marine inflows and its implications for changing salinity and to reconstruct the Holocene historical record of ice cover in the open Baltic Sea. The emphasis will be on identifying triggers and timing of high primary productivity events and the return to low productivity during the Littorina Sea stage in high resolution. Next to that, the relative importance of natural climate forcing versus anthropogenic forcing on environmental change of the Baltic Sea ecosystem will be assessed.

During IODP Expedition 347 'Baltic Sea Paleoenvironment', a unique sediment core was retrieved from Landsort Deep, the deepest basin within the Baltic Sea basin, which displays an intriguingly high resolution laminated Middle and Late Holocene sediment sequence. Diatom stratigraphy and microfabric analysis of the sediments will be used to reconstruct environmental changes during the Holocene and to investigate climatic and oceanographic mechanisms behind these changes. Recorded changes in the fossil diatom assemblages will guide us in determining the history of marine inflows and sea-ice in the Baltic Sea. Absolute diatom abundance will allow for a paleoproductivity reconstruction and determination of both high and low productivity events. In addition, microfabric analysis will be applied to determine the composition and formation of the lamina, in order to assess implications for paleoproductivity, hypoxia and nutrient cycling.

Preliminary results of diatom abundance from the Littorina Sea stage to the present from core M0063 will be presented. These results will guide us on which sediment sequences to carry out high resolution analyses.

Future plans include collaboration with a project working on sediment cores from the coastal Baltic Sea to investigate whether a synchronicity between the recorded environmental changes in the coastal sea and the open Baltic Sea exists. Furthermore, collaborations with IODP Expedition 347 Science Party Members working on other sites and proxies, will result in a comprehensive high-resolution multi-proxy reconstruction of Holocene climate-driven processes in the Baltic Sea.

Miocene/Pliocene Playa lakes from the Peruvian Altiplano

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Miocene/Pleistocene deposits from the northern part of the Peruvian Altiplano (El Descanso Formation) record a unique history of past fluvial and lacustrine environments formed under a different climatic regime than today's. The El Descanso Formation is composed of three members, A, B and C, respectively from bottom to top. Previous works indicate that Member B was deposited when the cordillera was at lower altitude while Member C was deposited at the Altiplano's current altitude (4,000 masl). In this study we present the interpretation of depositional environments as indicated by the diatom assemblages fossilized in these two members. Most diatomites samples are dominated by one or two species that constitute more than 60% of the diatoms in the sample. The most common species include *Fragilaria zeilleri,* small fragilarioids (*Opephora* and *Staurosira* spp.), *Amphora coffeaeformis* and species of *Nitzschia* and *Achnanthes*. Freshwater species are less abundant and include *Cyclotella gamma*, *Aulacoseira* cf *distans* and *Aulacoseira* spp. Although few laminae in Member B contained diatoms, the highest diversity of *Aulacoseira* spp. is found in this member (at least three species). This genus decreases in abundance and diversity in Member C, where it is confined to a few laminae. Diatom assemblages from Member C are mainly benthic (epipelics and epiphytic) and prefer waters of high mineral content. Stratigraphic variations in dominant diatoms suggest variations in the cationic composition of the water. Thus the depositional environments suggested by the diatoms, sediments, and stratigraphy of Member C are of seasonal, playa-like, water bodies, except for one location where the less variable diatom assemblages and greater abundance of freshwater species suggest a less evaporitic and seasonal lake or a less sensitive system, which in turn suggests a larger, deeper water body. Great variation in dominant species in samples from stratigraphically adjacent layers suggests marked seasonality, where periods of higher precipitation and reduced salinity alternated with periods of increased evaporation and higher salinity. The seasonal character of these water bodies suggests that during that time there was an important source of precipitation that no longer exists.

Araphid, monoraphid and biraphid individuals with rimoportulae in a single diatom taxon – Meet a new diatom genus from Venezuela

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The order Eunotiales has received a lot of attention in recent years, resulting in descriptions of dozens of new species in the genus *Eunotia* and splitting of several new genera within this group. South America appears as one of the biodiversity hotspots, particularly for Eunotiales. While studying material from a creek on top of the table mountain Churí-tepui (Chimantá Massif, Venezuela) we encountered an unusual diatom which did not fit within descriptions of any diatom species, genus, or even family. It seems to be morphologically most closely related to the genus *Peronia*, with which it shares heterovalvy, unusual raphe formation, and one rimoportula on each pole. However, all of the previous features are either facultative or with exceptions. Probably the most interesting and unique feature encountered were frustules that were clearly biraphid, monoraphid and araphid in the same population, with no indication of linking spines or other features implying colony formation. This exceptional diatom brings new questions regarding the evolution of raphid diatoms.

The present is the key to the past – an investigation of the distribution of modern diatom communities in Lake Kinneret (Israel)

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Warm, monomictic Lake Kinneret lies 210 m below sea level (BSL) and is located in the northern part of the Jordan Rift Valley. The lake is the largest natural freshwater body in Israel and plays an important role in the natural freshwater supply (50%) for the region. This has been the case since prehistory, and anthropogenic activities over time have had a marked effect on the lake ecosystem. Although anthropogenic influences have caused a shift in the modern diatom composition compared to the fossil one, the modern flora still contains many of the taxa present in the fossil record. As "the present is the key to the past" (in *Principles of Geology* after Lyell, 1830) the study of the ecological preferences of the modern flora may thus provide useful insights for interpretation of past environmental change. Around 50 surface samples from bottom sediments from Lake Kinneret were investigated to improve understanding of the distribution of modern diatom communities in the lake. Results are compared with (1) measured physicochemical water parameters such as conductivity, pH, dissolved oxygen etc.; (2) the ancient subfossil diatom assemblages investigated in a ca. 18 m long sediment core recovered from the deepest part (38 m) of the lake and (3) the pollen assemblages from 20 of the investigated surface samples.

Results show clear differences in species composition/richness and preservation between the littoral and the profundal zone: Diatoms are well preserved in most samples, with the exception of a few samples from the littoral zone, where their absence may be caused by the influence of saline brines, which run off in the lake near the western shoreline. Samples from the littoral zone are dominated by benthic taxa such as *Achnanthes*, *Anomeoneis, Cymbella, Epithemia, Nitzschia* and *Navicula*. Planktonic species show very low abundance and sponge spiculae are very abundant in these samples. Differences in the littoral diatom species composition are also visible between the eastern and western shoreline of Lake Kinneret, due to the steep slope basin morphology on the eastern side. Samples from the profundal zone are strongly dominated by planktonic taxa such as long filament chains of *Aulacoseira granulata* EHRENBERG and *Cyclotella* species; benthic taxa are often absent.

Edmund Grove (15th February 1823 - 11th February 1911) and his diatom collection at the Natural History Museum, London (BM)

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This presentation was inspired by examination of the specimens that illustrated Grove and Sturt's study on the fossil diatoms of Oamaru, New Zealand. Both Grove's and Sturt's collections, or at least parts of them, are in the Natural History Museum, London (BM), yet with respect to Grove, what actually constitutes his collection is not that clear. For example, inspection of the publications in the Californian Academy of Sciences online diatom name catalogue includes reference to a 'Grove Collection'. That reference is cited in various ways: "Grove Collection"; "'Grove collection' according to Mills 1933"; and "Collection of E. Grove (exsiccata). Preston, Brighton". The latter, seemingly an explicit reference to a set of slides, initially proved difficult to understand what it included or even meant.

It's not easy finding Edmund Grove, either. The standard biographical aids are devoid of any real information, lacking such basic details as his birth and death dates. Light eventually emerged from what initially appeared to be an unlikely source: *Grace's Guide to British Industrial History*, where information on Grove is given in its obituary series.

For this presentation, those biographical details will be provided, along with a discussion as to what the "Collection of E. Grove (exsiccata). Preston, Brighton" actually means in terms of slides, specimens and nomenclature.

Past and present: Changes in species diversity in diatom populations within a paleo-core from Lake Towuti, Indonesia

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A deep sediment core collected in 2015 from Lake Towuti, Sulawesi Island, Indonesia, revealed a significant change in diatom community composition. Using both common microscopic techniques and scanning electron microscopy, diatom identifications to the genus and species level allowed for a comprehensive comparison of diatom populations of both the past and the present. Surface sediment samples revealed that the diatom community was void of centrics, and dominated by endemic pennate species such as *Epithemia, Staurosirella, Nitzschia, Cocconeis, Gomphonema*, and *Fragilaria.* However, in the deeper segments of sediment core, the diatom community was primarily composed of centric species. This study reveals that past diatom communities of Lake Towuti were dominated by varieties and forms of *Aulacoseira granulata,* with very few pennate species such as *Epithemia,* and *Fragilaria*. This observation is quite different to that observed in other ancient lakes, (i.e. Lake Ohrid, Macedonia), where the sediments contained centric communities primarily composed of the genera *Cyclotella and Stephanodiscus.* The *A. granulata* population of Lake Towuti appears to have dominated the lake for a considerable period of time. The current endemic pennate assemblage within Lake Towuti can give insight as to why centric diatoms are no longer common.

Biosynthesis of silver nanoparticles by *Phaeodactylum tricornutum*

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Diatom cultures are promising systems for the 'green' synthesis of nanomaterials like metallic nanoparticles (NPs), nanostructured polymers and hierarchically structured nanomaterials, as well as for the in vivo functionalization of biomaterials and entrapment of enzymes. The formation of NPs is achieved today by using methods like solvothermal process, attrition, or pyrolysis. Unfortunately, the cost and the toxic substances used in the common physical and chemical methods for NPs synthesis limit their usage and applications. Therefore, biosynthesis of NPs by diatom cultures, which can be done at ambient temperatures and pressures, offers a less polluting alternative.

Silver NPs (AgNPs) are an example of an extensively used NP in electronics, catalysts, biosensors and in antibacterial products. Consequently, biogenic originated AgNPs and their amenability to biological functionalization increases their potential in important commercialized applications.

In this present work, the formation of AgNPs by *Phaeodactylum tricornutum* grown in ambient conditions for a period of 8 days was tested. In this approach, diatom cultures were either grown throughout the duration of the experiment in an ASW-f/2 medium enriched with 1 ppm Ag^+, or grown in an ASW-f/2 medium where similar silver ion concentrations were added on day 5. From the results, it was noticed that 1 ppm Ag^+ reduces the *Phaeodactylum* growth by up to 50% compared to the control treatment. Furthermore, Scanning Electron Microscopy (SEM) in combination with Energy Dispersive Spectrometry (EDS) revealed the presence of AgNPs nanoparticles with different sizes and chemical composition associated with the diatom frustules and extracellular polysaccharides.

In conclusion, these experiments indicated that silver can be introduced to diatoms during cultivation time in order to produce NPs. We hope that this knowledge will increase the usage of diatoms in developing new nanobiomaterials.

Does the chemical composition of diatom stalks code a taxonomic signal in stalked diatoms? Preliminary results of FTIR spectroscopy analyses on *Opephora* spp.

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Stalked diatoms are widespread among the epiphytic and epizooic forms. They attach to the substrate by stalks composed of either solely organic or structured inorganic and organic compounds. Stalked forms are widespread among all the major groups, with a very wide range of size and shape in araphid diatoms. Here, preliminary results of analyses performed on stalked diatoms by means of FTIR spectroscopy are reported. A number of stalked (*Opephora* spp. and *Achnanthes* sp., for comparison), non-stalked and tube-dwelling forms of diatom strains from various geographic regions were analyzed after dialysis. Diatomaceous silica was removed with HF. Replicate analyses were made of each of the *Opephora* strains. For the *Opephora* strains analyzed, a molecular phylogeny was built on the basis of three concatenated genes (rbcL, psbC and ^{18}S rDNA).

Whereas the chemical composition of *Achnanthes* sp. stalks and of non-stalked taxa was quite simple and included proteins, triglycerides and proteins (tube dwelling forms), the stalks of *Opephora* strains were composed of cellulose, proteins, triglycerides and chitin. The most striking result was the presence of chitosan in all *Opephora* spp. Although its content varied, chitosan seemed to be the most abundant amongst the organic compounds detected.

The chemical composition of the stalked *Opephora* spp., although similar (at least in terms of the presence of chitosan) seems not to be related to their taxonomy, as the *Opephora* strains studied are dispersed over the phylogenetic tree, grouping with various small-celled fragilarioid diatoms. Only two of them seem to represent the same species (Turkey and Canary Islands strains). Our preliminary results point to the fact that, despite the structural and chemical similarity of stalks, they do not always possess taxonomic meaning.

What do we really know about *Fragilariforma virescens*?

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Normally thought of as a cosmopolitan species, *Fragilariforma virescens* has indeed been recorded from many various localities around the globe and appears in many regional floras from around the world. A recent Google search (27/4/2016) of the name yielded over 6000 hits; an alternative search under its older, but perhaps more familiar, name of *Fragilaria virescens* yielded a further 9000+ hits. If nothing else, it seems many appear to be able to identify this species. Since its first description in 1843 the species has been sub-divided a number of times, yielding some 80+ names of varieties and forms, when addressing the California Academy of Sciences *Diatom Names online* list, but only 43 names when the more general names database Algaebase is queried. Some of these names are duplicates, synonyms, etc., but once the redundancy is excluded, one must presume that the remaining sub-specific names were invoked to represent some quantifiable deviation from the nominate species. Resolution might be achieved to a certain degree by examining the type specimens of each of these names, should they still be available. Rather less explored are the resources provided by the examination of a large number of specimens, specifically non-type and those geographically spread around. The collections of the BM provide just such a resource. This poster will offer some details on the nomenclature of *Fragilariforma virescens*, a summary of the examination of c. 500 relevant slides and will attempt to answer the question about what we know of a supposedly wide-spread, easily identified and common species.

Do water depth and water-level changes influence the diatom diversity of Yunlong Lake, South China?

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The effects of water-level changes on the biodiversity of the aquatic biota have been explored in both spatial and temporal perspectives aiming at a subtropical alpine lake in South China, namely Yunlong Lake. We have examined the relationship between diatom diversity and water depth based on the analysis of 62 surface sediment samples from three different depth zones of Yunlong Lake: the littoral zone, the shallow zone and the profundal zone. We observed no significant variations in diatom diversity with changing water depth despite the occurrence of significantly different diatom assemblages in the different depth zones. In addition, a sediment core from the lake center was studied to explore the possible effects of water-level changes on diatom diversity over the last ~100 years. Changes in sediment accumulation rates and sediment flux indicate that the water-level of Yunlong Lake increased greatly since the 1960s as a result of dam construction. However, we did not observe any relationship between diatom diversity and water-level changes. Our study demonstrates that lakes with simple bathymetry and which are relatively well mixed, such as Yunlong Lake, are suitable for the studies of changing aquatic biodiversity on long timescales since the sediments of such lakes are well representative of the biodiversity of the entire lake. Furthermore, the effect of water-level changes on the diatom diversity of such lakes can largely be ignored.

Long term assessment of ecological status of two karstic lakes (Plitvice Lakes NP, Croatia) using three multimetric diatom indices

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Phytobentos is one of biological quality elements used for ecological status assessments of lakes, as required by the Annex V of the Water Framework Directive. Assessments primarily focus on diatoms as proxies for phytobenthos, thus offering an accessible perception of the changes and pressures shaping the benthic community. Several different methods and indices comprising abundance and taxonomic composition of diatoms are used in EU countries.

Earlier research of the phytobenthic flora was carried out on lakes Kozjak and Prošće (Plitvice Lakes National Park, Croatia) during 2009 and 2010. Aim of this phase of research was to test the sensibility and applicability of three multimetric diatom indices in the water quality assessment: 1) Croatian trophic diatom index (TID_{RH}), modified from Rott's trophic index; 2) Pollution Sensitivity Index (IPS); and 3) saprobic index (SI_{HRIS}), modified from Pantle-Buck's saprobic index. Results showed that the phytobenthic community in Lake Kozjak was characterized by *Achnanthidium minutissimum*, *Brachysira vitrea* and *Encyonema muelleri*. According to TID_{RH} (range 1.5-2.3) ecological status of Lake Kozjak was assessed as high. The IPS index (range 16.5-18.5) indicated high ecological status, while SI_{HRIS} (range 1.4-1.9) indicated good to high status of the lake. Benthic community of Lake Prošće was characterized by *A. minutissimum*, *Cyclotella meneghiniana*, *Cyclotella plitvicensis*, *Encyonopsis microcephala*, *Encyonopsis minuta*, *Fragilaria capucina*, *Fragilaria crotonensis*, *Kobayashiella parasubtilissima* and *Stephanodiscus hantzschii*. The range of TID_{RH} (2.2-2.5) indicated good ecological status of this lake. According to both IPS (range 14.3-17.5) and SI_{HRIS} (range 1.7-2.0) indices status of Lake Prošće was assessed as good to high. The ongoing research in 2015 and 2016 aims to assemble perennial data using the same sampling methodology during the same temporal interval and the same spatial position in order to provide a comparable statistical evaluation of ecological status of the Plitvice Lakes. Moreover, after the calibration process the aggregated data will be compared and the results will be further discussed in terms of ecological assessment status.

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