Universität Bremen

marum

Conference Abstract Book



DAM Deutsche Allianz Meeresforschung

DKK Deutsches Klima Konsortium

IODP International Ocean Drilling Programme

KDM Konsortium Deutsche Meeresforschung

Index:

Organising and Scientific Comitees 3

Program ..... 4 – 8

Keynote Presentations ..... 7 – 10

Oral Presentations ..... 11 – 40

Poster Presentations ..... 41 - 65

13th International conference on modern and Fossil Dinoflagellates

5 - 10 July 2026
MARUM - Center for Deep-Sea Research, Leobener Straße 10, D-28359 Bremen, Germany

https://www.marum.de/en/13th-International-Conference-on-Modern-and-Fossil-Dinoflagellates.html

Organising comitee:

Karin Zonneveld (MARUM, University of Bremen, Germany, *Dinoflagellate cyst ecology*)

Francesca Sangiorgi (Utrecht University, The Netherlands, *Palaeo-ecology of dinoflagellate cysts*)

Scientific comitee:

Takuto Ando (Akita University, Japan, *Organic geochemistry*)

Joost Frieling (Universiteit Ghent, Belgian *Organic geochemistry, isotopes*)

Iria Garcia Moreiras (*Centre for Marine Research, University of Vigo (CIM-UVigo)*, M*odern dinoflagellate cyst ecology*)

Cary Lopez (Florida Fish and Wildlife Conservation Commission, USA, *Harmful algal blooms, dinoflagellate (cyst) ecology*)

Fabienne Marret (University of liverpool, United Kingdom, *Pelaeo-ecology of dinoflagellate cysts*)

Kenneth Mertens (Ifremer, France, Nomenclature, *genetics*)

Vera Pospelova (University of Minnesota, USA, *Dinoflagellate cyst ecology*)

Francesca Sangiorgi (Utrecht University, The Netherlands, *Palaeo-ecology of dinoflagellate cysts*)

Emilio Soler Onis (Observatorio Canario de Algas Nocivas, Spain, *Dinoflagellate ecology/biology, Harmfull Algal Blooms*)

Urban Tillmann (Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Germany, *HABs, dinoflagellate biology*)

Gerard Versteegh (MARUM, Acritarchs and "old dinoflagellates")

Karin Zonneveld (MARUM, University of Bremen, Germany, *Dinoflagellate cyst ecology*)

Program:

MONDAY, 6 JULY

8:45 Welcome by MARUM director Prof. K. Hinrichs

9:00 Welcome and introduction: K. Zonneveld and F. Sangiorgi

Theme: "Dinoflagellate and their cysts: what remains in sediments"

CHAIR: Fabienne Marret

9:30-9:50 **Lyudmila Shumilovskikh**. Identifying and naming non-pollen palynomorphs: reflections and perspectives (Abstract 27).

9:50 - 10:10 **Vincent Iratçabal**. Last century ecological shifts of coastal dinocysts communities in an anthropized estuary: the case of the Rance estuary, North Brittany, France (Abstract 15).

10:10 – 10:30 **Anne Behnen**. Seasonal trends in dinocyst assemblages at the North Sea – Atlantic Ocean gateway (Abstract 4).

Coffee/Thee break (+ posters)

11:00 – 11:30 **Keynote Anne de Vernal**. Late Quaternary dinoflagellate cyst assemblages document episodic seasonal sea ice opening in the circum-Arctic Ocean **(K-4)**

11:30 – 11:50 **Amy Dale**. Dinoflagellate cyst distribution in deep sea sediment traps from the Nordic Seas suggesting cyst transport is a crucial factor affecting accuracy of proxies (Abstract 8)

11:50 – 12:10 **Vera Pospelova**. Decades of sediment trap research on dinoflagellate cysts: ecological and paleoenvironmental insights (Abstract 21).

Lunch

13:30 – 13:50 **Gerard Versteegh**. How 18 years of dinoflagellate cyst export production in the upwelling of Cape Blanc is reflected in sediments (Abstract 29)

13:50 – 15:00 **Forum discussion Theme**: *"modern dinoflagellate cyst production + what and what not preserves in sediments*

Coffee/Thee break (+ posters)

15:30 – 16:30

Poster Pitch Themes 1 and 2: Vincent Iratçabal (P-6), Pietro Noga (P-16), Behnas Soumaya (P-21), Eldo Roza (P-18), Kristine Steinsland (P-22), Galyna Terenko (P-23), Peter Bijl (presenting Greup P-3), Suning Hou (P-5), Laura Keller (P-8), Bas Koene (P-9), Mei Nelissen (P-15), Pieter Van Rompaey (P-24), Nanato Wada (P-25)

16:30 – 18:00 Posters

TUESDAY, 7 JULY

Theme: "Fossil dinoflagellate cysts and their applications"

9:15 Welcome back

CHAIR: Joost Frieling

9:30-9:50 **Emanuele Ruiu**. Dinocysts among Dinosaurs: A palynological study from the Late Cretaceous Villaggio del Pescatore Konservat Lagerstätte (Northeastern Italy) (Abstract 23) .

9:50 - 10:10 **Elena Menichetti**. Dinoflagellate cysts of the Messinian Lago-Mare biofacies occurring offshore Nile Delta (Egypt): stratigraphic and ecological perspective (Abstract 19).

10:10 – 10:30 **Sander Houben**. New marine palynological datasets used for detailed subsurface characterization of the Paleogene-Neogene of the Netherlands (Abstract 13).

Coffee/Thee break (+ posters)

11:00 – 11:30 **Keynote: Henk Brinkhuis.** Cool stories behind cool High Arctic Eocene dinoflagellate cysts **(K-2).**

11:30 – 11:50 **Katerina Kouli**. Dinoflagellate cysts reveal Quaternary climatic variability in the Gulf of Corinth (NE Mediterranean Sea) (Abstract 14).

11:50 – 12:10 **Maythira Sriwichai**. Ocean–Cryosphere Variability during the late Pleistocene interglacials: a palynomorph Record from Baffin Bay (offshore NW Greenland) (Abstract 28).

Lunch

13:30 – 13:50 **Yannick Bats**. Reconstructing algal bloom dynamics using individual protist fossil δ13C measurements (Abstract 3).

13:50 – 14:10 **Peter Bijl**. New view on dinoflagellate cyst diversity through time: results from palsys.org and DINOSTRAT (Abstract 5).

14:10 – 15:00 **Forum discussion Theme: "***where are the gaps in our fossil dinocyst records and how to improve our reconstructions"*

Coffee/Thee break (+ posters)

15:30 – 16:30 Poster pitch Themes 3,4,5: Raphael Gegné (P-1), Marie Robert (P-17), Francesca Sangiorgi, (P-19) Albert Reñé (presenting Cecilia Satta, P-2)0, Maëla Le Ménec (P-11), Francine McCarty (P-13), Vera Pospelova (presenting Zhen Li. P-12), Cecile Hilgen (P-4), Kristina Gerdener (P-2), Rahaf Ishokani (P-7), Fabienne Marret (presenting Peta Mudie P-14), Ulrich Kotthoff (P-10).

16:30 – 18:00 Posters

WEDNESDAY 8 JULY

Theme: "Dinoflagellates and Harmful algal blooms: past, present and future"

9:15 Welcome back

CHAIR: Urban Tillmann

9:30-9:50 **Maria Saburova**. Bloom-forming *Karenia* species in the Northern Indian Ocean: Diversity, toxicity, and historical trends in a changing environment (Abstract 24).

9:50 - 10:10 **Ana Amorim**. New data on the distribution of *Gambierdiscus* spp. in the Eastern Atlantic: from the Gulf of Guinea to the Azores (Abstract 2).

10:10 – 10:30 **Albert Reñé**. Exploration of overlooked Aduncodinium-like (Pfiesteriaceae, Dinophyceae) diversity

Coffee/Thee break (+ posters)

11:00 – 11:30 **Keynote: Don Anderson.** Bloom dynamics and physiological ecology of the cyst-forming species *Alexandrium catenella* in temperate and Arctic waters **(K-1)**

11:30 – 11:50 **Maria Sachs**. Hidden diversity behind a well-known dinoflagellate name: Resolving boundaries in the *Prorocentrum micans* species complex using transcriptomics (Abstract 25).

11:50 – 12:10 **Karin Zonneveld**. Succession of dinoflagellate cyst export production in an offshore drifting upwelling filament: insight into encystment succession, excystment, sinking rate and lateral transport (Abstract 30).

Lunch

13:30 – 13:50 **Barrie Dale**. Living dinoflagellate cysts from The United Arab Emirates (UAE): relevance for present-day ecological management and paleoecological interpretations (Abstract 7).

13:50 – 15:00 **Forum discussion Theme**: "*Towards HAB prediction"*

16:00 Historic Tour

Conference dinner

THURSDAY 9 JULY

Theme: "Dinoflagellates and their cysts: morphology, genetics, taxonomy"

9:15 Welcome back

CHAIR: Vera Pospelova

9:30-9:50 **Alfred Champigny**. Morphological and molecular characterization of the genus *Protoperidinium* in the Canadian Arctic (Abstract 6).

9:50 - 10:10 **David Hernandez-Becerril**. Morphology and new records of planktonic species of the dinoflagellate family *Podolampadaceae* (Dinoflagellata) from the Mexican Pacific Ocean: species of *Lissodinium* and *Mysticella* (Abstract 11).

10:10 – 10:30 **Ophélie David**. Emendation of the cyst-based genera *Selenopemphix* and *Multispinula*: insights from morphology, molecular phylogeny, and cyst wall chemistry (Abstract 9).

Coffee/Thee break (+ posters)

11:00 – 11:20 **Fabienne Marret**. A proposal towards a global dinocyst database for data assimilation and bridging observations and models (Abstract 17).

11:20 – 11:40 **Aurélie Penaud**. Palynological study (dinocysts and pollen) at the mouth of the Loire: palaeohydrological and palaeolandscape dynamics over the last 2,500 years BP in western France (Abstract 20).

11:40 – 12:00 **Maëla Le Ménec**. Holocene deglaciation of Radstock Bay: Palynological and Sedimentary records (Devon Island, Nunavut, Canada) (Abstract 16).

12:00 – 12:20 **Martin Head**. Dual nomenclature as applied to fossil dinoflagellates and ciliates (Abstract 10).

12:30 Group-photo

Lunch

14:00 onward **WORKSHOPS:**

1. *Paleogene Dinocysts – Taxonomy & Paleoecology (Henk Brinkhuis, Appy Sluijs, Peter Bijl, Daniel Michoux)*
2. *The marine palynology contribution to TIMES (Peter Bijl)*
3. *Bring your own slides (Vera Pospelova, Francesca Sangiorgi, Karin Zonneveld)*

Workshops 1 and 2 take about 2 hours each and will be following each other. Workshop 3 runs parallel during the whole afternoon.

No registration for workshops is required

Ca. 17:00 DRINKS and some more

FRIDAY 10 JULY

Theme: "Challenges and emerging methods"

9:15 Welcome back

CHAIR: Takuto Ando

9:30-9:50 **Francine McCarthy**. The impact of oxidation on freshwater cyst assemblages (Abstract 18).

9:50 - 10:10 **Takuto Ando**. Are very small acanthomorph acritarchs dinoflagellate cysts?: Evidences from the Cretaceous and modern samples (Abstract 1).

10:10 – 10:30 **Kasia Sliwinska**. The overlooked bottleneck in digital dinoflagellate cyst analysis: slide preparation (Abstract 26).

Coffee/Thee break (+ posters)

11:00 – 11:30 **Keynote: Joost Frieling.** Stable carbon isotope analyses of dinoflagellate cysts – applications & outlook **(K-3).**

11:30 - 11:50 **Frida Hoem.** Palynological Digitalization and Machine-Assisted Dinoflagellate cyst Assemblage Counts: Possibilities, Limitations, and a Call for Community Discussion (Abstract 12).

11:50 – 12:50 **Forum discussion Theme**: "*Dinoflagellate cysts as proxies of past environmental changes: new challenges and emerging methods".*

Lunch

14:00 – closing session best early career presentation award (sponsored by TMS) and proposal for hosting DINO14

Keynotes:

K-1

Bloom dynamics and physiological ecology of the cyst-forming species *Alexandrium catenella* in temperate and Arctic waters

Donald M. Anderson

*Presenting author: danderson@whoi.edu

Biology Department, Woods Hole Oceanographic Institution, Woods Hole MA 02543

Keywords: Alexandrium, cysts, dormancy cycling, climate change, harmful algal blooms

Alexandrium is one of the major harmful algal bloom (HAB) genera with respect to the diversity, magnitude and consequences of blooms. The ability of *Alexandrium* to colonize multiple habitats and to persist over large regions through time is testimony to the adaptability and resilience of this group of dinoflagellate species, some of which produce potent neurotoxins. Many *Alexandrium* species have complex life histories that include sexuality and the formation of resting cysts that play a major role in bloom dynamics. This talk will focus on *Alexandrium catenella*, a producer of saxitoxins and thus a significant threat to human and ecosystem health worldwide. Following an introduction to new findings on the role of temperature in dormancy cycling similar to that seen in seeds of higher plants, ecophysiological studies in three habitats will be highlighted: 1) blooms in shallow, isolated embayments on Cape Cod where complete bloom cycles can be observed in exquisite detail; 2) widespread blooms in temperate coastal waters of the Gulf of Maine; and 3) blooms transported into, and originating within the rapidly warming waters of the Pacific Arctic near northwestern Alaska. All of these studies include investigations of resting cyst distribution, abundance, and physiology that underlie key aspects of cyst and vegetative cell dynamics, and all benefit greatly from the application of new technologies, including autonomous in situ sensors. The response of *A. catenella* populations to a warming climate in these habitats will also be discussed and contrasted, highlighting the critical role of temperature in cyst and bloom dynamics, as well as the complications that arise with cyst-forming species in climate-change assessments.

K-2

Cool stories behind cool High Arctic Eocene dinoflagellate cysts

Henk Brinkhuis[1*,2] & friends

*Presenting author: Henk Brinkhuis (henk.brinkhuis@nioz.nl)

[1] Department of Ocean Systems (OCS), NIOZ Royal Netherlands Institute for Sea Research, PO Box 1790 AB Den Burg, Texel, The Netherlands.
[2] Department of Earth Sciences, Marine Palynology and Paleoceanography group, Laboratory of Palaeobotany and Palynology, Faculty of Geosciences, Utrecht University, 3584 CB Utrecht, The Netherlands

Keywords: Arctic, Eocene, organic-walled dinoflagellate cysts, taxonomy, paleoenvironments, paleoceanography, paleobiogeography

Organic walled microfossils, including sporomorphs, and various aquatic algal remains including organic-walled dinoflagellate cysts (dinocysts) are abundant in the Eocene sedimentary succession recovered from the central Arctic part of the Lomonosov Ridge by Integrated Ocean Drilling Program (IODP) Expedition 302 back in 2004, (also dubbed 'Arctic Coring Expedition' ACEX). Early results from a few segments of this interval included e.g. the finding of an interval of mass-occurrence of remains of the aqueous fern *Azolla*, and in general low diversity, often peridinioid dominated dinocyst assemblages, indicating the strong influence of fresh to brackish water conditions overall. Most of these constitute undescribed taxa, some only known informally from High Arctic US and Canadian pioneering exploration studies. An overview of these, spanning the Ypresian to middle Lutetian interval (~54 – 44 Ma) will be presented, and their paleoenvironmental, paleobiogeographic and paleoceanographic implications, from North Slope Alaska to Kazakhstan and back, will be discussed.

K-3

Stable carbon isotope analyses of dinoflagellate cysts – applications & outlook

Joost Frieling[1,2], Gert-Jan Reichart[2,3], Appy Sluijs[2]

*Presenting author: joost.frieling@ugent.be

[1] Dept. of Geology, Ghent University, Ghent, Belgium
[2] Dept. of Earth Sciences, Utrecht University, Utrecht, Netherlands
[3] Royal NIOZ, Texel, Netherlands

Keywords: carbon isotope analyses, proxy development, ecology

The stable carbon isotope composition of fossil dinoflagellate cysts is largely unknown yet provides potentially important information on carbon acquisition physiology and past ocean conditions. Their isotope geochemistry is understudied due to various practical challenges. Notably, only few studies have been able to generate high-accuracy isotope data on 20-100 μm-scale organic particulates such as dinoflagellate cysts. Pioneering studies acquired genus or species-specific isotope analyses but generally involved very low accuracy or required manually picking hundreds to thousands of individuals for a single measurement. A novel laser ablation gas chromatography isotope ratio mass spectrometry approach has vastly reduced the amount of material required for carbon isotope analyses so that only a very small number or even an individual dinoflagellate cyst, may suffice.

Single-species dinocyst data acquired over the past few years confirm observations from culture experiments that dinocyst carbon isotope fractionation retains information on the CO_2 content of the water. In addition, the statistical distribution of species-specific isotope data on individual dinocysts, both in sub-recent times and geological deep-time, provides a unique perspective on the population structure and ecology. We find clear differences in fractionation and isotopic variance between species, as well as more subtle hints that the isotopic signature of rapid carbon emissions (Suess-effect) from fossil fuel burning may be recorded. Though these findings are promising for proxy development, the extraction of particulate organics from geological samples is non-trivial and testing for various analytical and procedural influences on isotope data will be key to ensure robust interpretation. We will discuss the current state of the art, challenges and potential future directions of single-specimen dinocyst isotope analyses.

K-4

Late Quaternary dinoflagellate cyst assemblages document episodic seasonal sea ice opening in the circum-Arctic Ocean

Anne de Vernal[1*], Jena Matthiessen[2], Claude-Hillaire-Marcel[1]

*Presenting author: devernal.anne@uqam.ca

[1] Geotop, UQAM, Montréal, Canada
[2] AWI, Bremerhaven, Germany

Keywords: Arctic, sea ice, productivity, Quaternary, interglacials.

The paleoceanography of the Arctic Ocean is challenging to document because it is characterized by extreme environmental conditions that result in equivocal signals from most proxies, not to mention the difficulty of establishing chronostratigraphic frameworks. In surface sediments, dinocyst assemblages are characterized by relatively high abundance and species diversity in the neritic domain of peripheral Arctic Seas, but by extremely low numbers in the central Arctic, likely due to perennial sea ice cover. Hence, dinocysts can be used as paleoceanographical tracers to document seasonal sea ice occurrence and summer sea-surface conditions (temperature, salinity, productivity) in the Arctic, except in areas of perennial sea ice. Palynological analyses of sediment cores from the circum-Arctic seas that cover the present interglacial reveal relatively rich dinocyst assemblages, enabling estimates of sea-surface conditions and demonstrating primary productivity and the seasonal opening of sea-ice cover. The dinocyst data further evidence contrasting variations in the western vs. eastern Arctic Ocean, likely related to changes in Pacific and Atlantic water inflows through the Bering Strait and the Fram Strait, respectively. While optimal conditions occurred during the early-middle Holocene in the Atlantic Arctic, from the Fram Strait to the Laptev Sea, the warmest conditions were achieved during the late Holocene in the Chukchi Sea, when sea level reached present-day levels at the Bering Strait, allowing for high Pacific Water inflow to the Arctic. Documenting sea-surface conditions over longer time intervals in the Arctic must be done from cores collected offshore in the central deep Arctic, at depths unaffected by ice advances during the last glaciation or by erosion during postglacial sea-level rise. Palynological analyses were done in many cores spanning longer time series from the central region, but revealed mostly barren dinocyst assemblages, which we associate with resilient perennial sea ice cover. Nevertheless, cores collected near the shelf edge contain dinocyst assemblages indicating episodic reductions in local-to-regional summer sea ice cover. In these cores, dinocyst data show a significant reduction of summer sea ice along the shelf edge during the early to middle Holocene, notably in the Laptev Sea. Older intervals also contain discrete occurrences of dinocysts that could be associated with episodic productivity and sea-ice opening during exceptional interglacial phases. The chronostratigraphy of the study cores remains equivocal, but short time windows with sea-ice reduction beyond the shelf seem to correspond to the early phase of major interglacials.

Oral Presentations:

1. Are very small acanthomorph acritarchs dinoflagellate cysts? : Evidences from the Cretaceous and modern samples

Takuto Ando[1*]

*Presenting author: tact@gipc.akita-u.ac.jp

[1] Graduate School of International Resource Sciences, Akita University.

Keywords: dinosteroid, acritarchs, the mid-Cretaceous OAEs, modern analogue, Micrhystridium

Dinosterol (4α,23,24-trimethyl-5α-cholest-22E-en-3β-ol) is dinoflagellate biomarker, produced by more evolved species of dinoflagellates such as Gonyaulacales, Dinophysiales, Prorocentrales and Peridiniales (e.g., Janouškovec et al., 2016). Several isomers of dinosteranes and triaromatic dinosteroids formed from dinosterols due to diagenesis are preserved even in sedimentary rocks. Moldowan et al (1996) reported that the ratio using triaromatic dinosteroid had related with abundance of Paleozoic acritarchs. Ando et al. (2016) and Killops et al (2021) reconsidered identification of triaromatic dinosteroids, and revised the calculation formula (TADS) as the indicator of dinoflagellate productivity in the past including deeper age like Proterozoic. Acritarchs, as palynomorphs with unknown origin, are observed not only in the Proterozoic and Paleozoic rocks but in the Mesozoic and Cenozoic rocks, and even in modern sediments. Talyzina et al (2001) focused on the morphology of acritarchs in the Cambrian rock samples, and found positive correlation between the percentages of dinosteranes and the relative abundance of acritarchs with spines (acanthomorph acritarchs).

Here, we focused on relationship between dinosteroid and acanthomorph acritarchs like *Micrhystridium* in the samples of the mid-Cretaceous Oceanic Anoxic Events (OAEs) and modern samples collected from Miho Bay and Nakaumi Lagoon, Japan, to discuss the evolution of acritarchs and dinoflagellate.

At first, we compared TADS with marine palynomorph (dinoflagellate cysts and acritarchs) assemblages by using the OAEs samples collected from the Vocontian Basin, SE France. Dinoflagellate cysts were rare in the OAE levels. However, interestingly, acanthomorph acritarchs, mainly very small (<20μm) *Micrhystridium* sp., were more abundant in the OAE1b, 1d and 2 samples with higher TADS, deposited under eutrophic condition. On the other hand, sphaeromorph acritarchs, *Lophosphaeridium* sp., are mainly observed in the OAE1a samples with lower TADS, deposited flourishing under oligo-mesotrophic condition. These data are consistent with Talyzina et al (2001). Therefore, it suggested that the organisms forming *Micrhystridium* sp., even in the Mesozoic sedimentary rocks, were dinoflagellate or favor similar condition where dinoflagellate flourished.

Modern acritarchs are still mysterious remains of organisms, possibly of aquatic eukaryotes. To compare dinoflagellate cysts and biomarkers with the abundance of modern acritarchs in estuarine environments, we collected surface sediments from Miho Bay of the Japan Sea and Nakumi Lagoon, both of them are connected. The percentages of dinosterol among steroids were lower in the samples from Miho Bay compared with those of Nakaumi Lagoon. In addition, P/G (Peridinoid/ Gonyaulacoid) ratios of dinoflagellate cysts are lower in the samples from Miho Bay than those of Nakaumi Lagoon. Both of results suggested lower dinoflagellate productivity in Miho Bay. However, acanthomorph acritarchs, while their abundances were rare, were mainly observed from the samples of Miho Bay. Main “sphaeromorph” acritarchs in the samples of Nakaumi Lagoon are *Micrhystridium ariakense* with very short spines, is resemble to *Lophosphaeridium* sp in the OAE samples while called by “*Micrhystridium*” as name for acanthomorph. It is opposite evidence with the case of Cretaceous OAEs. To solve this mismatches, DNA and macromolecule analyses of very small acritarchs are necessary, although the further development of methodology is needed.

2. New data on the distribution of *Gambierdiscus* spp. in the Eastern Atlantic: from the Gulf of Guinea to the Azores

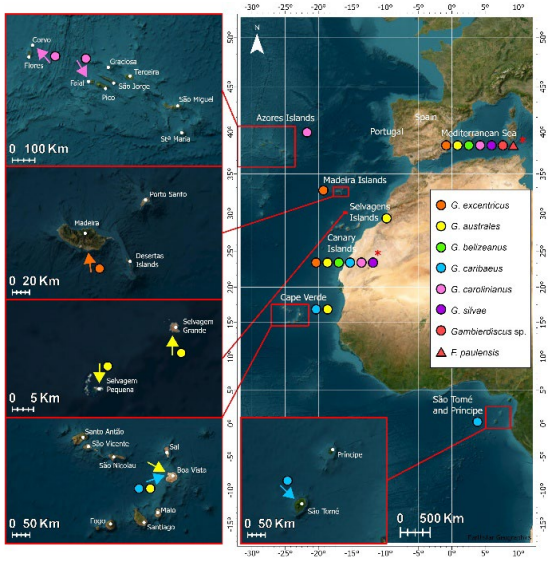
Miguel Barbosa[1,2], Catarina Churro[1,3], Bárbara Frazão[1], Sergei Danchenko[1], Pedro Afonso[4], Inês Gomes[4], Neide Gouveia[5], Viriato Timoteo[5], Rui Rosa[2,6,7], Jaquelino Varela[7], Maria Filomena Caeiro[6,8], Nicolas Chomérat[9], Pedro Reis Costa[1,10], Ana Amorim[2,6]

*Presenting author: Ana Amorim (aaferreira@ciencias.ulisboa.pt)

[1]IPMA – Portuguese Institute for the Sea and Atmosphere, 1749-077, Lisboa, Portugal
[2]MARE – Marine and Environmental Sciences Centre/ARNET – Aquatic Research Network, Faculdade de Ciências, Universidade de Lisboa, 1749-016, Lisboa, Portugal
[3]CIIMAR – Blue Biotechnology, Environment and Health, Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Terminal de Cruzeiros do Porto, Av. General Norton de Matos s/n, 4450-208 Matosinhos, Portugal.
[4]Institute of Marine Sciences - Okeanos, University of the Azores and Instituto do Mar - IMAR, Rua Professor Doutor Frederico Machado 4, 9901-862 Horta, Portugal
[5]Laboratório Regional de Veterinária e Segurança Alimentar, Caminho das Quebradas de Baixo nº 79, S. Martinho, 9000-254 Funchal, Portugal
[6]Departamento de Biologia, Faculdade de Ciências, Universidade de Lisboa, 1749-016, Lisboa, Portugal
[7]Sphyrna Association, Boa Vista Island, Cape Verde
[8]Centre for Ecology, Evolution and Environmental Changes (CE3C) & CHANGE – Global Change and Sustainability Institute, Faculdade de Ciências, Universidade de Lisboa, 1749-016, Lisboa, Portugal
[9]Ifremer, COAST/LER BO, Station de Biologie Marine de Concarneau, Place de la Croix, F-29900 Concarneau, France
[10]Centre of Marine Sciences (CCMAR/CIMAR LA), University of Algarve, Campus de Gambelas, 8005-139, Faro, Portugal

Keywords: *Gambierdiscus, Ciguatera, Benthic Harmful Algae, Biogeography*

Benthic dinoflagellates of the genus *Gambierdiscus* are responsible for the production of highly toxic compounds, such as maitotoxins and ciguatoxin precursors, associated with Ciguatera Poisoning (CP). Originally considered to be restricted to tropical regions, this genus has been increasingly reported from subtropical and temperate areas, including Eastern Atlantic islands in the Macaronesian region. This apparent geographical expansion has been linked to ocean warming and highlights the need for monitoring and risk assessment in newly affected areas. This study aims to characterize the distribution and species diversity of *Gambierdiscus* across five Eastern Atlantic archipelagos: the Azores, Madeira, Selvagens, Cape Verde, and São Tomé and Príncipe. Samples from different macroalgae were collected by snorkeling from seven islands, from which *Gambierdiscus* cells were isolated and established in culture. The obtained strains were studied using morphological (SEM) and molecular approaches targeting the LSU rRNA D1–D3 and D8–D10 regions. *Gambierdiscus* was detected in all studied archipelagos. Four species were identified (*G. carolinianus, G. excentricus, G. australes,* and *G. caribaeus*), showing distinct geographical distributions. *Gambierdiscus carolinianus* was isolated from the Azores, representing the first record of this genus in the archipelago and the northernmost record known to date (39°40′19″N). *Gambierdiscus caribaeus* was recorded in São Tomé and Príncipe and Cape Verde, corresponding, respectively, to the first record of this genus and the first record of this species in these archipelagos. In Cape Verde and São Tomé and Príncipe, benthic harmful algal bloom (BHAB) communities were also investigated using artificial substrates, with the aim of comparing this approach with natural macroalgal substrates. Quantitative cell abundances of the genera *Gambierdiscus, Prorocentrum, Ostreopsis, Coolia*, and *Amphidinium* were assessed, providing the first data on the relative contribution of these genera in benthic dinoflagellate assemblages from tropical Eastern Atlantic archipelagos. Both methods revealed a similar relative community composition, with *Ostreopsis* dominance in São Tomé, and co-dominance of *Ostreopsis* and *Prorocentrum* in Cape Verde. *Amphidinium* was the least abundant genus in both archipelagos. These results expand the known biogeographical distribution of *Gambierdiscus* in the Eastern Atlantic and highlight a potential CP risk that remains poorly assessed. (Figure 1 - New distribution data of *Gambierdiscus* in the Eastern Atlantic).



3. Reconstructing algal bloom dynamics using individual protist fossil $\delta^{13}C$ measurements

Yannick F. Bats[1], Jack J. Middelburg[1], Gert-Jan Reichart[1,2], Appy Sluijs[1]

*Presenting author: y.f.bats@uu.nl

[1] Department of Earth Sciences, Faculty of Geosciences, Utrecht University, Princetonlaan 8, 3584 CB Utrecht, The Netherlands
[2] NIOZ Royal Netherlands Institute for Sea Research, 1797 SZ 't Horntje, The Netherlands

Keywords: Algal blooms, dinocyst ^{13}C-fractionation, single-specimen measurements

Single-specimen stable carbon isotope ($\delta^{13}C$) measurements of foraminifera and dinocyst populations in marine sediment samples hold potential for elucidating carbon cycle dynamics on seasonal to interannual timescales. However, the theoretical basis for developing testable hypotheses is lacking. In this study we develop a simple numerical box model that simulates algal ^{13}C-fractionation (ε_p) during a seasonal algal bloom succession. In response to varying bloom conditions, the model simulates $\delta^{13}C$ population distributions of various types of algae, including dinoflagellates, and that of dissolved inorganic carbon (DIC), which is reflected by foraminifer calcite $\delta^{13}C$ values. We find a clear relationship between $\delta^{13}C$ variance and primary productivity (PP), which is validated by core top data of dinocysts and foraminifera. Furthermore, we find that the shape (i.e., variance and skewness) of $\delta^{13}C_{foram}$ and $\delta^{13}C_{dinocyst}$ distributions can be used as a proxy for relative changes in past algal bloom intensity and bloom type. For example, it allows for differentiating between abrupt versus gradual blooms. Based on this, we develop a simple inverse model (INVEBOR) that reconstructs the shape of the course of a bloom through time (i.e., bloom phenology) based on single-specimen $\delta^{13}C_{foram}$ distributions. We apply all these findings to published single-specimen $\delta^{13}C_{foram}$ and $\delta^{13}C_{dinocyst}$ distributions across the Paleocene-Eocene Thermal Maximum (~56 Ma) and find that bloom intensity and PP likely increased in open ocean settings, whereas it decreased in specific neritic locations, possibly due to sea level rise.

4. Seasonal trends in dinocyst assemblages at the North Sea – Atlantic Ocean gateway

Anne Behnen[1*], Cecile Hilgen[1], Furu Mienis[2], Daan Temmerman[2], Anne Enge[3], Francesca Sangiorgi[1]

*Presenting author: *a.c.behnen@students.uu.nl

[1]Department of Earth Sciences, Utrecht University, 3584 CB Utrecht, The Netherlands
[2]Department of Ocean Systems, Royal Netherlands Institute for Sea Research, 1797 SZ 't Horntje (Texel), The Netherlands
[3]Department of Hydraulic Engineering, Delft University of Technology, 2628 CN Delft, The Netherlands

Keywords: *Sediment traps, dinocysts ecology, seasonal succession, primary productivity.*

The Norwegian Trench (NT) is the gateway where waters, nutrients and carbon from the North Sea are exported to the Atlantic and where Atlantic oligotrophic waters enter the North Sea. Sediments in the Norwegian Trench likely record present and past water and nutrient exchange and primary productivity trends. Dinoflagellates are key primary producers in the North Sea, and some form cysts (dinocysts) that are preserved in sediments and can be used to reconstruct environmental conditions. Recent findings from modern surface (0-1 cm) sediments in the area have shown that the flux of heterotrophic dinocysts correlates best with surface waters primary productivity (Hilgen et al., 2026). However, sediment samples and their dinocyst assemblages generally integrate multiple years of water column conditions. This integration can obscure short-term variability, yet understanding seasonality remains important, as climate change is shifting the growing season of primary producers, with consequences for the entire trophic chain. Moreover, understanding what (seasonal) signal is mostly transferred from the water column to the sediments and is eventually preserved also allows us to discuss potential biases. Here we present the palynological results and dinocysts assemblages of a two-years' time series (June 2023–April 2025) from sediment traps from two locations in the NT. We compared the results to the surface sediment assemblages from sediments collected below the traps to discuss productivity, seasonality and potential transport and taphonomic biases due to resuspension and (selective) preservation. A total of 33 dinocyst taxa were identified, revealing a distinct seasonal succession at both locations: assemblages are dominated by heterotrophic species (mainly *Brigantedinium* spp.) in summer and autumn. Phototrophic species (primarily cysts of *Protoceratium reticulatum* and cysts of *Pentapharsodinium dalei*) dominate in winter and spring. Total dinocyst flux seems to be related to the particulate organic carbon (POC) flux, and the flux of heterotrophic cysts is linked to primary productivity. Winter signals may be affected by lateral transport and resuspension. This is supported by concomitant high bottom-water current velocities, high backscatter, high POC flux, and the absence of cysts with cell contents in the winter traps. When comparing sediment trap data to underlying surface sediments at both locations, it becomes apparent that the surface sediments are dominated by cysts of *P. reticulatum,* cysts of *P. dalei* and *Spiniferites* spp., reflecting a different signal than the annual average. We propose that this offset is driven by lateral transportation of cysts and selective degradation of heterotrophic cysts, partly by fungal predation and prolonged exposure to oxic bottom waters during resuspension.

5. New view on dinoflagellate cyst diversity through time: results from palsys.org and DINOSTRAT

Peter K. Bijl*

*Presenting author: p.k.bijl@uu.nl

Department of Earth Science, Utrecht University, Utrecht, The Netherlands

Keywords: dinoflagellate cyst diversity, databases, stratigraphy, taxonomy

Dinoflagellate cysts are widely used in the stratigraphic record, as biostratigraphic marker, as indicator for past oceanographic and environmental conditions and, more recently, as proxy carrier for chemical paleoceanography. For over 1,5 century dinocyst taxa have been described, grouped into genera, placed into suprageneric classification schemes and emended. Since then they are widely used as stratigraphic marker and to reconstruct paleoenvironments. Recognizing the need for barrier-free access of taxonomic information of dinoflagellate cyst taxonomy and stratigraphy, palsys.org is the open-access website that displays a comprehensive overview of taxonomic descriptions, synonymy, images and stratigraphic ranges of all dinoflagellate cysts known to science. The stratigraphic ranges of taxa have been compiled in a database called DINOSTRAT, wherein stratigraphic first and last occurrences of now active taxa from the literature are, along with their paleolocation, calibrated to the most up-to-date geologic time scale and paleogeographic framework. DINOSTRAT v2.2 was released recently and includes for each active species at least a ‘best guess’ stratigraphic range, based on the age of the type section. This compilation has now given a stratigraphic range to all active taxa and now enables a revisit the dinoflagellate cyst species diversity through time, per (sub)family. Since its last iteration in ’96, dinocyst diversity has particularly increased in the Paleogene and late Cretaceous, making these how the most diverse phases in the geologic record of dinoflagellate cysts. In my presentation, I will show how palsys.org and DINOSTRAT are constructed, what the status and progress of both platforms are, and critically discuss the revisited overview of dinoflagellate cyst diversity through time.

6. Morphological and molecular characterization of the genus *Protoperidinium* in the Canadian Arctic.

Alfred Champigny*[1], El Mahdi Bendif[1], André Rochon[1]

*Presenting author: alfred.champigny@uqar.ca

[1] Institut des Sciences de la Mer (ISMER) - Université du Québec à Rimouski (UQAR), Rimouski, Canada.

Keywords: Protoperidinium, Single-cell, Phylogenetic, Arctic, Biodiversity.

Protists are fundamental components of marine trophic networks, playing key roles at the base of food webs. Despite their high diversity, Arctic dinoflagellates remain largely underexplored. Among them, the genus *Protoperidinium* is one of the most abundant and species-rich heterotrophic dinoflagellate genera, with approximately 40 species reported from Arctic waters, yet it has received comparatively little attention in the Canadian Arctic.

This study pursues three complementary objectives. The first is to document the phylogenetic relationships of Arctic *Protoperidinium*. The second is to integrate morphological data within a phylogenetic context, in order to identify characters that reflect evolutionary lineages and to reassess current taxonomic criteria. The third is to establish a robust barcode reference dataset to improve metabarcoding approaches, enabling large-scale exploration of the diversity and biogeographical distribution of this genus.

Samples were collected using 20µm mesh vertical plankton net tows in Arctic, subarctic, and St. Lawrence Estuary waters, aboard multiple research vessels, primarily the CCGS *Amundsen in* 2024 and 2025. Additional samples from the Mediterranean Sea, Red Sea, and Indian Ocean were also processed. These were collected during 2021 and 2022 expeditions by the Station Biologique de Roscoff, providing a valuable comparative basis and further strengthening the reference database for metabarcoding applications. Individual cells were isolated using glass micropipettes, identified and photographed under light microscopy before DNA extraction. 18S and 28S ribosomal DNA genes were amplified via semi-nested PCR and sequenced using Sanger sequencing. Detailed morphological analyses were performed using scanning electron microscopy (SEM).

To date, molecular data have been obtained for 24 *Protoperidinium* species. We ultimately aim to sequence at least 40 *Protoperidinium* species, substantially expanding current knowledge of their genetic diversity. Phylogenetic analyses revealed no clear geographic structuring among lineages. Morphological characters traditionally employed in taxonomy showed limited congruence with phylogenetic relationships in Arctic *Protoperidinium*, which is consistent with previously published studies on this genus. Certain features, such as the hypothecal pore, appear more consistent with evolutionary lineages, while others, including the apical pore complex and the sulcal region, require further investigation. Our data also help to clarify the status of closely related species, such as *P. crassipes, P. curtipes*, and *P. divergens*, as well as *P. leonis* and *P. conicum*.

Collectively, these results contribute to a more robust understanding of dinoflagellate diversity and ecological roles within Arctic planktonic ecosystems, which are particularly vulnerable to ongoing environmental change.

7. Living dinoflagellate cysts from The United Arab Emirates (UAE): relevance for present-day ecological management and paleoecological interpretations

Barrie Dale[1*], Amy Dale[2]

*Presenting author: Barrie.dale@geo.uio.no

[1] Geoscience Department, University of Oslo, Oslo, Norway.
[2] GeoResearch Consulting, Skarnes, Norway.

Keywords: dinoflagellate cysts, HAB, eutrophication, climate change

Recent and living cysts from surface sediments at 131 nearshore to offshore sites in marine waters of Abu Dhabi and Dubai were studied in cooperation with the Environment Agency following serious harmful algal blooms (HABs). The main objective was to provide data on possible seedbeds of harmful cyst species that would allow a first-order regional assessment of risk for HABs from future sediment disturbance by development projects and dredging. Semi-quantitative methods were needed to extract enough cysts from extremely low concentrations in these largely sandy sediments: a finer-grained portion from up to 500 cc of wet sediment (according to coarseness of the sand) was separated out by elutriation and sieved between 25 and 200 microns. Cysts were examined in microscope preparations of the >25 µm fraction mounted in glycerine jelly ringed by wax, and counts were expressed as percentages of assemblages. The strength of associations between stations, cysts and environmental variables was explored using correspondence analysis (CA) and canonical correspondence analysis (CCA). 72 distinctive forms were identified including several new and seven global HAB producers. Notably, very few cysts were observed of *Cochlodinium* sp. thought to have caused the blooms. Sandstorms produce almost all sedimentation, and we postulated that these sink and bury cysts analogous to the spraying of clay elsewhere to terminate blooms. Results provided a regional reference database for assessing future threats of HABs to shell fishing for food, desalination plants, international shipping ports and ballast-water discharge. Results also showed a cyst signal for eutrophication associated with polluted sediments from sewage treatment: a gradual proportional decrease in heterotrophic species cysts from a high of 93% near a point source treatment plant; an example of the potential use of cysts to document the development of and recovery from cultural eutrophication with improved treatment. The study also provides relevant information for paleoclimate interpretations: a dry desert environment where seawaters reach >40º C and salinity 40 ‰ in <40 m. deep water extending far out to sea. Estimated paleo-sea temperatures and salinities even for extreme geological warming periods are usually lower than this. Calcareous cysts were omitted from counts here to allow comparisons with palynological data used in paleoecology. 32% of cysts recovered were calcareous forms (17 forms), showing the dinoflagellate component potentially lost to palynology. Cyst species of *Tuberculodinium*, *Polysphaeridium*, and *Lingulodinium* in our data are particularly interesting for paleoclimate studies, since they are long-ranging warm water indicators also included in cyst assemblages from the Paleocene-Eocene Thermal Maximum (PETM), a much-studied extreme global warming event. We also show other assemblage data for comparison with paleoecology: an unusually large variety of “heterotrophs” (~40 forms), including some large (>100 microns) offshore forms probably endemic to the Indian Ocean region. The distributions of cysts in our data raise questions for paleontologists attempting to isolate and interpret factors such as paleotemperatures. The seasonal temperature ranges that must be tolerated by a species living in the plankton with cysts in bottom sediments are of critical importance, and within these limits, cyst-forming dinoflagellates seem particularly robust.

8. Dinoflagellate cyst distribution in deep sea sediment traps from the Nordic Seas suggest cyst transport is a crucial factor affecting accuracy of proxies.

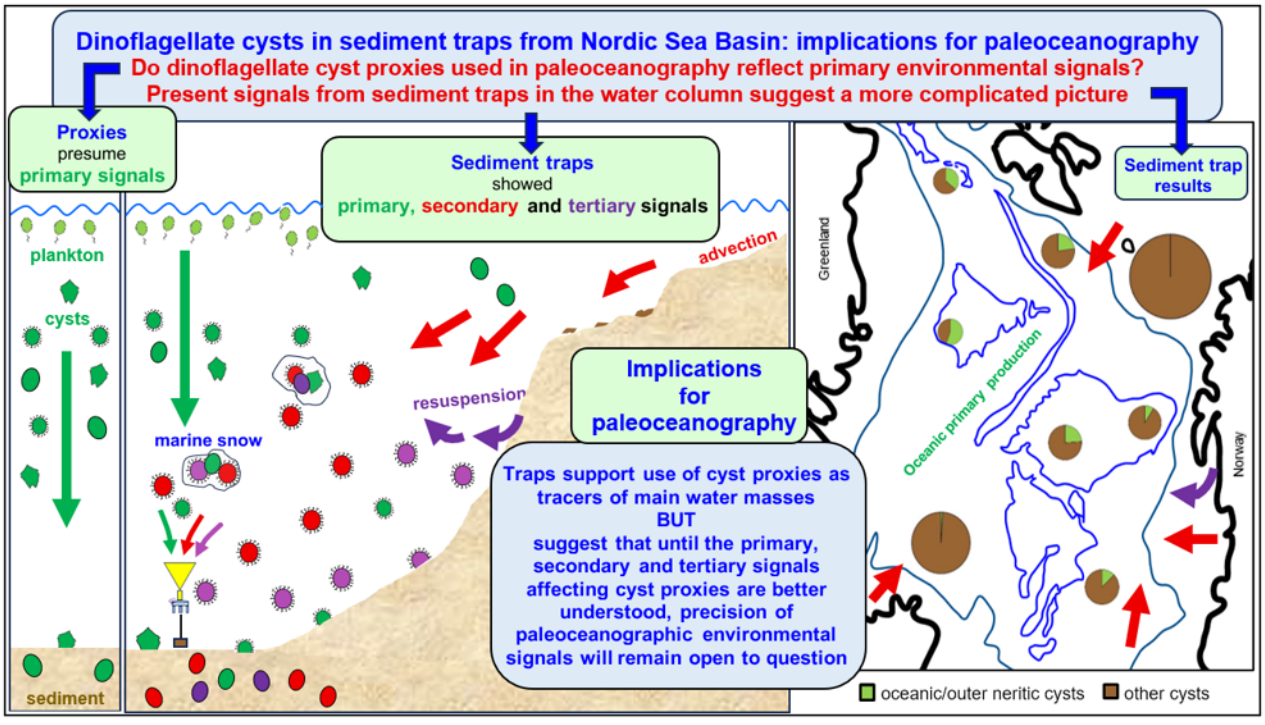
Amy L. Dale[1*] and Barrie Dale[2]

*Presenting author: Amy Dale georc@online.no

[1] GeoResearch Consulting, Nord-Odalsvegen, Skarnes, Norway
[2] Geosciences Department, University of Oslo, P.O. Box 1047 Blindern, NO-0316 Oslo, Norway

Keywords: *Paleoclimatic indicators, Nordic Seas, Sediment traps, Cyst transport, Proxies*

This first basin-wide study of dinoflagellate cysts in deep-sea sediment traps reassesses the basic assumptions of paleoceanographic proxies: that dinoflagellate cysts in bottom sediments represent primary environmental signals from overlying surface waters carried by cysts sinking without significant lateral transport. Samples were collected every 12-30 days over roughly one year from traps approximately 400 m above bottom at 9 stations around the Nordic Seas. We recorded 25 cyst taxa quantitatively (fluxes) and as assemblages calculated from the fluxes. Cyst, lithogenic and total sediment fluxes were compared. The generally high correlation between fluxes of cysts and lithogenic particles suggests common transport mechanisms for both. Correspondence analysis was used to compare cyst assemblages from traps with those in recent bottom sediments used to create proxies. We found poor correspondence between cysts in traps and those in bottom sediments mainly due to the dominance of O. centrocarpum in sediments, but correspondence analysis identified similar assemblages reflecting the main current regimes in both. We show three different sources of cysts and environmental signals: primary, from oceanic surface waters; secondary, transported in from shallow adjoining waters and ocean currents; and tertiary, older cysts resuspended from shelves. Consideration of factors highlighted here should help to improve the use of cyst proxies in paleoceanography.



9. Emendation of the cyst-based genera *Selenopemphix* and *Multispinula*: insights from morphology, molecular phylogeny, and cyst wall chemistry

Ophélie David[1,2*], Pjotr Meyvisch[3,4], Haifeng Gu[5], Gwenael Bilien[2], Dave Clarke[6], Fabienne Marret[7], Kenneth N. Mertens[2]

*Presenting author: ophelie.david72@gmail.com
[1] Univ. Brest, CNRS, Ifremer, Geo-Ocean, UMR 6538, F-29280 Plouzané, France
[2] Ifremer, COAST, F-29900 Concarneau, France
[3] Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, Maryland, USA
[4] Department of Geology, Ghent University, Ghent, Belgium
[5] Laboratory of Marine Biology and Restoration, Third Institute of Oceanography, Ministry of Natural Resources, Xiamen 361005, China
[6] Marine Institute, Rinville, Oranmore, H91 R673, Galway, Ireland
[7] Department of Geography and Planning, School of Environmental Sciences, University of Liverpool, Liverpool, UK

Keywords: *dinoflagellate cysts, LSU rDNA, ATR micro-FTIR,* Protoperidinium.

The cyst-based genus *Multispinula*, with generitype *Multispinula quanta* from recent sediments of the Persian Gulf, has long been considered a junior synonym of *Selenopemphix*, with generitype *Selenopemphix nephroides* from Oligocene deposits in Germany. Recent phylogenetic analyses have revealed polyphyly between *Selenopemphix quanta* and *Selenopemphix undulata*, questioning this synonymy and suggesting the need to distinguish two genera. However, the unresolved phylogenetic position of the type species *S. nephroides* has so far prevented taxonomic revision. Here, we reassess the taxonomy of *Selenopemphix* and *Multispinula*, based on a multiple approach combining morphological (light and field emission scanning electron microscopy) and molecular (partial LSU rDNA) analyses, focusing on the two type species. Additionally, the cyst wall composition was analysed via attenuated total reflection Fourier transform infrared (ATR μ-FTIR) microspectroscopy, to assess the diversity and preservation of cyst wall biomacromolecules. Our phylogenetic analyses demonstrate that both type species *S. nephroides* and *M. quanta* belong to different clades, supporting the distinction of two cyst-based genera. Morphological features further support this distinction and justify emended diagnoses thereof. The genus *Selenopemphix* is emended to include only cysts with a left-offset archeopyle, while emendation of the genus *Multispinula* now includes cysts with a mid-dorsal archeopyle and a paratabulation outlined by spiny processes and parasutural ridges. *Selenopemphix quanta* is transferred back to its initial name *Multispinula quanta*. Furthermore, our morpho-molecular results allow the description of two new species (**Fig. 1**): *Multispinula robusta* sp. nov. (equivalent of *Protoperidinium conicum*) and *Multispinula varispinula* sp. nov. (equivalent of *Protoperidinium parvivariplatum* sp. nov.), clarifying the taxonomic diversity formerly included within *M. quanta*. The cyst wall composition of *Multispinula* species is distinct from that of *S. nephroides*, although both are characterized as mixtures of proteins and pigments (melanin). *Multispinula* cysts are less melanized and more enriched in decay-prone proteins, which is expected to negatively affect their preservation potential. In conclusion, our study clarifies the taxonomy of the cyst genera *Multispinula* and *Selenopemphix* and highlights the value of integrating morphological, molecular, and cyst wall chemical analyses to resolve issues in dinoflagellate cyst taxonomy.

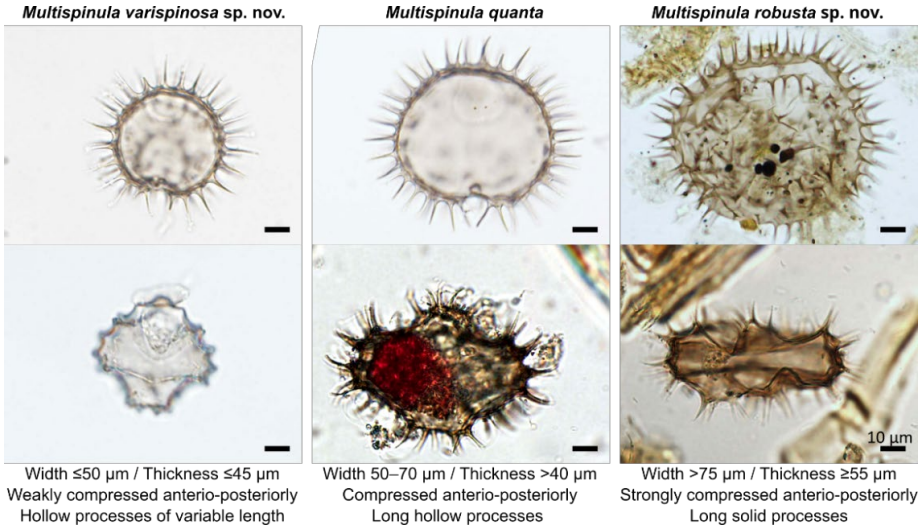


Fig.1: Micrographs of the three *Multispinula* species and corresponding morphological features. Scale bars = 10 µm.

10. Dual nomenclature as applied to fossil dinoflagellates and ciliates

Martin J. Head[1]*, Kenneth N. Mertens[2], Pieter R. Gurdebeke[3], Ophélie David[2], Anne de Vernal[4], Iria García-Moreiras[5], Vincent Iratçabal[6], Audrey Limoges[7], Fabienne Marret[8], Pjotr Meyvisch[9], Aurélie Penaud[10], Vera Pospelova[11], Taoufik Radi[4], Nicolas Van Nieuwenhove[7], Vincy Y. Winifred[11]

*Presenting author: mjhead@brocku.ca

[1]I Department of Earth Sciences, Brock University, St. Catharines, Ontario,Canada
[2]Ifremer, COAST, Concarneau, France
[3]Department of Geology, Ghent University, Ghent, Belgium.
[4]Geotop, Université du Québec à Montréal (UQAM), Montréal, Québec, Canada
[5]Centro de Investigación Mariña (CIM), GEOMA, Departamento de Bioloxía Vexetal e Ciencias do Solo, Universidade de Vigo, Vigo, Spain
[6]Geo-Ocean, Université de Bretagne-Sud, University of Brest, CNRS, Ifremer, Vannes, France
[7]Department of Earth Sciences, University of New Brunswick, Fredericton, New Brunswick, Canada
[8] School of Environmental Sciences, University of Liverpool, Liverpool, UK
[9]Department of Earth and Planetary Sciences, The Johns Hopkins University, Baltimore, USA
[10]University of Brest, CNRS, Ifremer, Geo-Ocean, Plouzané, France
[11]Department of Earth and Environmental Sciences, University of Minnesota, Minneapolis, USA

Keywords: Fossil, non-fossil, nomenclature, dinoflagellates, ciliates

The International Code of Nomenclature for algae, fungi, and plants (ICN) has long treated the names of fossil- and non-fossil taxa differently. Dual nomenclature now explicitly supports the names of fossil-taxa (diatoms excepted) under the ICN, on the premise that fossil- and non-fossil taxa (i.e., those with a fossil or non-fossil nomenclatural type) are conceptually different. This is reflected in the distinction between 'synonymy' and 'taxonomic equivalence'. Non-fossil taxa are classified potentially on all biological criteria, whereas fossil-taxa rely exclusively on morphological attributes of a single life-cycle stage (almost always the cyst). Accordingly, the name of a dinoflagellate fossil-species once morphologically linked (e.g. via incubation studies) to that of a non-fossil-species, leads to its loss as a junior taxonomic synonym (unified nomenclature), or continuance as a taxonomically equivalent name (dual nomenclature). The ICN does not attempt to regulate taxonomy (it is strictly a nomenclatural code) so it permits choice. The cysts and loricae of ciliates (phylum Ciliophora) are often found with dinoflagellate cysts in palynological preparations, and present similar taxonomic challenges. Ciliates are traditionally treated under the International Code of Zoological Nomenclature (ICZN) although many are non-constitutive phototrophs. As alveolates, ciliates are closely related to the dinoflagellates. Their fossil remains in palynological preparations of marine and freshwater deposits have strong potential for use in paleoenvironmental reconstructions but, like dinoflagellates, most cannot be linked unequivocally to their corresponding non-fossil motile stage. A separate taxonomy is needed for fossil ciliate remains and a corresponding formal nomenclature to track their occurrences. The ICZN explicitly prohibits separate names for different stages in the life cycle of a single organism. For nomenclatural purposes, we therefore place these fossils under the governance of the ICN (Head et al., 2026), which allows the names of fossil-species to coexist with those of their non-fossil equivalent stages using dual nomenclature. Accordingly, we have returned the ciliate fossil-genus *Halodinium* Bujak 1984 to the ICN and recommend the establishment of equivalent fossil-genera for the important non-fossil genera *Hexasterias* Cleve 1900 and *Radiosperma* Meunier 1910, which are now known to be ciliate cysts. The acritarch genus *Cyclopsiella* Drugg and Loeblich 1967 most likely represents ciliate resting cysts and extends to the Jurassic. We are progressing with the formulation of new ciliate fossil-taxa under the ICN.

Reference: Head, M.J., Mertens, K.N., Gurdebeke, P.R., David, O., de Vernal, A., García-Moreiras, I., Iratçabal, V., Limoges, A., Marret, F., Meyvisch, P., Penaud, A., Pospelova, V., Radi, T., Van Nieuwenhove, N., and Winifred, V.Y., 2026. Fossil remains of ciliates (phylum Ciliophora): a recommendation for their treatment under the International Code of Nomenclature for algae, fungi and plants. Marine Micropaleontology 204, 102557. https://doi.org/10.1016/j.marmicro.2026.102557

11. Morphology and new records of planktonic species of the dinoflagellate family Podolampadaceae (Dinoflagellata) from the Mexican Pacific Ocean: species of *Lissodinium* and *Mysticella*

David U. Hernández-Becerril[1]*, M. Consuelo Carbonell-Moore[2], Karina Esqueda-Lara[3]

*Presenting author: dhernand@cmarl.unam.mx

[1] Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Cd. Universitaria, Ciudad de México, México.
[2] Department of Botany and Plant Pathology, Oregon State University, College of Agricultural Sciences, Corvallis, Oregon, USA.
[3] Centro de Investigación sobre el Cambio Global, Universidad Nacional Autónoma de México, Villahermosa, México.

Keywords: *Morphology, New records, Phytoplankton, Scanning Electron Microscopy, Taxonomy*

Dinoflagellates are a diverse and important taxonomic group of the marine phytoplankton all over the world. Dinoflagellates of the family Podolampadaceae Lindemann refer to thecate peridinials in which the cingulum is not apparent but can be interpreted by their three cingular plates. Seven genera and 38 species are assigned to the family. Its members are exclusively marine and planktonic. This work is based on the analysis of phytoplankton net samples from a single oceanographic station, located off the port of Mazatlán, Sinaloa, in the Mexican Pacific Ocean. The specimens found were studied in light microscopy, but preferably in scanning electron microscopy (SEM), given that the morphological characters are inconspicuous and difficult to observe. Specimens of three *Lissodinium* species were detected: *Lissodinium taylorii*, *L. thomsonii*, *L. schilleri*, and one of *Mysticella*, *M. striata*. Except for the slight variations in shape and size of two species, all identified species fit well into the previous descriptions; *Lissodinium taylorii* was slightly smaller and *Mysticella striata* was slightly larger than previously reported. Relevant thecal plates were observed in all species, whereas morphological details of the apical pore complex, the sulcal area with its sulcal lists, the antapical pores and the theca ornamentation were additionally illustrated in most species. All the species found are new records, since only species of the genera *Blepharocysta* and *Podolampas* had previously been recognized within the family in the study area. Species of *Lissodinium* and *Mysticella* are claimed to be distributed in tropical to subtropical waters, in “relatively deep layers” (100-200 m depth) of the water column.

12. Palynological Digitalization and Machine-Assisted Dinoflagellate cyst Assemblage Counts: Possibilities, Limitations, and a Call for Community Discussion

Frida S. Hoem[1,2*], David Wade[3], Sissa Stefanowicz[3], Remco Bos[3] Kasia K. Sliwinska[4], Stijn De Schepper[1,2]

*Presenting author: Frida Snilstveit Hoem, Frida.hoem@uib.no

[1] Department of Earth Science, University of Bergen, Jahnebakken 5, 5007 Bergen, Norway
[2] Bjerknes Centre for Climate Research, Jahnebakken 5, 5007 Bergen, Norway
[3] Equinor ASA, Stavanger, Norway
[4]Geological Survey of Denmark and Greenland (GEUS), Copenhagen, Denmark

Keywords: Digitalization, machine learning, method, paleoceanography, North Atlantic.

Palynological digitalization and machine-assisted assemblage counting is beginning to break ground, yet its readiness for rigorous academic research remains largely untested. While machine learning tools for microfossil image classification have seen rapid development in applied and industrial settings, their validation for academic research remains limited. This study presents an ongoing assessment of machine-assisted palynological assemblage counting using SCAMPI (Species Classification Automation for Microfossil Photomicrograph Images), a content-based image retrieval (CBIR) system incorporating active learning, an intuitive user interface, and data export functionality (Wade et al., 2024).

As a means of ground-truthing the approach, approximately 40 palynological slides from previously studied International Ocean Discovery Program (ODP/IODP) sites and Norwegian industry wells are digitalized and reanalyzed. Case studies draw on datasets with well-established dinoflagellate cyst assemblage records: Oligocene/Miocene Southern Ocean ODP Site 1168 (Hoem et al., 2021) and mid-Pliocene North Atlantic sites; ODP Site 642 and IODP Site U1308 (de Schepper et al., 2017). By reanalyzing slides that have already been counted, this study aims to critically evaluate how machine-assisted methods compare with traditional palynological practice.

Early observations suggest great opportunities but also challenges. Digitalization and machine-assisted counting offers potential for increased efficiency, reproducibility, higher resolution work, and broader accessibility of archived material. The ability to revisit and recount existing collections without physical sample degradation is another notable advantage for academic research. At the same time, significant questions remain around species-level precision, the handling of rare, fragmented and poorly preserved taxa, and cost to benefit balance between computational resources and data/cloud storage.

Critically, our work does not suggest that palynologists will be replaced. On the contrary, it explores where machine assistance is genuinely useful, where human expertise remains indispensable, and what workflows best combine both. The outcome of this assessment is intended to provide realistic benchmarks for what palynological digitalization and machine-assisted assemblage counts can and cannot deliver in a research context. Digitalization is coming. The question is how we, as a community, choose to engage with it.

References:

Wade, D., Stefanowicz, S., Anthonissen, E. and Cullum, A. [2024] Species Classification Automation for Microfossil Photomicrograph Images (Scampi). 85th EAGE Conference & Exhibition, 2024(1) 1-5.
Hoem, F. S., Sauermilch, I., Hou, S. N., Brinkhuis, H., Sangiorgi, F., and Bijl, P. K.: Late Eocene-early Miocene evolution of the southern Australian subtropical front: a marine palynological approach, Journal of Micropalaeontology, 40, 175-193, 2021.
De Schepper, S., Beck, K. M., and Mangerud, G.: Late Neogene dinoflagellate cyst and acritarch biostratigraphy for Ocean Drilling Program Hole 642B, Norwegian Sea, Rev. Palaeobot. Palyno., 236, 12–32, https://doi.org/10.1016/j.revpalbo.2016.08.005, 2017

13. New marine palynological datasets used for detailed subsurface characterization of the Paleogene-Neogene of the Netherlands

Sander Houben[1] and Roel Verreussel[1]

[1]TNO – Geological Survey of the Netherlands, Utrecht, the Netherlands. Princetonlaan 6, 3584CB Utrecht

Within the Dutch national geological mapping program, there is a clear need to map and model the marine siliciclastic Paleogene–Neogene succession, which constitutes the upper ~1500 m of the subsurface of the Netherlands, in greater detail than has previously been achieved. This need is primarily driven by a shift in subsurface use: away from traditional hydrocarbon exploration, which typically bypassed these relatively “shallow” intervals, and towards geological characterization for geothermal energy production, energy storage, and aquifer storage for Carbon Capture and Storage (CCS). In response to this shift, two major developments have emerged. First, TNO-Geological Survey of the Netherlands (TNO-GSN) has initiated a systematic mapping program in which sequence-stratigraphic concepts take precedence over conventional lithostratigraphy. Second, a dedicated exploration campaign for geothermal energy potential (the SCAN program) has led to the drilling of nine new boreholes, accompanied by an extensive data acquisition program that includes substantial coring and state-of-the-art petrophysical logging.

These developments prompted us to initiate a dinoflagellate cyst-based stratigraphic study of the Dutch Paleogene–Neogene succession, addressing the Miocene – Lower Pleistocene in the greatest level of detail. This effort combines newly generated analyses with the integration and synchronization of extensive legacy datasets. Central in the present contribution are new palynological results from four recently drilled SCAN-program boreholes in the southern Netherlands. For these partly cored boreholes, we present quantitative palynological associations and dinocyst assemblage data that collectively provide insights into the paleoenvironmental evolution of the southern North Sea Basin from the Paleocene to the early Pleistocene. The resulting trends reveal several major sequence-stratigraphic bounding surfaces, that can be linked to regional tectonic processes, whereas others are evidently related to changes in climate and sea level. We also present a refined and practically applicable dinocyst zonation for the Paleocene to Early Pleistocene of the Netherlands.

14. Dinoflagellate cysts reveal Quaternary climatic variability in the Gulf of Corinth (NE Mediterranean Sea)

Eugenia Fatourou[1], Aikaterini Kafetzidou[1,2],Fabienne Marret[3], Olga Koukousioura[4,5], Konstantinos Panagiotopoulos[1,4], Patrick Grunert[4], Katerina Kouli[1,*]

*Presenting author: akouli@geol.uoa.gr

[1]National and Kapodistrian University of Athens, Natural Sciences, Geology and Geoenvironment, GREECE
[2]Globe Institute, University of Copenhagen, DENMARK
[3]School of Environmental Sciences, University of Liverpool, UK
[4]Institute of Geology and Mineralogy, University of Cologne, GERMANY
[5]School of Geology, Aristotle University of Thessaloniki, Thessaloniki, GREECE

Keywords: Dinoflagellate cysts, Gulf of Corinth, Mediterranean Sea, Quaternary

The Gulf of Corinth, in central Greece, is a semi-enclosed, active, young, rift basin that serves as an exceptional archive for studying Quaternary environmental and climatic variability. Due to its connection to the Mediterranean Sea through the shallow Rion sill (~ 62 meters depth), the basin is uniquely sensitive to eustatic sea-level fluctuations. This research presents a high-resolution paleoenvironmental reconstruction spanning the last 1.1 million years, focusing on the shifts between marine and isolated conditions during successive glacial-interglacial cycles. Palynological analysis reveals a diverse dinoflagellate cyst record consisting of more than 35 species, organized into two primary ecogroups, representing the alternation between marine and brackish conditions. These recorded shifts correlate closely with global Marine Isotope Stages and orbital-driven climate signals. Marine intervals, associated with interglacial highstands, are defined by high taxonomic diversity. Characteristic taxa include various members of the *Spiniferites* group, *Nematosphaeropsis labyrinthus*, *Operculodinium centrocarpum*, and *Lingulodinium machaerophorum* s.l. The presence of oceanic *Impagidinium* species is particularly significant, as it confirms clear communication with the open sea and high-saline conditions within the basin. Brackish intervals, corresponding to glacial lowstands, show a dramatic reduction in diversity and are dominated by low-salinity/brackish indicators. The most prominent species is *Spiniferites cruciformis*, which frequently appears in monospecific assemblages. Other characteristic brackish taxa include *Pyxidinopsis psilata*, *Caspidinium rugosum*, *Impagidinium caspienense*, and *L. machaerophorum* with short processes. These assemblages demonstrate strong affinities with the Ponto-Caspian region, specifically the Black, Marmara, and Caspian Seas. The integration of dinocyst data with other aquatic palynomorphs, such as freshwater green algae (*Botryococcus*, *Pediastrum*) and euglenid cysts (*Pseudoschizaea*), provides a comprehensive view of the basin's paleoceanographic evolution. These findings underscore the utility of organic-walled dinoflagellate cysts as a robust proxy for reconstructing the complex history of sea-surface salinity and temperature in shallow-sill connected Mediterranean basins. This study fills a critical gap in Eastern Mediterranean research, demonstrating the intricate interplay between eustatic sea-level fluctuations, and regional climate in shaping aquatic ecosystems.

15. Last century ecological shifts of coastal dinocysts communities in an anthropized estuary: the case of the Rance estuary, North Brittany, France

Vincent Iratçabal[1*], Clément Lambert[1], Aurélie Penaud[2], Gwendoline Grégoire[3, 4], Anne Murat[3, 4], Sabine Schmidt[5] & Evelyne Goubert[1]

*Presenting author: vincent.iratcabal@univ-ubs.fr

[1] Geo-Ocean, Univ Bretagne Sud, Univ Brest, CNRS, Ifremer, UMR6538, F-56000 Vannes, France
[2] Geo-Ocean, Univ Brest, CNRS, Ifremer, UMR6538, F-29280 Plouzane, France
[3] Conservatoire National des Arts et Métiers, Intechmer, Boulevard de Colignon, 50100 Cherbourg-en-Cotentin, France
[4] Université de Caen Normandie, Laboratoire Universitaire des Sciences Appliquées de Cherbourg,145 Chemin de la Crespinière, 50100 Cherbourg-en-Cotentin, France
[5] Univ. Bordeaux, CNRS, Bordeaux INP, UMR 5805, 33600 Pessac, France

Keywords: Dinocysts, Sediment core, Estuary, North Britanny, paleoecology

Over recent decades, dinoflagellate communities have undergone significant changes, resulting in the emergence of the toxic bloom-forming species *Alexandrium minutum* in Brittany, as observed along most European coastlines. Reconstructing the evolution of these communities requires, high-resolution studies of coastal and estuarine sediment cores.

This study focuses on the palynological analysis of two new sediment cores collected from the Rance estuary (UMR 5805 EPOC & Geo-Transfert, 2022), covering the past century. The Rance estuary is a 22 km-long inlet opening onto the English Channel, with a tidal range up to 13 m. Since the early 1900s, most of its already limited fluvial inputs have been cut off following the construction of the Châtelier Lock upstream. The estuary is also notable for hosting the world's first tidal power plant. Constructed between 1962 and 1966, it has since profoundly altered the hydrological regime, increasing the duration of high-water slack from minutes to several hours and raising the mean water level within the basin.

We use a multi-proxy approach combining sedimentological analyses (laser grain-size and calibrated XRF geochemical measurements) with palynological data (classical palynological protocol using cold HCl and HF, spiked with exotic markers). Palynomorphs identification were done by light microscopy at x400 with a focus on dinocysts, identified from genus to species level. The acquired dataset also involves non-exhaustive counts of ciliate cysts and green algae, as well as selected key pollen taxa. All those data are then compared to historical datasets ranging from meteorological data to river discharge and lands usages.

Over the last century, a marked ecological shift has been observed in the dinocyst community. The Rance estuary was initially dominated by heterotrophic dinocysts, followed by an increase in *Spiniferites* taxa in the 1960s. In the 1990s, the dinocyst assemblage was mainly composed of *Spiniferites* taxa and *Alexandrium* spp., wich accounted for up to 50 % of the community. These shifts in planktonic community structure reflect both macro-regional drivers (e.g., climate change and catchment-scale agricultural practices) and changes in the hydro-sedimentary functioning of the study site.

In this study, we demonstrate that high-resolution estuarine sediment cores allow the reconstruction of dinocyst community trajectories over the past century. Although the species involved differ, comparable trends are observed at other sites investigated at the regional scale. This study, together with others, will help improve our understanding of the driving forces behind these changes, the emergence of the toxic species *Alexandrium minutum,* and the relative contributions of anthropogenic and climatic forcing.

16. Holocene deglaciation of Radstock Bay: Palynological and Sedimentary records (Devon Island, Nunavut, Canada)

Maëla Le Ménec[13*], Jean-Carlos Montero-Serrano[12], Guillaume St-Onge[1], Aurélie Penaud[3],

*Presenting author: Maela.LeMenec@uqar.ca

[1] Institut des sciences de la mer (ISMER), Université du Québec à Rimouski (UQAR), Geotop & Québec-Océan, Rimouski, Québec, Canada
[2] The University of Tokyo, Atmosphere and Ocean Research Institute, Kashiwa, Japan
[3] Institut Universitaire Européen de la Mer (IUEM), Université de Bretagne Occidentale (UBO), Laboratory Geo-Ocean, Brest, France

Keywords: Arctic, Glacier, Sediment, Holocene, Dinocyst

The Devon Ice Cap (DIC), once part of the Innuitian Ice Sheet, experienced substantial deglaciation during the Early Holocene, driven by elevated boreal summer insolation and pronounced seasonal variability. As a result, the western region of Devon Island, including Radstock Bay, has remained ice-free since the mid-Holocene. In this study, we investigate the physical properties, elemental geochemistry, grain-size distribution, and mineralogical composition of dated sediment cores collected in Radstock Bay, together with bathymetric and elevation data from the region. The objective of this study is to document the response of the DIC to changing oceanic and climatic conditions since the last deglaciation, with particular attention to the opening of Lancaster Sound and the resulting isostatic rebound of Devon Island. To further strengthen our interpretations, we incorporated palynological analyses (dinocyst assemblages as well as foraminiferal linings, ciliate cysts, and pre-quaternary dinocyst concentrations) as corroborating proxies across the different lithofacies (2–3 palynological samples per lithofacies). The sedimentological results reveal three distinct lithofacies (LF) in Radstock Bay, reflecting variations in depositional processes throughout the Holocene. LF1 (Early Holocene) represents a proximal glacial environment dominated by meltwater discharge and exhibits the highest sedimentation rate in the core (72 cm kyr^{-1}). LF2 (Middle Holocene) is characterized by abundant concentrations of coarse ice-rafted debris (IRD) and a lower sedimentation rate (22 cm kyr^{-1}), suggesting proximity to a calving front that may have collapsed near the core location, as indicated by a sequence of moraines and abundant mega-scale glacial lineations. LF3 (Late Holocene) corresponds to glacier retreat towards the coast and is characterized by more homogeneous clay-rich deposits and a marked decrease in IRD content, followed by fluctuations in sea-ice cover reflected through variations in IRD abundances. Dinocyst assemblages display variations consistent with the sedimentological interpretations, notably with the dominance of Islandinium minutum and Brigantedinium spp., with additional contribution of Islandinium? cezare and Echinidinium karaense. Within LF2, we also identified a significant increase in Halodinium ciliate cysts and pre-Quaternary dinocysts, supporting our hypothesis of a major phase of erosion and fluvial discharge due to the melting of the glacier. Overall, the multiproxy approach used in this study improves our understanding of sedimentary processes and their evolution in the western sector of Devon Island since the last deglaciation and provides a well-preserved chronological record of glacier retreat over time.

17. A proposal towards a global dinocyst database for data assimilation and bridging observations and models

Fabienne Marret[1*], Anne de Vernal[2] et al.

*Presenting author: f.marret@liverpool.ac.uk

[1]Department of Geography and Planning, School of Environmental Sciences, University of Liverpool, Liverpool L69 7ZT, UK
[2] GEOTOP-UQAM, Montreal, Quebec, Canada

Keywords: Dinocyst biogeography, Surface assemblages, Sea-surface reconstruction, Proxy calibration, Data assimilation

The early 1970s saw the start of a new subject within the world of organic-walled dinoflagellate cysts (=dinocysts), with the first mapping of their distribution in surface sediments in the NW Atlantic Ocean (35 samples). Nowadays, studies of cyst occurrence in marine surface sediments worldwide have yielded around 4,190 assemblages, enabling not only the mapping of the biogeography of 91 taxa, but also the refinement of their ecological affinities. A few taxa are strictly cosmopolitan (*Brigantedinium* spp., *Operculodinium centrocarpum* sensu Wall and Dale 1966, *Spiniferites* species, *Lingulodinium machaerophorum*, *Nematosphaeropsis labyrinthus*, cyst of *Pentapharsodinium dalei*, and some *Impagidinium* species), only three are bipolar (*Islandinium minutum*, *Impagidinium pallidum*, *Polarella glacialis*) and very few are endemic or restricted to a small geographical range. Establishment of regional to hemispheric databases was necessary therefore in order to perform robust quantitative reconstructions of past sea-surface conditions.

The increasing size and spatial extent of these databases now allow their integration with numerical ocean–climate models through data assimilation approaches. This enables combining proxy-derived information with model outputs in order to better constrain environmental variables such as sea-surface temperature, salinity, sea-ice cover and productivity. Such integration relies on the establishment of quantitative relationships between cyst assemblages and environmental parameters, allowing dinocyst data to be used as indirect indicators within a coherent modelling framework. Application of these methods contributes to improving the spatial consistency of reconstructions, reducing uncertainties associated with individual proxies, and providing a more robust representation of past oceanographic conditions.

18. The impact of oxidation on freshwater cyst assemblages

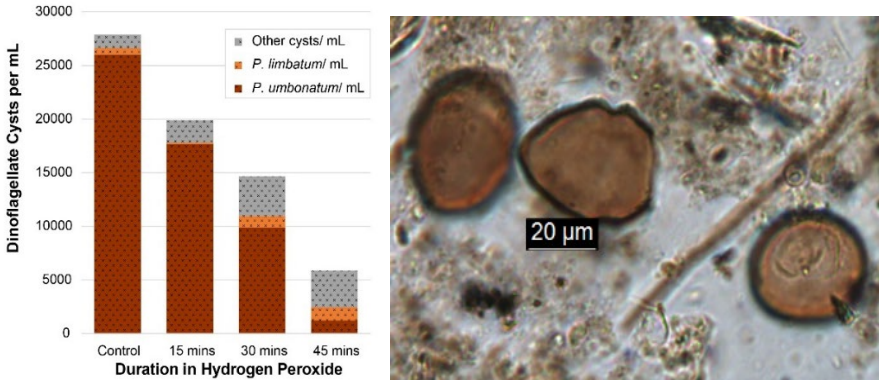
Francine M.G. McCarthy[1*], Andrea M. Krueger[1], Kenneth N. Mertens[2], Pjotr Meyvisch[3], Pieter R. Gurdebeke[4], Haifeng Gu[5], Donya C. Danesh[6], Brian F. Cumming[6]

*Presenting author: fmccarthy@brocku.ca

[1] Department of Earth Sciences, Brock University, St. Catharines, Ontario, Canada
[2] Station Ifremer de Concarneau - Place de la Croix - BP 40537 - 29185 Concarneau Cedex, France
[3] Johns Hopkins University – Morton K. Blaustein Department of Earth & Planetary Science – PaLEO lab, Baltimore, USA
[4] Department of Geology,Ghent University, Ghent, Belgium
[5] Third Institute of Oceanography China, Xiamen, China
[6] Department of Biology, Queen's University, Kingston, Ontario, Canada

Keywords: experimental oxidation, taphonomy, Parvodinium umbonatum, micro-FTIR

Water column-to-lakebed analysis of phycological and palynological assemblages of lakes in the Dorset region of central Ontario (Canada) illustrate the complex relationship between the abundance of motile dinoflagellate cells in the water column and their cyst record. Although it is not the most commonly sampled dinoflagellate taxon in plankton tows or sediment traps in Plastic Lake, distinctive cysts of *Parvodinium umbonatum* (F. Stein) Carty strongly dominate the cyst assemblage from the deep basin (Z_{max} ~16m) where hypolimnetic anoxia develops seasonally, with DO < 1 mg/L below ~12 m from mid-summer through fall turnover over more than 50 years of record. These cysts are rare or absent from palynological preparations of sediments from most lakes in this region of the Canadian Shield – including the larger, deeper Harp Lake, where this small dinoflagellate is an abundant component of the phytoplankton biomass. Water depth was the most important variable controlling the distribution of this cyst in the 32-lake dataset from the Experimental Lakes Area of NW Ontario. Cysts of *P. umbonatum* were greatly affected by 30% hydrogen peroxide (H_2O_2) in controlled laboratory settings prior to acetolysis-free maceration of surface Ekman grab samples from Plastic Lake, declining by nearly 1/3 from an estimated 26,000 to < 18,000 cysts/ ml wet sediment after 15 minutes exposure. After 45 minutes exposure, *Fusiperidinium wisconsinense* became the dominant identifiable cysts in a sparse (< 500 cysts/ ml), highly oxidized assemblage that resembles that of nearby Harp Lake. Laboratory oxidation had little impact on the *F. wisconsinense – Peridinium bipes/ Peridinium cinctum* cyst assemblage in sediments collected from 15.75 m in Harp Lake – the deepest that our 20m-long cable allowed – suggesting that it was oxidised *in situ*. Micro-FTIR analysis identified strong nitrogen bonds in the brown cyst walls of *P. umbonatum* which may contribute to its susceptibility to oxidation, as has been documented for the "round brown cysts" produced by heterotrophic marine protoperidinicaeans. This taphonomic skewing has obvious implications for the relating phycological and palynological datasets, but cyst assemblages can provide useful insights into variations in sedimentation rate and water depth in paleolimnological studies.



19. Dinoflagellate cysts of the Messinian Lago-Mare biofacies occurring offshore Nile Delta (Egypt): stratigraphic and ecological perspective

Elena Menichetti [1*], Gabriella Knezaurek [2], Andrea Piva[1], Stefano Torricelli[1]

*Presenting author: elena.menichetti@eni.com

[1] Eni S.p.A. Global Natural Resources, Via Emilia 1, 20097 San Donato Milanese, MI, Italy.
[2] Via Pescaria 37/D, 24123 Bergamo BG, Italy

Keywords: Messinian, Lago-Mare, Nile Delta, Dinoflagellate cysts

During the latest Miocene, the Mediterranean Sea underwent a profound paleoceanographic and paleoecological transformation as tectonic restriction of the Atlantic gateways progressively reduced water exchange with the global ocean. This process culminated in the Messinian Salinity Crisis (MSC), one of the most extreme environmental perturbations of the Neogene. Reduced inflow disrupted the hydrological balance between evaporation, precipitation and continental runoff. These produced oscillations in salinity, alternating phases of hypersaline conditions, causing the deposition of thick evaporitic sequences and intervals characterized by brackish to freshwater environments. Over the last decade, advances in integrated stratigraphy, astrochronology and basin-scale correlations have led to a robust chronostratigraphic framework for the MSC (e.g., Roveri et al. 2016), allowing high-resolution reconstruction of its depositional and paleoenvironmental evolution.

Within a seismo-stratigraphic investigation aimed at reconstructing the depositional architecture of the Messinian succession in the offshore Central Nile Delta (Egypt), sediments from the Abu Madi and Qawasim formations recovered from several HC exploration wells, were analyzed through an integrated biostratigraphic approach. The palynological assemblages document the presence of a Lago-Mare biofacies. The most frequent Paratethyan dinoflagellate cysts include *Impagidinium* (?) sp. 3 and *Impagidinium* (?) sp. 1, accompanied by specimens of *Spiniferites bentorii oblongus* and *Galeacysta etrusca* (e.g. Bertini 2006). These taxa are widely regarded as diagnostic of the Lago-Mare interval and reflect ecological conditions dominated by low-salinity, strongly fluctuating marginal-marine environments. Their occurrence tightly constrains the stratigraphic position of the upper Messinian deposits and significantly refines the sedimentological interpretation of the studied successions.

Palynology proves particularly effective in this context, where other marine biostratigraphic markers (nannofossils and foraminifera) are rare to absent. Nevertheless, uncertainties remain regarding the dispersal mechanisms that allowed Paratethyan taxa to colonize the Mediterranean, including possible episodic connections through the Balkans or Anatolian gateways and the role of large river systems in facilitating biotic exchange (Popescu et al. 2009; Grothe et al. 2016).

The ecological and hydrological conditions inferred from these assemblages can be further interpreted through comparison with modern dinoflagellate cyst associations showing morphological and ecological similarities to those observed in Lago-Mare deposits. Several Paratethyan taxa show affinities with cyst assemblages produced today by euryhaline dinoflagellates inhabiting restricted and brackish environments. Comparable communities occur in semi-isolated basins such as the Caspian Sea and the Black Sea, where dinoflagellate cyst assemblages are adapted to strong salinity gradients, significant freshwater input and stratified water columns. These analogies could give a significant insight into understanding the ecology of the final stages of the Messinian Salinity Crisis.

By documenting the presence of Paratethyan dinocysts in the offshore Nile Delta and in the Eastern Mediterranean, this study contributes to expand the knowledge of the geographic extent of Lago-Mare conditions and to a more comprehensive reconstruction of the paleogeographic and paleoenvironmental evolution of the Mediterranean–Paratethys system during the final stages of the Messinian Salinity Crisis.

Bertini A. 2006. The Northern Apennines palynological record as a contribute for the reconstruction of the Messinian palaeoenvironments. Sedimentary Geology 188–189, 235–258.
Grothe A., Sangiorgi F., Brinkhuis H., Stoica M., Krijgsman W. 2016. Migration of the dinoflagellate Galeacysta etrusca and its implications for the Messinian Salinity Crisis. Newsletters on Stratigraphy doi: 10.1127/nos/2016/0340.
Popescu S.-M., Dalesme F., Jouannic G., Escarguel G., Head M.J., Melinte-Dobrinescu M.C., Sütő-Szentai M., Bakrac K., Clauzon G., Suc J.-P. 2009. Galeacysta etrusca complex, dinoflagellate cyst marker of Paratethyan influxes into the Mediterranean Sea before and after the peak of the Messinian Salinity Crisis. Palynology 33, 105–134.
Roveri M., Gennari R., Lugli S., Manzi V., Minelli N., Reghizzi M., Riva A., Rossi M. E., Schreiber B. C. 2016. The Messinian salinity crisis: open problems and possible implications for Mediterranean petroleum systems. Petroleum Geoscience 22, 283–290. doi: 10.1144/petgeo2015-089.

20. Palynological study (dinocysts and pollen) at the mouth of the Loire: palaeohydrological and palaeolandscape dynamics over the last 2,500 years BP in western France

Aurélie Penaud[1*], Wiem Fersi[1], Matthieu Durand[2], Ophélie David[1,3], Kenneth Mertens[3], Frédérique Eynaud[4], Meryem Mojtahid[5]

*Presenting author: aurelie.penaud@univ-brest.fr

[1] Geo-Ocean, Univ Brest, CNRS, Ifremer, UMR6538, F-29280 Plouzane, France
[2] Cerema-Direction territorial ouest, Agence d'Angers, Groupe Géotechnique, Enrochements et Matériaux, 23 avenue de l'Amiral Chauvin, Les Ponts-de-Cé F-49130, France
[3] Ifremer, COAST, F-29900 Concarneau, France
[4] Laboratoire EPOC, Allée Geoffroy Saint Hilaire, Université de Bordeaux, FR-33615 PESSAC CEDEX, France
[5] Univ Angers, Univ Nantes, Univ Le Mans, CNRS, LPG, Laboratoire de Planétologie et Géosciences, UMR 6112, 2 Bd Lavoisier, 49045 Angers Cedex, France

Keywords: Loire River, fluvial discharge, paleolandscape, palynomorphs, Holocene

Core KV14-bis (5.4 m long, covering the last 2,500 years BP) was extracted in 2015 at the mouth of the Loire River (DYNSEDIM2015 campaign, Croisic trench) at a site directly influenced by the river's turbidity plumes, which in turn affect local hydro-sedimentary and ecological dynamics.
An initial multi-proxy approach (X-ray imaging, XRF and grain-size analyses, benthic foraminiferal assemblages) and a preliminary age model was proposed for this sedimentary sequence by Durand et al. (2018). Since the initial stratigraphy was established based on six radiocarbon dates (five of which were used for the age model; sedimentation rates ranging from 0.09 ± 0.03 to 0.35 ± 0.24 cm yr^{-1}), an additional 16 dates now allow us to establish a robust age model, enabling a high-resolution palynological analysis with an approximate resolution of ~50 years to investigate the palaeohydrological regimes of the Loire River (via dinocyst assemblages) and landscape dynamics within its catchment area (via pollen assemblages) during the Late Holocene.
The study by Durand et al. (2018) highlighted a succession of drier phases (indicated by low terrigenous inputs and higher calcimetry values) and wetter phases (indicated by high terrigenous inputs and higher organic matter content), linked to regional climatic control on a multi-century timescale, consistent with North Atlantic Oscillation (NAO)-type patterns, as well as a probable superimposed control by solar activity. In this study, we re-examine these temporal dynamics in light of the relative abundances and absolute concentrations of palynomorphs. We discuss multi-centennial paleohydrological dynamics under predominantly climatic forcing during the first half of the sequence, particularly through variations in the abundance of the dominant dinocyst taxon *Lingulodinium machaerophorum*. We then identify a major threshold at ~1.2 ka BP, which appears to coincide with a profound alteration in terrigenous and palaeoecological signals at the mouth of the Loire River. This threshold, corresponding to the early Middle Ages, appears to be linked to a period of maximum opening of anthropogenic landscapes and enhanced soil erosion (deforestation), likely resulting in increased primary productivity in coastal surface waters. Beyond this threshold, the signals indicate a substantially altered hydrological regime, in which the climatic signature can only be interpreted by accounting for human activities within the Loire catchment. This pattern closely mirrors findings from studies conducted further offshore, in the northern Bay of Biscay (Penaud et al., 2020), where a comparable major shift was documented in the sedimentary record of the Armorican Platform through palynological signals influenced by terrigenous inputs from the Loire.
Furthermore, a transparent cyst exhibiting polygonal folds has been observed in high concentrations since ~1.2 ka BP. Poorly described in the literature, this enigmatic cyst will be subjected to morphological and biomolecular analyses to determine its biological affinity. This observation also raises important questions regarding its origin and the environmental mechanisms controlling its proliferation in this antropogenically influenced system.

21. Decades of sediment trap research on dinoflagellate cysts: ecological and paleoenvironmental insights

Vera Pospelova*[1], Karin Zonneveld[2,3], Iria García-Moreiras[4,5], Manuel Bringue[6], Surya Eldo V. Roza[2], Kenneth N. Mertens[7]

*Presenting author: vpospe@umn.edu

[1]Department of Earth and Environmental Sciences, University of Minnesota, Minneapolis, MN, USA.
[2]MARUM–Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany.
[3]Department of Geosciences, University of Bremen, Bremen, Germany.
[4]Centro de Investigación Mariña (CIM), Universidade de Vigo, Geoma, University of Vigo, Vigo, Spain.
[5]Universidade de Vigo, Departamento de Bioloxía Vexetal e Ciencias do Solo, University of Vigo, Vigo, Spain.
[6]Natural Resources Canada, Geological Survey of Canada, Calgary, AB, Canada.
[7]Ifremer, COAST, Concarneau, France.

Keywords: sediment traps, dinoflagellates, cyst ecology, upwelling, paleoenvironmental proxy calibration

For several decades, extensive efforts have been dedicated to investigating dinoflagellates and their resting cysts through high-resolution sediment trap studies conducted in diverse marine environmental settings. These studies have produced a wealth of observational data, substantially improving our understanding of the ecological and biogeographical preferences of many dinoflagellate cyst species. Sediment trap records have provided the most comprehensive information on seasonal and interannual variations in cyst fluxes and assemblages across a range of environmental conditions and geographical locations. As a result, these datasets have become fundamental for determining the relationships between dinoflagellate cysts, water column processes, and environmental forcing.

In this presentation, we will address the strengths and limitations of sediment trap methodologies used in dinoflagellate cyst research. We will provide examples of how these studies have advanced our taxonomic research and present ample evidence for refining our understanding of the ecology of dinoflagellate cysts. The integration of seasonal and interannual observations has proven especially valuable for distinguishing short-term ecological variability from longer-term environmental trends.

Another major focus of this presentation will be the remarkable quality and applicability of dinoflagellate cyst percentage, concentration, and flux data for paleoenvironmental and paleoceanographic reconstructions. Since cyst assemblages often exhibit strong and quantifiable relationships with modern oceanographic conditions, they are highly sensitive proxies for reconstructing past marine environments. The talk will conclude with a discussion of the extent to which dinoflagellate cyst assemblages preserved in surface sediments reflect primary environmental signals from the overlying upper water masses. This synthesis will provide important perspectives on the reliability of dinoflagellate cysts as indicators of present and past marine environmental conditions.

22. Exploration of overlooked *Aduncodinium*-like (Pfiesteriaceae, Dinophyceae) diversity

Albert Reñé[1*], Aika Yamaguchi[2], Takeo Horiguchi[2], Kunihiko Watanabe[2], Mona Hoppenrath[3]

*Presenting author: albertrene@icm.csic.es

[1] Institut de Ciències del Mar (CSIC). Dpt. Biologia Marina i Oceanografia. Pg. Marítim de la Barceloneta, 37-49 08003 Barcelona, Catalonia (Spain)
[2] Department of Biological Sciences, Faculty of Science, Hokkaido University, Sapporo 060-0810 (Japan)
[3] Senckenberg am Meer, German Centre for Marine Biodiversity Research (DZMB), Südstrand 44, D – 26382 Wilhelmshaven (Germany)

Keywords: benthic dinoflagellates, Katodinium, morphology, rDNA, sand-dwelling

The dinoflagellate genus *Aduncodinium* was erected to encompass *Katodinium glandula*, belonging to the family Pfiesteriaceae. Other described species, like *K. asymmetricum*, show *Aduncodinium*-like characters and probably belong to this genus. These two species are commonly reported in the literature. However, detailed morphological characterization of observed specimens is rarely provided mostly due to difficulties in culturing and studying these thin-walled dinoflagellates. Likewise, molecular information for *Aduncodinium*-like species is scarce. In this study, we provide a morpho-molecular characterization of *Aduncodinium*-like morphospecies mostly detected in coastal sediments from Spain, Germany, Japan, and Canada. Surface eulittoral and sublittoral sediments were collected and processed with the seawater-ice method to recover sand-dwelling dinoflagellates. *Aduncodinium*-like specimens were documented, and their morphology and plate pattern were determined using light, epifluorescence or scanning electron microscopy. Ribosomal molecular sequences (SSU and LSU rDNA) were obtained from single-cell isolates, and phylogenetic analyses were performed. The information collected and the detections reported in the literature, mostly referring to *K. glandula* or *K. asymmetricum*, highlight the existence of a largely overlooked diversity of *Aduncodinium*-like taxa, and the existence of cryptic diversity in some morphospecies. In fact, up to 16 different morphospecies are reported in this study, some of them supported by their molecular information. Different morphogroups are recognized. Regarding the *A. (=K.) asymmetricum* morphogroup, the new data generated in this study suggests the existence of cryptic species. The information collected also results in the description of the new species *Aduncodinium robustum* sp. nov., belonging to the *A. glandula* morphogroup. Within the described diversity, mostly corresponding to sand-dwelling coastal dinoflagellates, some tabulation variability is observed, as recognized in other pfiesterians. In light of the used characters separating genera in the most closely related clades, it can be discussed whether the tabulation differences in the potential *Aduncodinium* species, including species still assigned to *Katodinium*, like *K. asymmetricum*, are species features or represent generic level traits.

23. Dinocysts among Dinosaurs: A palynological study from the Late Cretaceous Villaggio del Pescatore Konservat-Lagerstätte (Northeastern Italy)

Ruiu, E.[1*], Kustatscher, E.[2], Corradini, C.[3], Consorti, L.[4], Fanti, F.[5,6], Muscioni, M.[5,6], Arbulla, D.[7], Moggi Cecchi, V.[8], Di Michele, A.[1], Spina, A.[1]

*Presenting author: emanuele.ruiu@dottorandi.unipg.it

[1]Dipartimento di Fisica e Geologia, Università di Perugia, Via Pascoli, 06123 Perugia, Italy
[2]Department of Natural History, Collection and Research Centre (SFZ), Tirolean State 18 Museums, Hall in Tirol, Austria
[3]Dipartimento di Matematica, Informatica e Geoscienze, Università degli Studi di Trieste, Via Weiss 2, 34128 Trieste, Italy
[4]Istituto di Scienze Marine (CNR-ISMAR), Area Scienze Park, Basovizza, Trieste, Italy
[5]Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Alma Mater Studiorum 6 Università di Bologna, via Zamboni 67, 40126 Bologna, Italy
[6]Collezione di Geologia 'Museo Giovanni Capellini', Alma Mater Studiorum Università di 8 Bologna, via Zamboni 63, 40126 Bologna, Italy
[7]Museo Civico di Storia Naturale di Trieste, Conservatore Paleontologia, Via dei Tominz 4, 34139 Trieste, Italy
[8]Museo "La Specola", Sistema Museale di Ateneo, Università di Firenze, Via Romana, 50121 Firenze, Italy

Keywords: Late Cretaceous, Villaggio del Pescatore, Lagerstätte, dinocysts, palynology

Villaggio del Pescatore (VdP) site is one of the most exceptional Late Cretaceous fossil sites in Europe, preserving a diversified vertebrate assemblage, including multiple individuals of the hadrosauroid dinosaur *Tethyshadros insularis*, fishes, crocodilians, pterosaurs, and invertebrates. The fossiliferous beds record a transition from shallow marine to organic-rich marginal-marine environments. These sedimentary conditions favor the preservation of organic matter. The aim of this study is the description and the characterization of the dinoflagellate cysts from the VdP succession. Samples were prepared following the standard palynological methods and examined by transmitted light microscope; high resolution images of selected dinocysts were obtained by scanning electron microscopy. The dinocysts assemblage is characterized by heterotrophic peridinioid dinoflagellate cysts such as *Palaeoperidinium cretaceum*, *P. pyrophorum* and *Subtilisphaera* sp., and autotrophic gonyaulacoid such as *Coronifera oceanica*, *Cribroperidinium orthoceras*, *Oligospaheridium pulcherrimum* and *Spiniferites* spp. Ceratioid dinocysts, such as *Odontochitina operculata*, *Odontochitina* cf. *costata* and *Xenascus* sp., are particularly abundant. The record of marker palynomorphs, such as *Cribroperidinium cooksoniae* and *Cribroperidinium orthoceras*, supports a Late Cretaceous age of the site. We also computed the peridinioid/gonyaulacoid ratio (P/G): to quantify community structure. The prevalence of heterotrophic peridinioid dinocysts and the common occurrence of ceratioid dinocysts among gonyaulacoids is consistent with a highly productive, nearshore environment. These results, integrated with fluorescence of amorphous organic matter (AOM) observations, further constrain the palaeoenvironmental and palaeoclimatic conditions framework for the VdP *Fossil-Lagerstätte.*

24. Bloom-forming Karenia species in the Northern Indian Ocean: Diversity, toxicity, and historical trends in a changing environment

Maria Saburova*[1], Igor Polikarpov[1]

*Presenting author: msaburova@gmail.com

[1]Coastal and Marine Resources Program, Environment and Life Sciences Research Center, Kuwait Institute for Scientific Research, Kuwait

Keywords: Karenia, HABs, Northern Indian Ocean, Kuwait, Molecular phylogeny

The dinoflagellate genus *Karenia* is globally recognized for forming recurrent harmful algal blooms. Accurate identification within the kareniacean taxa is of high ecological and socio-economic importance, as many species produce potent toxins that impact coastal marine ecosystems worldwide. Despite their significance, species diversity within the genus has often been overlooked in regional phytoplankton surveys across the Northern Indian Ocean and its marginal seas. This is primarily due to the challenges of identifying small, unarmored dinoflagellates based solely on morphological similarity and a historical lack of regional molecular data. To resolve long-standing taxonomic uncertainties, ten clonal *Karenia* strains isolated from Kuwait's coastal waters were characterized using integrated light and fluorescence microscopy alongside LSU rDNA gene sequencing. The results confirmed the presence of *Karenia papilionacea* (seven strains, >99% similarity to type material) and *Karenia selliformis* (one strain, identical to the Australian holotype), while *Karenia brevis* was not identified. The Northern Indian Ocean, specifically the Persian/Arabian Gulf and the Arabian Sea, is facing a growing threat from *Karenia* species. A number of taxa have now become annual components of coastal phytoplankton communities, typically present at low background concentrations. However, significant *Karenia* blooms have occurred in 1992, 1999, 2009, 2017, and 2019–2025 along the Iranian, Kuwaiti, and Indian coasts. In the autumn of 1999, Kuwait Bay experienced a *Karenia selliformis* bloom, resulting in massive fish kill, the first such event recorded in the Persian Gulf waters. Additionally, toxic blooms of *Karenia mikimotoi* were reported along the western Indian coast off Cochin and Someshwar in 1992 and 2009. Since 2011, spring blooms of *K. papilionacea* and *K. selliformis* have been recurrently recorded along Kuwait's coast, contributing to the contamination of the marine environment with brevetoxins. Notably, a long-term increase in *K. papilionacea* biomass has been observed along the Kuwaiti coast. This trend is hypothesized to be driven by increased nutrient availability and altered nutrient ratios resulting from rapid human population growth and anthropogenic eutrophication. Integrating the molecular findings with long-term monitoring datasets allowed for the mapping of *Karenia* distribution and the identification of "environmental windows" – specific temperature, salinity, and nutrient thresholds – that can trigger bloom events. Future trends suggest that as eutrophication persists, the frequency and intensity of these blooms may increase. Characterizing the morphology, phylogeny, and ecology of these commonly occurring *Karenia* species is essential for enhancing early detection, risk assessment, and mitigation strategies for HABs.

25. Hidden diversity behind a well-known dinoflagellate name: Resolving boundaries in the *Prorocentrum micans* species complex using transcriptomics

Maria Sachs[1*], Urban Tillmann[2], Natalia V. Annenkova[3], Marc Gottschling[4], Cecilia Satta[5] and Mona Hoppenrath[1]

*Presenting author: maria.sachs@senckenberg.com

[1] Senckenberg am Meer, German Centre for Marine Biodiversity Research (DZMB), Wilhelmshaven, Germany
[2] Alfred Wegener Institut, Helmholz-Center for Polar and Marine Research, Bremerhaven, Germany
[3] Institute of Cytology of Russian Academy of Sciences, St. Petersburg, Russia
[4] Faculty of Biology – Systematics, Biodiversity and Evolution of Plants, GeoBio-Center, Ludwig-Maximilians-University, Munich,Germany
[5] Agenzia Regionale per la Ricerca in Agricoltura (Agris), Sassari, Sardegna, Italy

Keywords: delimitation; epitypification; morphology; Prorocentrales; taxonomy

Speciation in microbial eukaryotes remains poorly understood, particularly in the systems influenced by environmental gradients such as salinity. In *Prorocentrum*, closely related species often show only subtle morphological differences, and commonly used molecular markers sometimes provide limited taxonomic resolution. This is particularly evident in the *Prorocentrum micans* species complex. Building on the recent epitypification of *P. micans*, this study aims to clarify the taxonomic status of closely related taxa. One such case is *Prorocentrum viride*, a species originally described from the Baltic Sea by Ch.G. Ehrenberg almost two centuries ago, but remaining taxonomically ambiguous due to an incomplete description and poorly informative type material. Integrative approaches, including phylotranscriptomic analyses, were used to evaluate whether robust species delimitation can be achieved within this complex. New strains corresponding to *P. viride* were isolated from its type locality near Wismar (Baltic Sea) and detailed morphological and morphometric analyses were performed, including examination of the periflagellar platelets. Molecular characterisation was conducted using ribosomal RNA markers and transcriptome-based multigene phylogenies comprising 109 genes.
Morphological analyses revealed consistent differences in terms of e.g., length to width ratio and posterior angle (cell shape) between *P. viride* and the closely related and co-occurring *P. micans*. However, ribosomal RNA markers did not clearly resolve the relationship between the two taxa. In contrast, transcriptome-based analyses provided robust phylogenetic support for their separation as distinct lineages. Based on these results, including a morphology consistent with the protologue, *P. viride* will be epitypified, enabling the unambiguous application of the name.
These findings highlight how genome-scale data can help to recognize and interpret subtle but consistent morphological differences improving species delimitation in protists and provide new insights into the processes underlying biodiversity and speciation. Ongoing work extends this framework to additional taxa, and environmental gradients, with the aim of understanding how ecological factors, particularly salinity gradients, contribute to diversification and speciation in dinoflagellates.

26. The overlooked bottleneck in digital dinoflagellate cyst analysis: slide preparation

Kasia K. Śliwińska[1*], Julie Fredborg[2], Lorenzo Edoardo Monetti[3], Tirza Maria Weitkamp[4]

*Presenting author: kksl@geus.dk

[1] Geological Survey of Denmark and Greenland (GEUS), Copenhagen, Denmark.
[2] Department of Geosciences and Natural Resource Management, Copenhagen University, Copenhagen Denmark
[3] Università degli Studi di Milano, Department of Earth Science, Milano, Italy
[4] Department of Geological Sciences, Stockholm University, Stockholm, Sweden

Keywords: Dinoflagellate cysts, Digitization, FAIR principles, Palynology, Slide preparation

Traditional palynological workflows rely on acid digestion, palynomorph concentration, slide mounting, and manual identification under transmitted-light microscopy within a loosely defined counting area. Although this approach has been groundwork for palynology and palynofacies studies, it introduces subjectivity related to analyst experience, counting strategy, and the treatment of non-discrete organic particles such as amorphous organic matter and phytoclasts.

Recent advances in artificial intelligence promise to transform palynology through automated identification of palynomorphs, including dinoflagellate cysts. This study assessed how slide preparation affects digital palynological analysis using more than 100 whole-slide images of digitized palynological slides. Annotation on digital images within clearly marked counting areas allowed for iterative revision of particle identifications without repeating the counting process.

Organic sedimentary particles, including dinoflagellate cysts and palynofacies components, were examined to assess the image quality of the entire slide as well as the difficulty of palynomorph identification.
The results show that overlapping particles, thick aggregates, and the presence of non-discrete organic matter reduce the quality of digital slides. Coverslip size also affects the scanning process. In traditional microscopy, all these issues can often be partly compensated for through analyst expertise and time investment. In the digitization process, however, they become major constraints. This study reveals that slide processing is a critical but overlooked bottleneck in current AI-driven approaches.

In conclusion, making palynological slides more suitable for digitization requires rethinking slide preparation and analytical workflows rather than directly transferring traditional microscopy practices. Addressing these constraints is important for producing robust, comparable, and FAIR-compliant dinoflagellate cyst datasets as well as for unlocking the full potential of digital palynology.

27. Identifying and naming non-pollen palynomorphs: reflections and perspectives

Lyudmila Shumilovskikh, on behalf of the co-authors

Dep. Palynology and Climate Dynamics, Albrecht-von-Haller Institute for Plant Sciences, University of Göttingen, Untere Karspüle 2, 37073 Göttingen, Germany; shumilovskikh@gmail.com

Palynological slide preparations usually contain numerous remains of fungi, algae, plants, and animals. Even experienced palynologists may struggle to identify palynomorphs and determine how they should be labelled in a way that ensures clarity and comparability across studies. During the 10th NPP Workshop in Göttingen (Germany) in 2025, we initiated a discussion on this issue, which led to the present paper.

We synthesise existing approaches to the study of NPPs, with particular emphasis on their definition, identification, and nomenclature. We demonstrate a conceptual broadening of the term “non-pollen palynomorphs”, which has direct consequences for both identification and naming practices. We consider NPPs in pollen slides as morphological entities (morphs), defined here as the specific morphological characteristics of a palynomorph that have undergone fossilisation and/or laboratory treatment. By combining existing morph-based frameworks (e.g. dinocysts, pollen, chironomids, and the NPP type-number approach), we propose a hybrid system for the study of NPPs. This system relies primarily on NPP morphology and can be independent of taxon and life stage, while incorporating relationships between NPP morphotypes and biological taxa whenever possible. The proposed conceptual framework and practical recommendations should reduce ambiguity in nomenclature and facilitate the harmonisation of NPP data across studies and palaeoecological databases. Overall, it is intended as a starting point for broader discussion within the community.

28. Ocean–Cryosphere Variability during the late Pleistocene interglacials: a palynomorph Record from Baffin Bay (offshore NW Greenland)

Maythira Sriwichai[1*], Mei Nelissen[1,2], Francesca Sangiorgi[1] and the IODP Expedition 400 science team

*Presenting author: m.sriwichai@uu.nl

[1] Department of Earth Sciences, Faculty of Geosciences, Utrecht University, Utrecht, Netherlands
[2] NIOZ Royal Netherlands Institute of Sea Research, Texel, the Netherlands

Keywords: Dinoflagellate cyst, late Pleistocene, interglacials, Baffin Bay, Northwest Greenland

Polar ice sheets and sea ice play a central role in regulating global climate and sea-level change. Due to a combination of ocean and atmospheric warming, the polar cryosphere is currently undergoing rapid transformation with ice sheets losing mass at an accelerating rate. By 2025, global atmospheric temperatures have reached approximately 1.5 °C above pre-industrial levels, with polar amplification driving disproportionately rapid warming in high-latitude regions, particularly in the Arctic. However, substantial uncertainties remain regarding the response of the Greenland Ice Sheet (GrIS) to continued warming.
The continental-scale GrIS developed around 2.6 Ma, during the earliest Pleistocene, and its present state was achieved through repeated glacial-interglacial cycles.

Here, we present preliminary results from marine sedimentary records recovered from the Baffin Bay, offshore the northwestern Greenland margin, during IODP Expedition 400. The marine sedimentary record from Site U1604 cover multiple late Pleistocene glacial-interglacial cycles and provide a valuable archive for investigating the dynamics of the GrIS and stability in relation to changing sea-surface condition, particularly during the warmer-than-present periods.

We use marine palynology (e.g. dinoflagellate cysts, aquatic algal remains, acritarchs) to reconstruct sea surface properties, including temperature, sea-ice presence, nutrient availability, meltwater input and water-column stratification in sediments covering the late Pleistocene (approximately latest 600,000 years).

Our results show the occurrence of reworked cysts and/or barren samples in the intervals corresponding to the glacial periods, a decrease in *in situ* dinocyst concentration toward the upper part of the record, and a shift in the dominant species from *Brigantedinium* spp. in the older sediments to cysts of *Protoceratium reticulatum* in the younger sediments. However, distinct variations in surface ocean condition are observed during “super-interglacials” of Marine Isotope Stage 11 (~ 400 ka) and Marine Isotope Stage 5 (~125 ka) that are known to be warmer than the present day.

During MIS11, the dinoflagellate assemblage is characterized by *Brigantedinium* spp. *and Impagidinium pallidum*, indicating high surface-water productivity, likely linked to increased nutrient availability associated with sea-ice (melt). In contrast, cysts of *Protoceratium reticulatum*, *Nematosphaeropsis labyrinthus* and *Spiniferites elongatus* possibly reflect (seasonally) warmer sea-surface temperature during peak warmth of MIS5. Enhanced meltwater input during this interval is supported the occurrence of *Cymatiosphaera*. Notably, the dinoflagellate cyst assemblages during MIS5 closely resemble modern assemblages as derived from surface sediments, suggesting that these past intervals may serve as analogues for present-day conditions.

29. How 18 years of dinoflagellate cyst export production in the upwelling of Cape Blanc is reflected in sediments.

Gerard Versteegh[2*], Surya Eldo Roza[2], Jasmin Kirchner[1,3], Karin Zonneveld[1,2]

*Presenting author: gjm.versteegh@gmail.com

1. Department of Geosciences, University of Bremen, Bremen, Germany
2. MARUM - Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany
3. Marine Environmental Sciences, Carl von Ossietzky University Oldenburg, Oldenburg, Germany

Keywords: Cyst export production, environmental reconstruction, transport, selective preservation, sediment traps

Fossil dinoflagellate cysts assemblages stored in marine archives have proved to be excellent tools to reconstruct past changes in climate as well as oceanographic and environmental conditions. Over the years these reconstructions have faced a strong improvement in quality as a wealth of information became available about the ecology of dinoflagellate cyst species.
However, it is already for a long time being discussed to what extend the sedimentary signal represents a local signal of upper waters above the deposition site and to what extend it might reflect a more regional or extraregional signal. Furthermore, there is a long time discussion about to what extend the primary export flux signal might be altered by post-depositional processes such as post depositional aerobic species selective degradation of cysts.

In this study we obtain insight into these processes by comparing the dinoflagellate cyst export flux of 18 years (June 2003 - March 2020) collected by sediment traps located in the upwelling area off Cape Blanc to the fossilised cyst association in a well ^{210}PB dated sediment archive collected at the trap location.

To obtain insight into to what extend these processes of cyst transport and selective preservation alter the cyst association during the sinking process in the water column we compared for the time interval between January 2017 - March 2020 the export flux collected by traps from the same morning site at ~1249 and ~ 2700 m water depths. At the mooring location the deeper trap is positioned in the upper part of an permanent existing bottom nepheloid layer.

Within this presentation we will show in how far changes in local upper water environmentally steered changes in cyst export flux are being preserved in the sediments. We will elucidate to what extend the primary export flux signal is altered by processes of lateral transport of allochthonous cysts by bottom-water nepheloid layers as well as species selective aerobic degradation. Furthermore we will provide insight into what part of the upper water export flux dynamics are being archived in the sediments.

30. Succession of dinoflagellate cyst export production in an offshore drifting upwelling filament: insight into encystment succession, excystment, sinking rate and lateral transport.

Karin Zonneveld[1, 2*], Nicole Kniebel[2] , Gerard Versteegh[2]

*Presenting author: kzonneveld@marum.de

1. Department of Geosciences, University of Bremen, Bremen, Germany
2. MARUM - Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany

Keywords: Cyst export production succession, sinking rate, lateral transport, encystment, excystment, dormancy period.

It is well known that dinoflagellate cysts can form a seedbank in sediments from which the upper water motile population can be renewed. Although this seems a logical life-strategy in shelf regions and shallow seas, there is an ongoing discussion about cyst production in the pelagic ocean. For cysts produced in the open ocean, information is largely lacking about e.g. the presence and duration of a dormant period, sinking rates as well as dispersal by ocean currents of living cysts and empty cysts. Such information is of major importance for the study of dinoflagellate bloom dynamics in open oceanic environments as well as for palaeo-environmental studies that use fossil cyst associations in sediment archives to reconstruct past changes in oceanic environment, current systems and climate.

In this study we present the results of an unique drifting trap survey in the upwelling area off Cape Blanc (NW Africa) that provide insight into open oceanic cyst production, encystment and vertical and lateral dispersion of cysts in the upper water column. This region is characterised by permanent upwelling located at a small band along the outer shelf break about 60km offshore. Here deep relatively cold nutrient rich water is upwelled into the photic zone. The freshly upwelled nutrient rich water is successively transported offshore in the form of large filaments.

At times of maximal upwelling in February 2025, we placed a drifting trap mooring with traps positioned at 100m, 200m and 400m water depth at the outer rim of a recently developed active upwelling cell. Traps were recovered every 24 hours to be replaced immediately at the recovery site. During the experiment of 12 days duration, the trap drifted offshore within a major offshore drifting upwelling filament.

By studying the cyst association change over this period we could observe a clear succession of cysts species produced in the active upwelling cells where upper waters were characterised by high turbulence, towards towards the increasingly stratified conditions at the more distal part of the filament. Whereas cyst export production in the active upwelling was relatively low flux rates were about 400x higher at the more distal part of the filament suggesting that light limitation in the active upwelling cell limited cyst production.
By comparing the association composition of cyst trapped at the different collection depths information could be obtained about the cyst sinking speed of cysts in this open oceanic environment.
We observed considerable amounts of allochthone cyst species in the deepest trap at the start of the experiment when this trap was positioned within the influence of the bottom nepheloid layer. This suggests that in the area, considerable lateral transport of cysts from the shelf into the deep ocean within the bottom nepheloid layer is taking place.
By comparing the relationship between cyst with and without cell contend it became clear that hatching depth of cysts is species dependent although the majority of the cysts hatched above 400m water depth.

With this study we provide new insight into the cyst export production, excystment, sinking characteristics and dispersion dynamics of cysts in an open oceanic high productivity setting.

Poster Presentations:

P-1. Impact of coastal sediment environmental changes on harmful algal species with implications for bivalve populations in Eastern Canada

Raphaël Gagné[1, 2*], Émilie Saulnier-Talbot[1, 2], Roger C. Levesque[1], André Rochon[2, 3]

[*]Presenting author: raphael.gagne.7@ulaval.ca

[1] Institut de biologie intégrative et des systèmes, Université Laval, Québec, Canada
[2] Regroupement stratégique Québec-Océan, Université Laval, Québec, Canada
[3] Institut des sciences de la mer, Université du Québec à Rimouski, Rimouski, Canada

Keywords: climate change, harmful algal blooms, eDNA, dinoflagellates, diatoms

Seafood poisoning is a significant public health concern, primarily occurring when individuals consume bivalves or other marine organisms contaminated with phycotoxins. These toxins are produced by marine phytoplankton, including many dinoflagellate and diatom species. When present in the environment, these toxins accumulate in the tissues of filter-feeding bivalves, rendering them unfit for human consumption. Across Eastern Canada, from the temperate waters of Prince Edward Island to the Arctic waters of Baffin Island, coastal populations regularly harvest and consume shellfish, thereby increasing their potential dietary exposure. Climate change is driving more frequent and geographically extensive harmful algal blooms (HABs), amplifying the risk to coastal communities. To mitigate these risks, it is essential to assess the specific environmental variables that drive the development, survival, and proliferation of harmful algal species. This research project aims to understand how environmental changes influence the frequency and extent of HAB episodes across a broad latitudinal gradient in Eastern Canada. Specifically, we investigate how surface sediment characteristics, such as temperature, dissolved oxygen, organic carbon content, and chlorophyll *a*, influence the distribution of harmful algal species. To achieve this, surface sediment samples will be collected from coastal environments where mariculture and wild shellfish harvesting are actively practiced from the Gulf of St. Lawrence to Baffin Bay. To study the diatom and dinoflagellate communities, we employ a dual-methodological approach, integrating traditional taxonomic identification via microscopy with environmental DNA analysis. This combined approach enables higher-resolution detection of harmful algal species, including those that may be overlooked by either approach taken alone. By characterizing the relationship between environmental proxies and microalgal biodiversity, this study provides critical insights into the future trajectories of HABs in a warming climate, offering essential data for the sustainable management of coastal resources and the protection of public health.

P-2. A Comparison of Palynomorph Assemblages Processed using Two Different Methods: Preliminary Results

Kristina Gardner[1*] and Diana Carriker[1]

*Presenting author: Kgardner@usgs.gov

[1] US Geological Survey, Florence Bascom Geoscience Center, Reston VA, USA

Keywords: *Micropaleontology, laboratory methods, processing techniques, palynomorphs*

Techniques used for the concentration of fossil palynomorphs vary between laboratories. Hydrochloric acid is commonly used for the digestion of carbonates, followed by hydrofluoric acid for the removal of silicate material. Other techniques rely on manual disaggregation of fine sediments via agitation in a deflocculant solution, and removal of heavy minerals via sieving, swirling, and/or heavy density liquid separation. Acid-free processing is a safer and more cost-effective methodology. This study aims to 1) outline the process of acid-free sample processing for dinocysts and other palynomorphs; 2) determine if, and to what extent, assemblage recovery and specimen preservation are impacted by the use of techniques involving strong acids compared to an acid-free methodology; 3) observe which lithologies are more suitable for each method; and 4) determine what impact age has on recovery with differing methods.

Samples with varying lithologies, including chalk, clean sands, and silty to sandy core and outcrop material ranging from Late Cretaceous to Recent in age, were processed. Depositional environments of the processed samples range from terrestrial to marine. Sample locations include the Sandtown core from Delaware and Bureau of Ocean Energy Management core 46 from South Carolina in the Mid-Atlantic Coastal Plain, Integrated Ocean Drilling Program Leg 342 Site 1408 from the North Atlantic Ocean, Schneider #7 core from Texas in the Gulf Coast, and outcrops from Tres Pinos and English Ridge in California and Blue Road in Utah. Paired samples were processed in separate laboratories, spiked with the same batch of *Lycopodium* tracer prior to processing as a control for final palynomorph concentrations; none underwent acetolysis. Samples processed using acid-free methods were swirled to manually remove sands. All samples were treated with potassium hydroxide, and hydrous sodium poly-tungstate was used as a heavy density medium. Recovered microfossils include plant and fungal spores, pollen, foraminiferal tests and linings, calcareous nannoplankton, and dinoflagellate cysts. Preliminary analysis shows that acid-free processing preserves a greater variety of microfossil groups and may improve the preservation of large, thin-walled palynomorphs.

P-3. Reconstructing Turonian–Santonian Paleoceanography on the Agulhas Plateau (Site U1580) using marine and terrestrial palynology and the TEX_{86} paleothermometer.

Mariëlle Greup[1], Henk Brinkhuis[1,2], Bas van de Schootbrugge[1], Peter K. Bijl*[1]

*Presenting author: Peter K. Bijl (p.k.bijl@uu.nl)

[1] Department of Earth Sciences, Marine Palynology and Paleoceanography, Laboratory of Palaeobotany and Palynology, Faculty of Geosciences, Utrecht University, 3584 CB Utrecht, The Netherlands
[2] Department of Ocean Systems (OCS), NIOZ Royal Netherlands Institute for Sea Research, PO Box 1790 AB Den Burg, Texel, The Netherlands.

Keywords: *Late Cretaceous, Algulhas Plateau, organic-walled dinoflagellate cysts, TEX86*

Abstract:
The Agulhas Plateau, part of the Agulhas Large Igneous Province, formed during the opening of the South Atlantic Gateway and may have influenced Southern Ocean–South Atlantic connectivity through changes in bathymetry and possible episodes of subaerial exposure. Until recently, reconstructing the bathymetric and oceanographic history of the Agulhas Plateau was problematic, but IODP Expedition 392 recovered well-preserved Late Cretaceous sediments and basement basalts enabling such investigations in detail for the first time.

We reconstructed Turonian–Santonian (~93–83 Ma) paleoceanography on the Agulhas Plateau (Site U1580) by integrating marine palynological data with mixed-layer temperature (MLT) estimates from lipid biomarkers employing TEX_{86} paleothermometry. The exceptional preservation of diverse dinoflagellate cysts and miospore assemblages enabled the first reconstructions of concomitant terrestrial and oceanographic changes, including subaerial exposure history of the newly formed Plateau. In addition, a quantification of the palynomorph maturity index allowed us to evaluate thermal maturity of organic matter from sill intrusion.

Our results show generally high MLT values, consistent with that found elsewhere in the Southern Ocean for this time interval. Variations in dinocyst species composition reflects changing paleoenvironmental conditions, while miospore abundance and composition suggest fluctuating terrestrial input, terrestrial ecosystem changes including recurring subaerial exposure of the plateau. Our results reveal a complex subsidence and formation history of the Agulhas Plateau that includes phases of renewed uplift from sill intrusions, which penetrated organic-rich Cenomanian-Turonian sediments. Together our results paint a holistic and exciting picture of the history of the formation of the Agulhas Plateau and its oceanographic consequences.

P-4. Dinocysts as tracer of climate and environment at the North Sea-Atlantic gateway during the past 14,000 years

Cecile Hilgen[1*], Rick Hennekam[2], Marcel T.J. van der Meer[3], Gert-Jan Reichart[1,2], and Francesca Sangiorgi[1]

*Presenting author: c.s.hilgen@uu.nl

[1] Department of Earth Sciences, Utrecht University, the Netherlands.
[2] Department of Ocean Systems, NIOZ Royal Netherlands Institute for Sea Research
[3] Department of Marine Microbiology and Biogeochemistry, NIOZ Royal Netherlands Institute for Sea Research

Keywords: *Norwegian Trench, Younger Dryas, Holocene, dinocysts, primary productivity*

The Norwegian Trench (NT) is the main gateway through which North Sea water flow into the Atlantic Ocean and for Atlantic Waters to flow into the North Sea. Along the NT, outflowing North Sea surface waters are generally cold, fresher (due to Baltic water contribution), and rich in nutrients, while inflowing Atlantic waters are generally warmer and more oligotrophic. Due to nutrient-rich waters and high primary productivity, the North Sea is at present an important basin for carbon burial. Sediments deposited in the NT have recorded how water exchange, nutrient, marine primary productivity and carbon burial have varied through time in response to climatic and oceanographic changes.

The aim of this study is to reconstruct North Sea environmental and oceanographic changes and carbon burial dynamics over the past ~14,000 years using sediment cores (multi-core and piston core; 61.6 °N, 3.0 °E) collected in the NT. Dinoflagellate cyst assemblages are used to reconstruct paleoceanographic conditions and marine primary productivity, while carbon burial rates provide insight into the long-term preservation of organic carbon in the sediment record.

Results show that during the Younger Dryas (~ 12,500 – 11,500 years BP), high carbon burial rates coincide with cold, nutrient-rich conditions, reflected by assemblages dominated by heterotrophic taxa such as *Islandinium minutum*. In the early Holocene (~ 11,500 – 7,000 years BP), increasing abundances of *Spiniferites mirabilis* indicate warming, while *Nematosphaeropsis labyrinthus* suggests enhanced Atlantic water influence. At the same time, carbon burial rates decreased, likely due to reduced sediment accumulation rates during postglacial marine transgression. During the latest Holocene (~ 3,000 years BP – present-day), increased fluxes of heterotrophic taxa, including *Protoperidinium americanum*, together with higher carbon burial rates, point to enhanced marine primary productivity. This increase may be linked to higher nutrient supply, potentially influenced by anthropogenic driven land-use changes in the surrounding coastal areas.

P-5. Millennial-timescale East Antarctic Ice Sheet variability and recurrent seafloor oxidation during the Miocene Climatic Optimum offshore Prydz Bay

Suning Hou[1*], Julianne Burns[2], Klaas Nierop[3], Jared Nirenberg[4], Gijs Leenarts[1], Denise Kulhanek[5], Rosannah S. van Halsema[1], Timothy Herbert[4], Trevor Williams[6], Robert McKay[2], Francien Peterse[1], Peter K. Bijl[1], Francesca Sangiorgi[1]

*Presenting author: s.hou@uu.nl

[1] Department of Earth Sciences, Utrecht University, the Netherlands
[2] Geolab, Utrecht University, the Netherlands
[3] Victoria University of Wellington, New Zealand
[4] Brown University, USA
[5] Kiel University, Germany
[6] University of South Florida, USA

Keywords: *dinocyst, biomarker, oxidation, Antarctica, Miocene*

The Amery Ice Shelf, the third largest ice shelf at the head of Prydz Bay, and one of the four regions where Antarctic Deep Waters form, is reported as one of the most stable portions of the East Antarctic Ice Sheet (EAIS). Yet, its response to future warming remains uncertain. The Miocene Climatic Optimum (MCO, ~17–15 million years ago) is the warmest period of the past 23 million years, with global temperatures 3–8°C above modern and pCO_2 of 400–600 ppm, similar to end-century projections. It therefore provides a valuable opportunity to investigate EAIS stability under warm conditions. Here, we present a combined lipid biomarker, palynology and XRF record from ODP Site 1165, offshore Prydz Bay, spanning ~16.3-16 Ma at an unprecedented millennial-scale resolution, crucial for understanding the near-future EAIS conditions in a warmer world. Interestingly, the record shows recurrent pulse-like intense organic matter oxidation events associated with elevated proportions of reworked and oxidation-resistant *in situ* dinoflagellate cysts as well as ice-rafted debris (IRD). IRD presence in this record was previously interpreted as evidence for deglaciation. However, deglaciation, meltwater and subsequent stratification are somewhat in contrast with seafloor oxidation. Oxidation events at the seafloor may rather be linked to oxygen-rich deepwater associated with EAIS and sea ice dynamics at location, or other processes we are investigating. Excluding the interval where organic matter oxidation is recorded, the remaining record indicates relatively stable seawater conditions. Specifically, regarding sea water temperature (SST) based on glycerol dialkyl glycerol tetraethers (GDGTs)-based SST proxy (TEX_{86}) and alkenone-based SST proxy both suggest SSTs around 9-16°C, although hydroxylated-GDGTs suggest much lower SSTs around 4-9°C. Furthermore, the occurrence of plant-derived fatty acids and pollen-spore assemblages indicate a sustained woody-tundra vegetation and an intensified hydrological cycle on the hinterland than modern throughout the record.

P-6. Spatial distribution of modern dinocyst assemblages in two western France estuaries: a North (Rance) – South (Gulf of Morbihan) comparison in Brittany

Vincent Iratçabal[1*], Clément Lambert[1], Aurélie Penaud[2], Gwendoline Grégoire[3, 4], Anne Murat[3, 4], Sabine Schmidt[5] & Evelyne Goubert[1]

*Presenting author: vincent.iratcabal@univ-ubs.fr

[1] Geo-Ocean, Univ Bretagne Sud, Univ Brest, CNRS, Ifremer, UMR6538, F-56000 Vannes, France
[2] Geo-Ocean, Univ Brest, CNRS, Ifremer, UMR6538, F-29280 Plouzane, France
[3] Conservatoire National des Arts et Métiers, Intechmer, Boulevard de Colignon, 50100 Cherbourg-en-Cotentin, France
[4] Université de Caen Normandie, Laboratoire Universitaire des Sciences Appliquées de Cherbourg,145 Chemin de la Crespinière, 50100 Cherbourg-en-Cotentin, France
[5] Univ. Bordeaux, CNRS, Bordeaux INP, UMR 5805, 33600 Pessac, France

Keywords: *Dinocysts, cellular content, seed bank, Gulf of Morbihan, Rance Estuary*

European coastal ecosystems are facing unprecedented changes, resulting in an increased frequency and intensity of algal blooms, some of which may become harmful. Algal blooms are seasonally recurring phenomena resulting from massive proliferation of planktonic microorganisms, some of which may produce toxins. Dinoflagellates, one of the groups involved, can produce resting cysts that remain viable for at least a century and contribute to coastal seed banks.
This study describes the ecological states, as indicated by dinocysts, of two estuaries in Brittany: one in the south, the Gulf of Morbihan (GoM), and the other in the north, the Rance Estuary (RE). These shallow embayments are characterized by ocean-like salinity, low turbidity, and limited freshwater inputs.
Sampling was carried out in coves and lateral tidal flats in order to ensure the recovery of fine-grained sediments. In the GoM, 33 samples were collected in 2023. They consist of the uppermost layers of surface sediments collected using two methods: orange peel grab for subtidal zones and by foot for intertidal zone. In the RE, 18 sediment slices were retrieved from the upper 15 cm of several cores collected in 2022 by UMR 5805 EPOC and Geo-Transfert (Uwitec gravity corer, virtual top, average depth: 9 cm). All samples were processed to obtain sedimentological data (laser grain-size) and palynological data (classical palynological protocol using cold HCl and HF). Palynomorphs identification were done by light microscopy at x400 (dinocysts identified from genus to species level, non-exhaustive counts of ciliate cysts and green algae, as well as selected key pollen taxa). RE samples were also analysed for geochemical measurements (calibrated XRF). Owing to the freshness of the samples, dinocysts with preserved cellular content were counted in the sediments from both the GoM and RE, allowing the assessment of the proportion of “viable” cysts within reconstructed assemblages.
In both estuaries, spatial variations in dinocyst concentrations are mainly correlated with tidal dynamics and grain size, while dinocyst assemblages (taxa percentages) are highly homogeneous at the scale of each estuary and also depend on continental shelf assemblages that are transported into the estuaries by tides. Regarding discrepancies between both estuaries, total dinocyst concentrations are three times higher on average in the GoM than in the RE. Moreover, assemblages from the GoM are strongly dominated by *Lingulodinium machaerophorum* (> 50%) while, in the case of the RE, assemblages are dominated by *Spiniferites* taxa (30–80%) and *Alexandrium* spp. (up to 40%). Despite lower dinocyst concentrations, the RE shows a high proportion of “viable” cysts (~44%). The proportion of “viable” cysts is unrelated to dinocyst concentrations and appears to be controlled by taphonomic processes. This study, focusing on the distribution of modern dinocysts in estuarine surface sediments, is crucial for understanding: i) dinocyst ecological preferences and the estimation of seed bank stocks, and ii) paleoecological and paleoenvironmental studies conducted in parallel on late Holocene sediment cores.

P-7. Investigating the geochemical preservation of organic-walled dinocysts during extreme climatic events through experimental and paleontological approaches using infrared spectroscopy and mass spectrometry

Rahaf Ishkokani[1,2], Pjotr Meyvisch[3], Aurélie Penaud[4], Kenneth Neil Mertens[5], Ilias Semmouri[2], Jana Asselman[2], and Johan Vellekoop[1,6]

*Rahaf Ishkokani: rahaf.ishkokani@kuleuven.be

[1] Department of Geology, Ku Leuven Univeristy, Leuven, Belgium
[2] Blue Growth Research Lab, Gent University, Gent, Belgium
[3] Department of Geology, Gent University, Gent, Belgium
[4] Geo-Ocean lab, Université de Bretagne Occidentale, Plouzane, France
[5] Ifremer, Concarneau, France
[6] Directorate Earth and History of Life, Royal Belgian Institute of Natural Sciences, Brussels, Belgium

Keywords: *(Dinoflagellate cysts, Molecular biology, Organic geochemistry, Infrared spectroscopy, Mass spectrometry)*

Dinoflagellates play a crucial role in marine ecosystems and are known for producing organic-walled cysts (dinocysts), valuable in reconstructing paleoceanic and climatic variability. Over the past years, chemical analyses based on infrared spectroscopy, in particular Attenuated Total Reflection Micro–Fourier Transform Infrared Spectroscopy (ATR–micro FTIR), have identified the molecular structure of dinosporin, the primary constituents of the dinocyst wall. Dinosporin is a chemically stable, carbohydrate-based biomacromolecule that may exhibit variable contributions from specific functional groups (Meyvisch et al., 2023).

Recently, we have assessed the compositional stability of dinosporin during early diagenetic processes related to the fossilization of modern dinocysts, e.g. the transition from ‘biomolecules’ into ‘geobiomacromolecules’, across shallow- to deep-marine settings spanning the Upper Pleistocene to Holocene. Our findings show that dinosporin remains largely unaltered, thus reiterating its remarkable compositional consistency and long-term biomolecular stability. Nevertheless, the integrity of dinosporin further back in geological time, and under extreme climatic and oceanographic perturbations, remains poorly constrained. Therefore, in this project, we aim to investigate the response of dinocyst wall molecular chemistry to global warming by combining experimental and paleontological approaches. Cultures of living dinoflagellates are subjected to controlled environmental stressors analogous to geological events, namely the Palaeocene–Eocene Thermal Maximum (PETM; ~56 Ma) and the Late Maastrichtian Warming Event (LMWE; ~66 Ma). In parallel, fossilized dinocysts from these intervals, including prior timeframes leading to those events, will be analyzed.

A combination of spectrochemical techniques, including ATR–micro FTIR, and mass spectrometric methods such as Inductively Coupled Plasma Mass Spectrometry (ICP-MS), are employed to characterize molecular modifications, trace element incorporation, and potential adaptive responses in cyst wall chemistry. By combining experimental and fossil evidence, this research will refine our understanding of dinocyst resilience under rapid climate change and contribute to the development of novel biomarkers for monitoring past and future climate variability.

P-8. Assessing shallow marine ecosystem turnover across early Eocene hyperthermals in the NW of Europe (UK and Belgium)

Laura Kellner[1*], Robert P. Speijer[1], Peter Stassen[1], Johan Vellekoop[1,2]

*Presenting author: laura.kellner@kuleuven.be

[1] Department of Earth & Environmental Sciences, KU Leuven, Leuven, Belgium
[2] Directorate Earth and History of Life, Royal Belgian Institute of Natural Sciences, Brussels, Belgium

Keywords: *Eocene; Shallow marine ecosystems; Biostratigraphy; Stable Isotopes; NW Europe*

Among all marine ecosystems, shallow marine ecosystems generally yield the highest biodiversity and play a crucial role in providing resources for our society. Within this biodiversity, at the base of the marine food web, dinoflagellates represent the majority of the eukaryotic phytoplankton in shallow marine ecosystems, both in modern seas as well as throughout recent geological history (e.g., Eocene). As Earth faces an uncertain future characterised by rising anthropogenic climate change and other pressures, it is crucial to understand how its ecosystem structures respond. Shallow marine ecosystems are already showing signs of profound disruption, thus it is relevant to constrain the scaling relationships between magnitude of climate change and ecosystem perturbations and identify tipping points at which ecosystem architectures change as a consequence of climate change. Geological reference intervals such as Eocene hyperthermals, may provide insights into how severe biotic changes scale with rapid climate changes. For the Eocene, quantitative analysis of organic-walled dinoflagellate cyst (dinocyst) assemblages provide an effective way to assess how dinoflagellates responded to environmental perturbations. Therefore, this new research project at KU Leuven focusses on the early Eocene hyperthermals in the NW European (Belgium and UK) shallow marine settings. Hyperthermals are being identified in selected cores and outcrops, through a combination of chemostratigraphy (bulk organic and foram $\delta^{13}C$), new biostratigraphic age constraints (dinoflagellate cysts and nannofossils), and stratigraphic intrabasinal correlation. Environmental proxies, such as benthic foraminiferal $\delta^{18}O$ and Mg/Ca ratios, the biomarker-based TEX_{86}, and trace- and major elemental composition will be used to reconstruct the relative changes in parameters such as temperature, eutrophication, freshwater influx and oxygenation. Finally, high-resolution quantitative palynology is used to assess the responses of the marine phytoplankton community. The expected outcomes of this project will allow us to potentially identify thresholds where climate change causes ecosystem structure to change.

P-9. A 10-million-year dinoflagellate cyst record from offshore the western Antarctic Peninsula

Bas Koene[1*], Kristine Steinsland[1], Francien Peterse[1], Claus-Dieter Hillenbrand[2], Robert Larter[2], Claire Allen[2], Peter Bijl[1], Francesca Sangiorgi[1]

*Presenting author: Bas Koene

[1] Marine Palynology and Paleoceanography, Department of Earth Sciences, Utrecht University, Utrecht, The Netherlands.
[2] British Antarctic Survey, Cambridge, United Kingdom.

Keywords: dinocysts, paleoceanography, cryosphere, West Antarctic Peninsula, Southern Ocean

The West Antarctic Ice Sheet and Antarctic Peninsula Ice Sheet (WAIS and APIS) are rapidly losing mass due to anthropogenic climate change and associated atmospheric and oceanographic warming. Little is currently known of the consequences of this melt, such as the impacts of meltwater input on primary productivity and water-column stratification. We aim to broaden the understanding of these feedbacks by reconstructing surface ocean conditions near these ice sheets during past episodes of warmth and ice loss.

We use sediment cores retrieved during Ocean Drilling Program Leg 178 from Sites 1095 and 1096, which provide archives of ocean and cryosphere dynamics during the last 10 million years. We conduct a multi-proxy study, combining dinoflagellate cysts and other palynomorphs (as indicative of primary productivity, salinity and stratification, and temperature) with lipid biomarker paleothermometry. We couple these to alternating lithological facies (glacial versus interglacial facies) to investigate ocean and ice-sheet changes on orbital time scales.

In line with findings of a previous study performed by Pudsey and Harland (2001) on the same sediment records, we find (1) dominance of Protoperidinioideae (such as *Brigantedinium* spp. and *Selenopemphix* spp.) but scarcely any Gonyaulacoideae (e.g., *Impagidinium* spp.); (2) fewer dinoflagellate cysts in the interglacial than in the glacial sediments; and (3) decreasing diversity in the younger parts of the records. Moreover, our high-resolution dinoflagellate cyst work reveals the stratigraphic range and abundance changes of the *Selenopemphix* species previously described from this site, such as *S. kepion, S. bothrion, S. minusa.* Interestingly, dinocyst concentration changes are mirrored by lipid biomarker data from the records, and this relationship may suggest temporal variations of bottom-water oxygenation with implications for proxy preservation. The biomarker-based paleothermometry shows a cooling trend throughout the past 10 Myr that is most prominent in the interglacial phases.

Ongoing analyses will increase the resolution of both dinocyst and lipid biomarker datasets to: (1) characterize changes in oceanography, including temperature variability, sea-ice cover, melt-water supply and biological productivity over glacial-interglacial time scales; (2) refine the stratigraphic ranges of the dinocyst taxa that were found (which will be useful for biostratigraphic analyses on other Antarctic records), and (3) investigate the ecologic affinities of these dinocyst taxa. Moreover, we will focus on selected glacial-interglacial transitions of the Pliocene and the Pleistocene, such as the M2 to mid-Piacenzian Warm Period (~3.3 Ma) as well as Marine Isotope Stage (MIS) 12 to 11 (~424 ka) and MIS 6 to 5e (~130 ka) transitions, known as transitions from cold periods to climate stages warmer than today.

P-10. A concept for an applied micropalaeontology course for BSc students

Ulrich Kotthoff[1*], Gerhard Schmiedl[2]

*Presenting author: u.kotthoff@leibniz-lib.de

[1] Leibniz-Institute for the Analysis of Biodiversity Change and Museum der Natur Hamburg, Hamburg, Germany
[2] Department of Earth System Sciences, Geology, University of Hamburg, Hamburg

Keywords: teaching, knowledge transfer, palynomorphs, microfossils.

Introductory courses on applied palynology and micropalaeontology are not easy to organize. Which case studies are well-suited as examples and are suitable samples available? What if the number of students exceeds the number of available microscopes? How can theory ideally be balanced with practical tasks?
Here we present a concept of an introductory course in applied micropalaeontology with a focus on palynomorphs and calcareous microfossils that has been successfully conducted in recent years at the Institute of Geology, Hamburg, and that received consistently positive evaluations by students. With little modification, the course was also given online during the CORONA crises with similar success.
We show how different fossil groups can be handled without access to huge collections, using a combination of 'real' fossils, posters, and online material. We illustrate how different palaeontological and biological concepts such as biodiversity, taphonomy, and functional morphology are assessed with encouraging cross-linking between different microfossil groups, but without going into too much detail. Use of smartphones/tablets is also included in our concept, but not mandatory. Last but not least, we illustrate how and why learning success is evaluated in short oral exams. After completing our course, students have received a basic knowledge on Pleistocene to modern dinoflagellate cysts, pollen and foraminifera ecology and taphonomy as well as on simple statistical, morphometrical, and laboratory concepts and methods.

P-11. Glacial and climatic influence on sea-surface conditions over the last 2000 years: evidence from two contrasting bays of Devon Island (Nunavut, Canada)

Maëla Le Ménec[13*], Jean-Carlos Montero-Serrano[12], Guillaume St-Onge[1], Aurélie Penaud[3],

*Presenting author: Maela.LeMenec@uqar.ca

[1] Institut des sciences de la mer (ISMER), Université du Québec à Rimouski (UQAR), Geotop & Québec-Océan, Rimouski, Québec, Canada
[2] The University of Tokyo, Atmosphere and Ocean Research Institute, Kashiwa, Japan
[3] Institut Universitaire Européen de la Mer (IUEM), Université de Bretagne Occidentale (UBO), Laboratory Geo-Ocean, Brest, France

Keywords: *Arctic, Glacier, Sediment, Late Holocene, Dinocyst*

The Arctic has been warming three times faster than the global average since the onset of modern climate change. This warming affects ice caps, oceanic conditions, and consequently the biodiversity of the region. The study focuses on two bays around Devon Island, along the Northwest Passage in Lancaster Sound. Radstock Bay appears to have been glacier-free since approximately 9000 yr BP, based on a gravity core analyzed in this project. In contrast, Croker Bay is influenced by the increasing ice velocity of two marine-terminating glaciers from the Devon Ice Cap. This area is affected by cold waters from the Arctic Ocean, while the warm West Greenland Current can also penetrate into Croker Bay. To investigate Late Holocene changes in the region, we studied two sediment cores collected using a box corer in 2021 and 2023 onboard the CCGS Amundsen. The cores were dated using ^{210}Pb and radiocarbon (^{14}C) on foraminifera, allowing reconstruction of environmental changes over the past 2000 years. MSCL-X, CT-scan imaging, grain-size, and mineralogical analyses were previously conducted (UQAR, ISMER) and reveal two distinct depositional environments between the bays. Core AMD2103-01GGC from Radstock Bay shows a single lithofacies over the last 2000 years cal BP characterized by homogeneous clay-rich deposits and variations in ice-rafted debris (IRD) linked to sea-ice cover. In contrast, core AMD2303-11GGC from Croker Bay exhibits three distinct lithofacies clearly associated with climatic variability. LF1, representing the early Late Holocene (~4000 to ~1100 cal BP), corresponds to a proximal glacial environment characterized by alternating silt–clay layers and moderate sedimentation rates (~90 cm ka^{-1}). LF2 begins around the transition to the Medieval Warm Period and consists of finer sediments with higher sedimentation rates (~200 cm ka^{-1}), indicating increased meltwater input and a more distal position relative to the grounding line. Within LF2, an additional shift occurs at the onset of the Little Ice Age, marking a new phase of glacier adjustment with even finer sediment. Modern warming is associated with a further increase in sedimentation rate to ~250 cm ka^{-1}, as observed in the box core. In addition, palynological analyses focusing on dinocyst assemblages are currently being conducted (UBO, IUEM–Geo-Ocean). The Modern Analogue Technique (MAT) will be used to derive quantitative estimates of sea-surface conditions, including temperature, salinity, and sea-ice cover and duration. Preliminary results from the last ~200 years enable comparison of conditions before and after the onset of the industrial period, which initiated the recent warming trend. Overall, this multiproxy approach provides new insights into environmental changes related to recent climatic variability in the southern sector of Devon Island and allows assessment of paleohydrological differences between a glacially influenced bay and an ice-free bay.

P-12. A 12,000-year record of dinoflagellate cysts from the Vancouver Island margin (NE Pacific): tracing past climatic, primary productivity, and oceanographic changes.

Zhen Li[1,2], *Vera Pospelova[3], Kenneth Neil Mertens[4], Alice S. Chang[2], Yongsheng Wu[5]

*Presenting author: vpospe@umn.edu

[1]Geological Survey of Canada-Pacific, Natural Resources, Sidney, BC, Canada.
[2]Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, BC, Canada.
[3]Department of Earth and Environmental Sciences, University of Minnesota, Minneapolis, MN, USA.
[4]Ifremer, COAST, Concarneau, France.
[5]Fisheries and Oceans Canada, Bedford Institute of Oceanography, Dartmouth, NS, Canada.

Keywords: Holocene, Paleoceanography, Paleoenvironments, Post glaciation, Climatic changes

This study is the first to examine dinoflagellate cyst sedimentary records (core MD02–2496) from the latest Pleistocene to the late Holocene along the Vancouver Island margin (Li et al., 2025). We identified 14 autotrophic and 26 heterotrophic taxa and defined four dinoflagellate cyst zones related to paleoclimatic and paleoceanographic conditions. Zone I (~14–~11.6 cal kyr BP) showed the lowest marine primary productivity (PP), evidenced by the lowest total cyst concentrations and fluxes, with *Brigantedinium* spp. dominating the assemblages. This was likely a result of cooler conditions associated with glacial meltwater input and weak coastal upwelling. Zone II (~11.6–~10.6 cal kyr BP) displayed a slight increase in both total cyst concentrations and fluxes, alongside a rapid rise in *Operculodinium centrocarpum* sensu Wall and Dale 1966 and the highest abundances of *Nematosphaeropsis labyrinthus*. This zone was likely linked to reduced meltwater input and enhanced coastal upwelling, which promoted nearshore PP. Zone III (~10.6–~8.2 cal kyr BP) exhibited a rapid increase in PP, demonstrated by maximum total cyst concentrations and fluxes, as well as higher abundances of autotrophic taxa. This zone was interpreted to reflect a strengthened California Undercurrent and increased upwelling, coinciding with the highest insolation intensity. High abundances of *Impagidinium* during this time indicated more open ocean conditions. A sharp increase in *Operculodinium centrocarpum* with short processes around 9–8.2 cal kyr BP may relate to the 8.2 ka event and a deceleration in sea-level rise. Zone IV (~8.2–2.3 cal kyr BP) suggested gentle fluctuations in PP, with overall declines in total cyst concentrations and fluxes, reaching their lowest point around 8.0 cal kyr BP. This was followed by a slight increase at approximately 6.5 cal kyr BP, before stabilizing. After incorporating geochemical proxies from the same sediment core (Chang et al., 2008, 2014), we compared our findings with previously published reconstructions of climatic and oceanographic conditions along the western margin of North America. This comparison revealed spatial and temporal differences in marine PP and sea surface temperatures, especially between the northern and southern regions.

Li, Z., Pospelova, V., Mertens, K.N., Chang, A.S., We, Y. 2025. A 12,000-year dinoflagellate cyst record on the Vancouver Island margin, Canada: tracing past climatic, primary productivity and oceanographic conditions. Palaeogeography, Palaeoclimatology, Palaeoecology, 667: 112876, 18 p. https://doi.org/10.1016/j.palaeo.2025.112876.

Chang, A.S., Pedersen, T.F., Hendy, I.L. 2008. Late Quaternary paleoproductivity history on the Vancouver Island margin, western Canada: a multiproxy geochemical study. Canadian Journal of Earth Sciences, 45: 1283–1297. https://doi.org/10.1139/E08-038.

Chang, A.S., Pedersen, T.F., Hendy, I.L. 2014. Effects of productivity, glaciation, and ventilation on late Quaternary sedimentary redox and trace element accumulation on the Vancouver Island margin, western Canada. Paleoceanography, 29: 730–746. https://doi.org/10.1002/2013PA002581.

P-13. The dinoflagellate record of the Holocene–Anthropocene *Lagerstätte,* Crawford Lake, Ontario, Canada

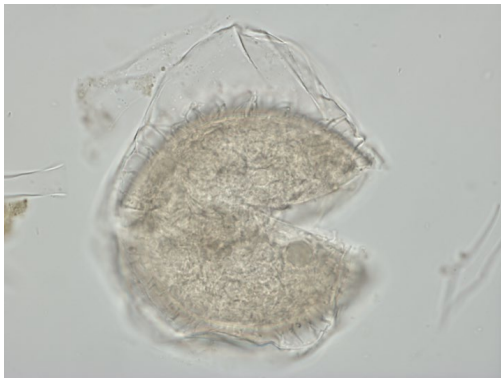
Francine M.G. McCarthy[1*], Andrea M. Krueger[1], Martin J. Head[1], Olena Volik[2]

*Presenting author: fmccarthy@brocku.ca

[1] Department of Earth Sciences, Brock University, St. Catharines, Ontario, Canada L2S 3A1
[2] Severn Sound Environmental Association, Port McNicoll, ON, L0K 1R0

Keywords: peridinioid cysts, cellulosic thecae, lacustrine, Lagerstätte

Dinoflagellate remains are a major component of the dark organic-rich laminae that accumulate rapidly during fall turnover below the chemocline in Crawford Lake, Ontario, Canada, contributing to the varved nature of the sediments. Exceptionally preserved cellulosic thecae of *Parvodinium inconspicuum* and *Peridinium* spp. (mainly *P. volzii* and *P. willei*) are relatively common in palynological preparations of sediments, and all stages of the dinoflagellate life cycle – including mitosis – have been observed. The preservation of cellulose at times of cultural eutrophication over the last 750 years, particularly during operation of a sawmill at the south end of the lake in the late 19th century, is attributed to short-lived anoxia in this unusual meromictic lake with a monimolimnion typically well-oxygenated from groundwater recharged nearby. Also preserved are cysts of *Ceratium hirundinella*, rarely preserved even in lakes where they are a common constituent of the phytoplankton biomass, as well as the enigmatic *Cobricosphaeridium awendae* (Burden et al. 1986) Head et al. 2003. Preservation of a thin-walled apparently bipesioid theca with a pointed apex around a cyst with a transapical suture led us to revisit whether this palynomorph, with processes of variable length and shape, can be attributed to the division Dinoflagellata. In addition to providing exceptionally preserved specimens, as with all *Lagerstätten*, sediments from the deep basin of this limestone sinkhole provide unparalleled paleoenvironmental insights. This has contributed to their selection as the proposed GSSP to define the Anthropocene as an epoch. Markers of the proposed Anthropocene epoch in palynological preparations include the regional decline in *Ulmus* pollen attributed to Dutch Elm Disease, a sharp increase in spheroidal carbonaceous particles recording the Great Acceleration of human industry, and an increase in acid-resistant remains of chrysophytes and green algae relative to dinoflagellate cysts, reflecting increased concentrations of atmospheric CO_2.



Rarely preserved cyst of Ceratium hirundinella (O.F.Müller) Dujardin 1841, and Cobricosphaeridium awendae (Burden, McAndrews & Norris 1986) Head, Borel, Guerstein & Harland, 2003 with possible enveloping theca.

P-14. From Morphogradational Series to Species Flocks: Revisiting Cruciform Dinoflagellate Cysts in Eurasian Marginal Seas

Petra J. Mudie[1], Keith Richards[2,4], André Rochon[3], Fabienne Marret[4*], Thomas M. Hoyle[5], Eugenia Fatourou[6], Katerina Kouli[6], Suzanne A.G. Leroy[4,7], Viktória Baranyi[8], Adele Bertini[9], Koraljka Bakrač[8]

*Presenting author: f.marret@liverpool.ac.uk

[1]Geological Survey of Canada Atlantic, 1 Challenger Drive, Dartmouth, NS B2Y4A2, Canada
[2]Formerly KrA Stratigraphic Ltd, 116 Albert Drive, LL319YY, Deganwy, Wales, United Kingdom
[3]Institut des sciences de la mer (ISMER), Université du Québec à Rimouski, Rimouski, QC G5L 3A1, Canada
[4]Department of Geography and Planning, School of Environmental Sciences, University of Liverpool, Liverpool L69 7ZT, UK
[5]ArcStrata, Liskeard, Cornwall, UK
[6]National and Kapodistrian University of Athens, Natural Sciences, Geology and Geoenvironment, Greece
[7]Aix Marseille University, CNRS, Ministry of Culture, LAMPEA, Aix-en-Provence, France
[8]Department of Geology, Croatian Geological Survey, Sachsova 2, HR- 10000 Zagreb, Croatia
[9]Dipartimento di Scienze della Terra – Università degli Studi di Firenze, Via G. La Pira, 4 50121 Firenze, Italy

Keywords: Late Miocene–Pleistocene cruciform cysts, Paratethys–Caspian system, Pontocaspian biogeography, Ecophenotypy

Dinoflagellate cysts displaying wing-like ornamentation and/or cruciform endocysts are widely used to characterise salinity conditions, as well as the timing and direction of Eurasian inter-basin biotic migrations. These dinocysts first appear during the Late Miocene, when the brackish–marine Paratethys extended from the Pannonian to the Caspian basins, prior to progressive basin isolation during the Plio–Pleistocene. The oldest species, *Galeacysta etrusca*, is a Pannonian galeate taxon that became abundant during the Messinian Paratethys–Mediterranean connection, co-occurring with *Spiniferites cruciformis*. Both taxa are only sparsely recorded in Lower Pliocene sediments of the Caspian Basin. Subsequently, *S. cruciformis* and *Pterocysta cruciformis* become common in the Caspian Sea, while additional cruciform species and morphotypes appear after ~5 Ma and reach maximum diversity and abundance during the Middle Pleistocene Bakunian Stage, together with *Seriliodinium explicatum* and *Pyxidinopsis psilata,* the oldest taxon known to produce cruciform cyst morphotypes.

Some modern and fossil Black Sea dinocyst assemblages have grouped diverse “Pontocaspian” taxa into morphogradational matrices or ecophenotypic series. However, re-examination of type material combined with new scanning electron microscopy observations indicates that these groupings include representatives of multiple gonyaulacalean subfamilies, suggesting that they do not reflect a single lineage but demonstrate the parallel evolution of cruciform morphology in two gonyaulacacean families. In this context, the family Gonyaulacaceae is emended to include dorsoventrally compressed cruciform cyst morphologies, and the morphogradational matrix framework is shown to encompass both gonyaulacoid and cribroperidinioid genera.

Two new taxa with cruciform morphology, *Pterocysta richardsii* sp. nov. and *Spiniferites bakunianus* sp. nov., are identified from Bakunian deposits of the Caspian Sea, where they co-occur with *Spiniferites cruciformis*, *Pterocysta cruciformis* and cruciform *Pyxidinopsis psilata* in an acme of cruciform cysts taxa — the “Cruciform City” assemblage of the late Keith Richards who discovered these taxa. In addition, eight formae of *Spiniferites cruciformis* are recognised, previously defined Black Sea morphotypes are clarified, and it is shown that only *S. cruciformis* and cruciform *P. psilata* occur in the Gulf of Corinth at the western terminus of the relic Paratethyan basins

Overall, the distribution, morphology, and variability of cruciform dinocysts highlight their endemic restriction to Eurasian marginal basins of variable salinity where cruciform morphologies apparently evolved through ecotypic response within a polyphyletic species flock, with variable amounts of ecophenotypic morphological expression. This interpretation provides a revised framework for understanding Pontocaspian dinocyst diversity and its palaeoenvironmental significance.

P-15. Late Cenozoic marine palynology of the Baffin Bay, North-Western Greenland from IODP Expedition 400

Mei Nelissen[1,2], Gijs Leenarts[2], Maria Karatzanou[2], Kasia K. Sliwinska[3] and Francesca Sangiorgi[2]

[1] NIOZ Royal Netherlands Institute of Sea Research, Texel, the Netherlands
[2] Department of Earth Sciences, Faculty of Geosciences, Utrecht University, Utrecht, the Netherlands
[3] Department of Geo-energy and Storage, Geological Survey of Denmark and Greenland (GEUS), Copenhagen, Denmark

*Presenting author: mei.nelissen@nioz.nl

Reconstructing the past evolution of the Greenland Ice Sheet (GrIS) and its response to warmer-than-present climate conditions is essential for identifying thresholds of glacial instability and projecting the cryosphere's future response to anthropogenic climate perturbations. Despite its significance for global climate dynamics and the global sea level rise, the evolutionary history of the GrIS remains poorly understood. To fill this knowledge gap, International Ocean Discovery Program (IODP) Expedition 400 recovered sedimentary sequences from six sites along the northwest Greenland margin into Baffin Bay (74°N). The >2000 m thick successions (composite thickness) records the evolution of the northern GrIS (NGrIS) over the past ~30 million years. Shipboard biostratigraphic- and paleoecological information based on marine palynology, particularly dinoflagellate cysts (dinocysts), seemed promising but was limited by the treatment methods allowed on board. As diatoms and foraminifera where only rarely observed throughout most of the studied intervals, refining palynological data is critical for biostratigraphic- and paleoecological interpretations. Here, we present updated marine palynological results from late Cenozoic sequences, based on reprocessed samples. Indeed, most of reprocessed samples yield well preserved and diverse dinocysts assemblages and other palynomorphs. These allow refining the age models and offer insights into variations in sea surface conditions during warm intervals in the Miocene and Pliocene, including presence of sea-ice, phases of freshwater/meltwater input and productivity.

P-16. Distribution and diversity of dinocysts and other non-pollen palynomorphs in surface sediments of Anticosti Island, Canada

Pietro Noga[1*], Anne de Vernal[1]

*Presenting author: martins_barbosa_noga.pietro@uqam.ca

[1] Département des sciences de la Terre et de l'atmosphère-GEOTOP, Université du Québec à Montréal

Keywords: dinoflagellates, Holocene, Naiadinium, lake, micropaleontology

Anticosti Island, located in the Gulf of St. Lawrence, eastern Canada, preserves an exceptional and continuous geological record, particularly across the Ordovician–Silurian transition, leading to its designation as a UNESCO World Heritage Site. This interval has been the focus of extensive investigation due to the abundance and high preservation quality of fossil assemblages, providing evidence and key insights into major global climatic and biotic events, including the first mass extinction in Earth's history. In contrast, the Holocene postglacial history of the Island remains comparatively understudied, largely due to the scarcity of (neo)paleoecological archives. Hence, the objectives of this study are to document the distribution and diversity of modern dinocysts and other non-pollen palynomorph (NPP) assemblages; synthesize the ecological significance of the identified taxa and assess their utility as modern ecological proxies. Thus, up to 2 cm of the surface sediment was collected with a box core at the deepest point of Baie de la Tour, located on the northern margin of Anticosti Island, where a 45 cm core was also sampled for further paleoecological study. Two replicates were collected at the littoral zone of each side of the lake with a spatula and stored in plastic bags at low temperature. The assemblage composition and spatial distribution will be analyzed in relation to environmental parameters measured *in-situ*, such as pH, oxidation-reduction potential, conductivity, total dissolved solids, surface salinity and surface temperature; In addition, geochemical elemental parameters were measured on the sediment, including organic/inorganic carbon/nitrogen content, C/N ratio and $\delta^{13}C$, $\delta^{15}N$ isotopes. For palynological purposes, 2 cm^3 subsamples were processed following standard protocols, with cold HCl and HF digestion, sonication and filtration at 10 and 63 µm. The residues were mounted on permanent slides for examination under transmitted light and fluorescence microscopy, taxonomic identification, and systematic counts. Preliminary results will be presented at the conference. The assemblages identified to date show taxonomic diversity and include dinoflagellate cysts with high abundance and shape diversity of *Naiadinium* sp. cyst, along with other diverse freshwater algae such as *Pediastrum*, *Botryococcus*, *Microcystis*, and numerous representatives of the *Desmidiales*. Other ornamented forms bearing spiny processes are present, as well as zoological fragments, eggs, and frequent ciliates, reflecting multiple biological sources and depositional inputs. Ordovician acritarchs occur consistently in the samples, indicating sediment reworking and the incorporation of older material into recent deposits, a pattern consistent with the geological setting of the island. The lack of marine representatives within the samples, such as foraminiferal linings and specific dinocyst taxa illustrate the freshwater character of the assemblage, contrasting with older material from the same site that comprises a variety of marine organisms, suggesting storm conditions or sea intrusion variations throughout the recent history of Baie de la Tour.

P-17. Exploring the molecular basis of dinoflagellate toxicity.

Marie Robert[1,2*], Eva ternon[2], Rodolphe Lemée[2], Stefania Castagnetti[1]

*Presenting author: marie.robert@imev-mer.fr

[1] Laboratoire de Biologie du Développement de Villefranche, UMR7009, Sorbonne Université/CNRS, France
[2] Laboratoire d'Océanographie de Villefranche, UMR7093, Sorbonne Université/CNRS, France

Preferred presentation type: oral presentation and/or poster

Keywords: micro-algae, toxins, transcriptomics, cell cycle, marine ecology

Toxic proliferations of dinoflagellates represent a major ecological and public health concern in coastal ecosystems. Among harmful algal bloom (HAB) forming species, the benthic dinoflagellate *Ostreopsis* cf. *ovata* has expanded from tropical to temperate regions, including the Mediterranean Sea and the French Atlantic coast. This species produces ovatoxins, analogs of the potent neurotoxin palytoxin. These compounds have been associated with adverse effects on marine organisms as well as negative impacts on human health, particularly when cell concentration is high. Despite increasing monitoring efforts, the biological mechanisms underlying bloom formation and toxin production remain poorly understood, and the extent to which toxin biosynthesis is linked to growth dynamics remains an open question.
To examine the relationship between cell proliferation and toxin biosynthesis, we first analysed toxin content at different phases of the growth curve in *O*. cf. *ovata* cultures maintained at two temperatures (17°C and 22°C). Our results show that toxin content per cell is driven by growth phase with higher toxin levels consistently observed during the exponential phase compared to the stationary phase. Interestingly, cells grown at the lower temperature (17°C, which is below typical environmental conditions for this species), showed higher toxin content per cell compared to those grown at 22°C. Differences of up to 4–5 fold were observed between contrasted conditions. Total RNA extracted from the same time points of the growth phases was used to generate *de novo* transcriptomes. Differential gene expression analyses showed specific gene expression profiles associated with the different growth phases, and will help identify candidate genes potentially involved in toxin biosynthesis and cell-cycle regulation. Comparative analyses have revealed that O. cf. ovata may rely on non-canonical regulatory mechanisms to control cell-cycle progression, as some key regulators described in model eukaryotes appear to be absent in this species. This suggests that alternative regulatory strategies may operate in dinoflagellates, potentially reflecting a broader evolutionary divergence in the control of cell cycle progression in these organisms.
Overall, this work provides new insights into the coupling between cell proliferation and toxin production in *O*. cf. *ovata*. It also highlights the diversity of molecular strategies underlying cell-cycle regulation in dinoflagellates. These findings contribute to a better understanding of HAB dynamics in a context of global environmental change.

P-18. How to use the longest time series of dinoflagellate cyst sediment trap to unveil their responses to recent climate changes

Surya Eldo V. Roza[1*], Runa T. Reuter[1], Jan-Berend W. Stuut[2,3], Gerard J. M. Versteegh[4], Vera Pospelova[5], Iria García-Moreiras[6,7], Karin AF Zonneveld[1,8]

*Presenting author: eroza@marum-alumni.de
[1] MARUM–Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany
[2] Department of Ocean Systems, NIOZ Royal Netherlands Institute for Sea Research, `t Horntje, The Netherlands
[3] Faculty of Earth and Life Sciences, Vrije Universiteit (VU) Amsterdam, Amsterdam, The Netherlands
[4] Department of Physics and Earth Sciences, Constructor University, Bremen, Germany
[5] Department of Earth and Environmental Sciences, University of Minnesota, Minneapolis, United States
[6] *Centro de Investigación Mariña* (CIM), *Universidade de Vigo*, Geoma, University of Vigo, Vigo, Spain
[7] *Universidade de Vigo*, *Departamento de Bioloxía Vexetal e Ciencias do Solo*, University of Vigo, Vigo, Spain
[8] Department of Geosciences, University of Bremen, Bremen, Germany

Keywords: dinoflagellate cyst, coastal upwelling, Saharan dust, wavelet analyses, climate changes

In the last few decades, the effects of current climate change on coastal ecosystems have become more visible. However, only limited information is available on climate-induced changes in marine pelagic ecosystems, for instance, changes in plankton communities. Among the significant marine plankton are dinoflagellates, which comprise photosynthetic and heterotrophic species and, as such, represent both primary producers and consumers to form the major basis of the marine pelagic food webs. Since their cysts are species-specific, changes in the dinoflagellate cyst (dinocyst) assemblage composition exported from the photic zone can provide a detailed reflection of shifts in the upper water ecosystem. Here, we present the results of a study investigating the responses of a pelagic ecosystem to recent climate change in eastern boundary upwelling systems off Cape Blanc. This region is characterised by year-round upwelling, which brings nutrient-rich waters to the surface, stimulating phytoplankton growth and making it one of the most productive regions worldwide. This region has become a valuable site for studying the export fluxes and environmental drivers of key dinoflagellate species through dinocyst time series. However, long-term primary production and environmental time series are scarce, which are essential for distinguishing climate-driven trends from short-term variability and improving our ability to predict the responses of marine ecosystems to future environmental changes. To fill this gap, we studied the dinocyst export flux over 18 years, collected by a sediment trap positioned at about 1300 m water depth. Then we compared this record with climate-sensitive environmental parameters, including upwelling winds, dust emissions, and sea surface temperature (Roza et al., 2024). Wavelet analyses were used to determine comparable cyclic patterns in time series of dinocyst export flux and the environmental parameters (Roza et al., 2026).

The wavelet power spectra showed pronounced annual and half-year cycles in the total dinocyst export flux record. These cycles typically occurred in January (winter peak) and between May and July (summer peak). The wavelet annual band of the dinocyst export time series can be divided into three phases, each dominated by a different ecological group of dinocysts described in our previous study (Roza et al., 2024). When correlated with upwelling wind and dust input data, those phases coincided with the annual bands of both parameters, supporting the positive influence of upwelling and dust input on dinoflagellate cyst export flux in this study site. Our results demonstrate that shifts in local environmental or climatic conditions can be traced through changes in the cyclic patterns and species composition of dinocysts. Since dinocysts are highly preservable in sediment archives, the information we found in this study is also applicable to past environmental and climatic reconstructions using fossil assemblages of dinocysts.

References:

- *Roza, S.E.V., Reuter, R.T., Stuut, J.-B.W., Versteegh, G.J.M., Pospelova, V., García-Moreiras, I., Zonneveld, K.A.F., 2026. Assessment of the Cape Blanc (northwest Africa) upwelling ecosystem response to recent climate change, using wavelet analyses on dinoflagellate cyst export. Biogeosciences 23, 831–850.*
- *Roza, S.E.V., Versteegh, G.J.M., Pospelova, V., Zonneveld, K.A.F., 2024. Environmental control of interannual and seasonal variability in dinoflagellate cyst export flux over 18 years in the Cape Blanc upwelling region (Mauritania). Front. Mar. Sci. 11, 1284425.*



P-19. Can we reconstruct *Pyrodinium bahamense* past blooms in Tampa Bay (Florida)?

Francesca Sangiorgi[1], Marisa Storm[1], Fabian van Rooij[1], Marcel van der Meer[2], Cary Lopez[3], Gregg Brooks[4], Rebekka Larson[4], Katherine Hubbard[3], Laura Villanueva[2]

*Presenting author: Francesca Sangiorgi

[1] Marine Palynology and Paleoceanography, Department of Earth Sciences, Utrecht University, Utrecht, The Netherlands.
[2] NIOZ Royal Institute for Sea Research, Department of Marine Microbiology and Biogeochemistry, Texel, The Netherlands
[3] Fish and Wildlife Research Institute (FWRI), Florida Fish and Wildlife Conservation Commission (FWC), St. Petersburg, FL, USA
[4] Department of Marine Science, Eckerd College, Saint Petersburg, FL, USA

Keywords: Pyrodinium bahamense, HABs, Polysphaeridinium zoharyi, biomarkers, Tampa Bay

Harmful algal blooms (HABs), the (excessive) proliferation of photosynthetic microorganisms in aquatic systems, are natural phenomena. HABs have adverse effects on the ecosystems, human health, and can have huge economic impact. HABs are particularly noxious when the species causing them produces toxins. HAB occurrences seem to have increased worldwide during the last decades due to climate change and anthropogenic stressors, but data to confirm this apparent trend are needed.

The Florida west coast is a HAB hotspot and experiences recurrent blooms of two toxic dinoflagellates, *Pyrodinium bahamense* and *Karenia brevis*. Blooms of *Pyrodinium bahamense* have been regularly observed in Old Tampa Bay in the last 20 years. This species produces a resting cyst called *Polysphaeridium zoharyi* which preserves in sediments that can act as seed bank for future blooms. *Pyrodinium bahamense* also produces a specific sterol called 4α-methylgorgostanol.

Here we present palynological and biomarker results obtained from a sediment core collected in Old Tampa Bay covering the past ~60 years with the aim of investigating whether past HABs of *Pyrodinium bahamense* can be identified, in times preceeding monitoring efforts. We compare our results with monitoring data on the number of cells of *Pyrodinium bahamense* observed in the water column and discuss trends, advantages and potential biases of reconstructing paleo-HABs.

P-20. First data on the presence of *Gambierdiscus* and other benthic harmful dinoflagellates in Sardinian coastal areas (NW Mediterranean Sea)

Cecilia Teodora Satta[1*], Mona Hoppenrath[2], Albert Reñé[3], Esther Garcés[3], Antonella Lugliè[4], Jorge Diogène[5], Mònica Campàs[5], Jacopo Culurgioni[1], Gabriele Costa[1], Francesco Mura[1], Nicola Fois[1]

*Presenting author: ctsatta@agrisricerca.it

[1] AGRIS-Sardegna, Agricultural Research Agency of Sardinia, Bonassai (Sassari, Sardinia), Italy
[2] Senckenberg am Meer, German Centre for Marine Biodiversity Research (DZMB), Wilhelmshaven, Germany
[3] Institut de Ciéncies del Mar, ICM-CSIC, Barcelona, Spain
[4] University of Sassari, Sardinia, Italy
[5] Institut of Agrifood Research and Technology (IRTA), La Ràpita (Tarragona), Spain

Keywords: Ostreopsis, Prorocentrum, Padina pavonica, artificial substrates

In recent decades, benthic harmful algal blooms (BHABs) have become of growing concern due to their impacts on human health and well-being, as well as the expanding distribution ranges of several problematic species. Consequently, much effort is being made to enhance knowledge and understanding of the benthic microalgal component, including the development of new sampling and analysis techniques. Many recent studies are focusing on BHABs along the Mediterranean coasts, however the information available from the coast of Sardinia (Italy) is scarce, despite its central location in the western Mediterranean. The first qualitative data from the island were obtained in 2020, revealing the presence of *Gambierdiscus* spp. and other species of interest, such as *Fukuyoa paulensis*. These findings also marked the first records of these species in Italy. More structured samplings were conducted in summer 2025 at two selected sites along the Sardinian coast (Tramariglio Bay on the northwestern side and Capo Malfatano in the south). Samples were collected from natural macroalgal substrates: *Padina pavonica* as a common substrate among sites and other substrates at specific sites (e.g., seagrasses at Tramariglio Bay). Additional samples were obtained using artificial substrates (nylon nets with 1 mm and 2 mm mesh sizes). Samplings were conducted in August (Tramariglio Bay) and in September and October (Capo Malfatano). Cell abundances of benthic harmful dinoflagellates were calculated as cells x gr^{-1} of natural substrate fresh weight (cells gr^{-1} fw), as cells x cm^{-2} of the natural substrate, and as cells x cm^{-2} of artificial substrate. Preliminary results from *P. pavonica* showed the presence of *Ostreopsis* spp., *Coolia* spp., *Fukuyoa* cf. *paulensis* and some *Prorocentrum* species with different abundances between the two sites. *Gambierdiscus* spp. were only detected at Capo Malfatano. *Coolia* spp. and the *Prorocentrum lima* group reached the highest cell abundances at Capo Malfatano (maxima of 5 x 10^3 cells gr^{-1} fw and 3 x 10^3 cells gr^{-1} fw respectively). In contrast, *Fukuyoa* cf. *paulensis* and *Prorocentrum* cf *rhathymum* reached the highest cell abundances at Tramariglio Bay (maxima of 0.7 x10^3 cells gr^{-1} fw and 0.9 x10^3 cells gr^{-1} fw, respectively). The cell abundances of *F.* cf. *paulensis* and *P.* cf. *rhathymum* were even higher on the other natural substrate taken (maximum of 3.7 x 10^3 cells cells gr^{-1} fw and 3.3 x 10^3 cells gr^{-1} fw, respectively). *Gambierdiscus* spp. showed lower abundances reaching a maximum of 0.2 x 10^3 cells gr^{-1} fw. The artificial substrates allowed the observation of the same taxa. For some taxa, artificial substrates showed higher abundances than the natural substrates, especially on the 2 mm mesh, but for others, they showed lower abundances than the natural substrates. These preliminary data constitute an important knowledge base for further investigations on the benthic component and on emerging species (i.e., *Gambierdiscus* and *Fukuyoa*) in the Mediterranean basin.

P-21. Dinoflagellate cyst assemblages in surface sediments of Annaba Gulf (NE Algeria, southern Mediterranean): spatial distribution, environmental drivers and HAB risk assesment

Behnas Soumaya[1], Frehi Houcine[1]

*Presenting author: behnas.soumia@hotmail.fr

[1] Marine Bioresources Laboratory, Department of Marine Sciences), Badji Mokhtar University, Annaba, Algeria

Keywords: *dinoflagellate cysts; Alexandrium pacificum; PSP; eutrophication; southern Mediterranean*

Surface sediments from 20 stations in Annaba Gulf (NE Algeria) were analysed for dinoflagellate cyst assemblages to assess spatial distribution, trophic status and harmful algal bloom (HAB) risk. A total of 43 taxa were identified across three orders: Gonyaulacales (14 spp., 68.96%), Peridiniales (21 spp., 25.21%) and Gymnodiniales (5 spp., 5.83%), plus three unidentified *incertae sedis* morphotypes reported for the first time from the region. Cyst concentrations ranged from 29.1 to 1,862.9 cysts/g dry sediment, structured by a coast-to-basin gradient driven by sediment organic matter ($\rho = +0.665$; $p < 0.01$) and fine fraction ($\rho = +0.782$; $p < 0.001$). Redundancy analysis ($R^2 = 0.651$; $p = 0.002$) confirmed the predominance of sedimentary over water column controls on assemblage composition. *Lingulodinium machaerophorum* dominated (D = 38.67%), consistent with widespread eutrophication: 65% of stations were eutrophic (IE; Zonneveld et al., 2012). Twelve HAB species represented 63.8% of total abundance. *Alexandrium pacificum* [PSP] was recorded at 85% of stations (max. 198.6 cysts/g), constituting a chronic paralytic shellfish poisoning risk for Annaba Gulf fisheries. These results provide the first dinocyst baseline for the open Algerian coast.

P-22. Expanding surface sediment dinocyst and biomarker calibrations to improve reconstructions of ocean-ice interactions offshore West Antarctica

Kristine Steinsland[1], Bas Koene[1], Francien Peterse[1], Claus-Dieter Hillenbrand[2], Robert Larter[2], Claire Allen[2], Francesca Sangiorgi[1], Peter Bijl[1]

*Presenting author: k.steinsland@uu.nl

[1] Marine Palynology and Paleoceanography, Department of Earth Sciences, Utrecht University, Utrecht, The Netherlands
[2] British Antarctic Survey, Cambridge, United Kingdom

Key words: West Antarctica, Antarctic Peninsula, Southern Ocean, proxy calibration, dinocysts

Dinoflagellate cyst assemblages in marine sediment cores have generally been shown to be sensitive recorders of palaeoceanographic conditions and past ocean-ice interactions. However, in the modern Southern Ocean, sparse and uneven surface sediment sampling impedes a clear evaluation of dinoflagellate cyst oceanic and ecological affinities and limits their use as transfer functions for paleoenvironmental reconstructions. We analysed dinoflagellate cysts from ca. 100 new surface sediment samples from the West Antarctic and Antarctic Peninsula regions. This new set of samples fills a key geographic gap in the existing database of Southern Ocean surface sediment samples. We constrain the relationships between dinoflagellate cyst assemblages and oceanographic conditions of the overlying water masses (i.e., temperature, salinity, sea ice, nutrients), and aim to develop a new transfer function for Southern Ocean paleoenvironmental reconstructions. Furthermore, we combine dinoflagellate cyst findings with biomarker-based paleothermometry of subsurface ocean temperatures to better understand surface-subsurface ocean and ice sheet interactions. Ongoing analysis has defined seven robust Antarctic-proximal species clusters, often with a single dominant species. For the first time, we identify a sharp boundary between clusters dominated by *I. minutum* in the northern Antarctic Peninsula and *Selenopemphix* sp. 1 in the southern Peninsula. *Selenopemphix* sp. 1 and *S. antarctica* also dominate separate clusters, demonstrating the importance of distinguishing these species as paleoenvironmental indicators. In further analysis, we will compare the seven clusters to environmental indices, strengthening the dinocyst tool for reconstructing past interglacial-glacial ocean-ice interactions.

P-23. Dinoflagellates of the Northwestern Black Sea, Ukraine

Galyna Terenko[1,2], Alexander Krakhmalnyi[3], Kenneth N. Mertens[1], Nicolas Chomérat[1], Gwenael Bilien[1]

*Presenting author: terenkogalina@gmail.com

[1] Station of Marine Biology, Ifremer, Littoral – Lerbo, Concarneau, France
[2] Ukrainian Scientific Center of Ecology of the Sea (UkrSCES), Odesa, Ukraine
[3] Institute for Evolutionary Ecology, NAS of Ukraine, Kyiv, Ukraine

Keywords: dinoflagellates, northwestern Black Sea.

Dinoflagellates in the Northwestern Black Sea (NWBS) are the second most diverse and widespread phytoplankton group after diatoms. In recent decades, their intensive development and harmful algal blooms (HABs) have been associated with eutrophication and increasing sea surface temperature (Terenko & Krakhmalnyi, 2022; Krakhmalnyi et al., 2024). Until 2020, 192 dinoflagellata species had been recorded in NWBS (Terenko L., 2005). During 2020–2026, we conducted comparative studies of dinoflagellate species composition in Odesa Bay. In addition, samples from Sukhyi Estuary, Tylihul Estuary, Tylihul–sea channel and temporary water bodies of the Tylihul Estuary region were investigated. Dinoflagellates identification was performed using light microscopy (OLYMPUS BX51, IX70, BX41), scanning electron microscopy (FE-SEM Sigma 300, Carl Zeiss Microscopy GmbH, Jena, Germany), cultures and molecular diagnostics.

In total, we recorded 133 species of dinoflagellates in the northwestern part of the Black Sea (Ukraine). Among planktonic taxa, the highest species richness was observed in the genera *Protoperidinium* (32 species), *Prorocentrum* (8), *Dinophysis* (8), *Tripos* (6), *Amphidinium* (4), *Gonyaulax* (4), *Gyrodinium* (4), *Heterocapsa* (4), *Pentapharsodinium* (3) and *Durinskia* (3). A considerable proportion of the detected taxa belonged to benthic dinoflagellates. Species of the genera *Aduncodinium*, *Amphidiniopsis*, *Amphidinium, Ansanella*, *Bysmatrum*, *Coolia*, *Cryptoperidiniopsis*, *Dinotrix*, *Thecadinium*, *Testudodinium*, *Togula*, and *Stylodinium* were recorded for the first time in the Black Sea.

A distinct ecological group preferred small, highly eutrophic, well-heated water bodies with salinity up to 27 ppt, often drying out during summer and reforming after rainfall. This group includes *Ansanella* sp., *Bysmatrum subsalsum*, *Durinskia dybowskii*, *Durinskia oculata*, *Gymnodinium litoralis*, *Heterocapsa limii*, *Levanderina fissa*, *Protoperidinium achromaticum*, *Kryptoperidinium triquetrum*, and *Protoperidinium* sp.

Some species were specific to estuary ecosystems. In Sukhyi Estuary (salinity up to 18 ppt), considered a semi-enclosed Black Sea Bay, *Peridiniopsis borgei* formed a massive summer bloom in 2022. Only in Tylihul Estuary (salinity >27 ppt) were *Oxyrrhis marina*, *Amphidinium* sp., *Durinskia* sp., and *Stylodinium* sp. recorded. Some dinoflagellates preferred the slow-flowing waters of the Tylihul–sea channel and were identified using laboratory cyst germination methods. The largest number of dinoflagellates species (120) was recorded by us in the Odesa Bay.

A group of HAB-forming species was identified during both summer (*L. polyedra, Prorocentrum micans, P. cordatum, P. ponticum, Blixaea quinquecornis, Protoperidinium divergens*) and winter (*Chimonodinium lomnickii*) periods (fig.1).

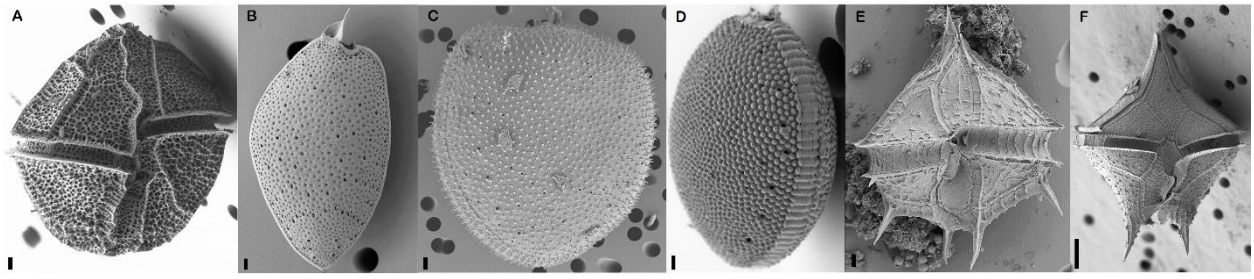


Fig. 1. Some HAB-forming species of Dinoflagellates of NWBS**:** *Lingulaulax polyedra* (A), *Prorocentrum micans* (B), *Prorocentrum*

cordatum (C), *Prorocentrum ponticum* (D), *Blixaea quinquecornis* (E), *Protoperidinium divergens* (F). A-F – SEM. Scale bars – A, B = 2 µm, C, D, E = 1 µm, F = 10 µm.

P-24. Integrating Ypresian dinocyst biostratigraphy with chemo-, sequence- and nannoplankton biostratigraphy for the identification of early Eocene hyperthermals from the South Dover Bridge core (Maryland, USA)

Pieter Van Rompaey[1*], Monika Doubrawa[2], Peter Stassen[1], Johan Vellekoop[1, 3]

*Presenting author: Pieter.vanrompaey@kuleuven.be

[1] Department of Earth and Environmental Sciences, KU Leuven, Leuven, Belgium
[2] Earth Sciences, Natural History Museum Basel, Basel, Switzerland
[3] Directorate Earth and History of Life, Belgian Institute of Natural Sciences, Brussels, Belgium

Keywords: *Ypresian, dinocyst biostratigraphy, hyperthermals*

The Ypresian (early Eocene) global climate is marked by a gradual warming trend, culminating in the Early Eocene Climatic Optimum (EECO). Superimposed on this trend is a series of orbitally induced, transient global warming events, termed hyperthermals. These hyperthermals are associated with relatively rapid additions of isotopically depleted carbon in the ocean/atmosphere and are as such expressed in sedimentary components through more negative values of their stable carbon isotopic composition. The Ypresian hyperthermals are originally defined from open oceanic cores. Shallow marine successions are, contrary to oceanic records, typically highly discontinuous and often lack magnetostratigraphic control, impeding the correct identification of hyperthermal events expressed in them. Here we present isotope records (δ^{13}Corg and benthic foraminiferal δ^{13}C and δ^{18}O)of the South Dover Bridge core (Maryland, US Atlantic Coastal Plain), spanning calcareous nannoplankton zones NP11 and NP12 and comprising a series of hyperthermal events. To correctly identify the hyperthermals expressed in our shallow marine record, we employ an integrated sequence- and biostratigraphic approach. Sequence boundaries are recognized as sharp lithological contacts characterized by abrupt shifts in sediment grain size. In support of our sequence stratigraphical interpretations, we reconstruct regional sea level changes using C/N-ratios of bulk organic matter and quantitative analyses of dinocyst assemblages. Finally, since each hyperthermal is worldwide expressed and isochronous, it acts as a globally correlative chronostratigraphic event if identified correctly. As dinoflagellates are a predominantly shallow marine group, dinocyst first and last occurrences are interregionally often more diachronic compared to other microfossil groups with a more open oceanic depositional center like e.g. calcareous nannoplankton or planktic foraminifera. As such, we aim to use our integrated stratigraphic framework to understands the constraints of stratigraphically important Ypresian dinocyst events occurring on the US Mid Atlantic Coastal Plain.

P-25. Marine environment in the Japan sea from Middle to Late Miocene reconstructed by dinoflagellate cyst assemblages and palynofacies using ODP Leg 127 Site 794 samples

Nanato Wada[1*], Takuto Ando[1], Shun Chiyonobu[1], Kazumi Matsuoka[2]

*Presenting author: wd77100@gmail.com

[1] Graduate school of International Resource Sciences Akita University, Akita, Japan
[2] Nagasaki University, Nagasaki, Japan

Keywords: *Miocene, Japan Sea, palynofacies, ODP*

During the Neogene, the warmest Middle Miocene climate shifted to a cooler regime following cooling reported environmental change due to cooling occurred in the Japan Sea from Middle to Late Miocene. Palynofacies and palynomorph analyses are effective, because the preservations of both calcareous and siliceous microfossil are generally poor in the Miocene samples of the Japan Sea.

In the North Pacific, studies in dinoflagellate cysts have been conducted using samples of the Bering Sea (Bujak,1984), Sakhalin Island (Kurita et al., 2000) and Korea (Yun et al., 2007). However, these studies mainly focused on biostratigraphy and depositional processes. In addition, Bujak and Matsuoka (1986) compared the dinoflagellate cyst assemblages in the Bering Sea with those in the Japan Sea. These data in the Japan Sea including data of Matsuoka et al. (1987) were mostly based on the samples from outcrops. Therefore, it is necessary to discuss the paleoenvironment using sediment cores from the Japan Sea. We discuss change in marine environment in the Japan Sea based on palynofacies and palynomorphs including dinoflagellate cysts using the ODP Leg 127 Site 794 core samples.

Palynofacies analysis showed that kerogen consists of approximately 90% amorphous organic matter (AOM), whereas palynodebris and palynomorphs together account for about 10%. AOM was classified into NFA, WFA, and FA based on fluorescence characteristics. The proportion of WFA, derived from aquatic organisms, is high (60-80%) between approximately 15 Ma and 7 Ma, indicating consistently high marine productivity during that interval.

Palynomorph analyses showed that the P:G (Peridinoid:Gonyaulacoid) ratios decreased from the Middle to Late Miocene. The T:M (terrestrial:marine palynomorphs) ratios decrease before 7Ma and increase after 7Ma, which is consistent with palynofacies data.

In the *Diphyes latiusculum* zone (Matsuoka, 1987), the assemblages were generally similar, although *Brigantedinium* spp. were observed. The samples of *D. latiusculum* zone were characterized by high P:G and T:M ratios, indicating higher terrestrial input and marine productivity before and during MMCT in the Japan Sea. In the *Operculodinium echigoense* (=*O. centrocarpum*) zone, the age range of that is consistent with that reported by Matsuoka (1987), although one sample has higher percentage of *O. centrocarpum*. Samples of this zone were characterized by higher WFA percentages and lower T:M ratios, indicating higher productivity after MMCT in the Japan Sea. This result is consistent with that siliceous mudstone as petroleum source rocks with high TOC during this interval and suggests higher productivity with cooling in the Japan Sea.

In the *Capillicysta fusca* zone, *Nematosphaeropsis labyrinthus* occurred earlier than those of Matsuoka (1987). Samples of *C. fusca* zone characterized by abundance of *N. labyrinthus* and lower P:G and T:M ratios, indicating a pelagic marine environment with lower productivity during Late Miocene after ~8Ma in the Japan Sea. Furthermore, these results suggest that cooling-driven oceanographic changes in the Japan Sea caused a shift from a productive, terrestrially influenced marginal sea to a more pelagic and less productive marine environment from the Middle to Late Miocene.

P-26 Reconstructing Italian temperature and precipitation in the Etruscan Period

Thore Früchtenicht[1], Nicole Kniebel[2], Karin Zonneveld[1,2]

*Presenting author: thofru@uni-bremen.de

1. Fachbereich Geowissenschaften, University of Bremen, Bremen, Germany
2. MARUM, canter for marine environmental research, University of Bremen, Bremen, Germany

To date high resolution climate data during the rise of the central Italian cultures is largely lacking and there is an ongoing debate about the relationship between local climate and the Late Iron Age communities.
Here we provide insight in ongoing work on an unique marine archive from the Gulf of Taranto that will allow the establishment of the reconstruction of local South Italian temperatures and Italian precipitation for the Late Iron Age with a resolution of about one datapoint every three years.
We will provide information about the establishment of the tephrachonological based age model as well as preliminary results from temperature and precipitation reconstructions of the Etruscan period.

Universität Bremen

marum

Conference Abstract Book

