14th European Diatom Meeting

Meise Botanic Garden, Belgium
09-11 May 2023

Book of Abstracts

225 years
Meise
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FINANCIAL SUPPORT
Meise Botanic Garden
Association des Diatomistes de Langue Française (ADLaF)
Nederlands-Vlaamse Kring van Diatomisten (NVKD)
Koeltz Botanical Books
Schweizerbart Science Publisher
Fonds voor Wetenschappelijk Onderzoek, Flanders

THIS PUBLICATION SHOULD BE CITED AS FOLLOWS:
Bart Van de Vijver, Christine Cocquyt & Myriam de Haan (Eds) 2023. Book of Abstracts, 14th European Diatom Meeting, Meise, Belgium, 09–11 May 2023. Meise Botanic Garden, Belgium, 105 pp.

ISBN 978-9072619-037

Contents

Preface

Four years after the last physical Central European Diatomist Meeting (CED), we finally can meet again. Since this last meeting, organised by the late Luc Ector in Luxembourg, a lot has happened. We changed the name of the meeting in European Diatom Meeting (EDM) as more and more European countries were represented on the meeting, not only restricted to Central-Europe. And we have a very successful and well attended online meeting in Cardiff (Wales), organised by Ingrid Jüttner.

Covid-19 strongly limited our possibilities to meet but, at last, we are proud to continue the tradition of meeting each other personally this year to discuss a broad array of scientific diatom topics. We are very happy to announce the presence of almost 120 delegates from 27 countries on this 14th European Diatom Meeting, presenting 3 keynote lectures, 31 oral presentations and 50 poster presentations, covering a wide range of topics ranging from (paleo)ecology and taxonomy to physiology and molecular biology.

The meeting will be followed by a one-day Workshop on diatom taxonomy entitled "The genus *Brachysira* in Europe", organised by Bart Van de Vijver.

This 14th EDM is also dedicated to our dear friend and colleague Luc Ector who left us too early last year. Luc was one of the most motivating, enthusiast, inspiring and professional diatom scientists of the past 25 years and for many of us also a very close friend. Honouring him with this meeting is only a small gesture to highlight his important scientific contributions and his warm personality once more.

Meise Botanic Garden is one of leading botanical gardens in Europe, situated just north of Brussels, in the centre of Belgium. Besides a beautiful historic 92 hectare domain, the Garden is also a centre of excellence for research on tropical and European botany, conducted in one of the largest herbaria in the world. Part of this herbarium is formed by the world-famous Van Heurck diatom collection conserving more than 20.000 slides and numerous unmounted materials from famous 19th century diatomists such as William Smith, George A. Walker Arnott, Albert Grunow, Friedrich T. Kützing and of course Henri Van Heurck himself.

While we hope that you will experience an intellectually stimulating conference, we also encourage you to discover our beautiful Botanic Garden, taste some of our best Belgian Beers and enjoy meeting and talking to each other in person again.

On behalf of the organizing committee, we wish you a pleasant time and fruitful meeting!

Myriam de Haan, Christine Cocquyt & Bart Van de Vijver

Keynote presentations

Freshwaters, ecosystem services, resilience, and sustainability: where is diatom research today and where will it be in the future

Paul B. Hamilton

PHAMILTON@nature.ca

Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, Ontario K1P 6P4 Canada

Freshwaters globally have many secrets to tell. To find the secrets, it is all about the right question or scalable hypothesis. Over the last 30 years, the diatom world has seen many changes in taxonomy, ecology, paleolimnology and genetics. We have lived through these changes and are adapting to new directions of research. Using the research colleagues and I have conducted over the last 30 years in classical taxonomy, ecology, paleolimnology and genetics, this presentation will explore these changes through space and time. In ecology, researchers (the diatom community) have completed a plethora of water quality assessments using diatoms and related organisms. Mercury, arsenic, sulphur, and nutrients all have effects on diatoms. Our research will demonstrate changing environments and further hint at research to come. In paleolimnology, analyses have varied from broad studies to fine detailed year to sub-yearly evaluations using large datasets. Climate change and anthropogenic impacts will continue to drive diatom-based paleolimnological studies into the future with big-data and less speculation. Whether it is Crawford Lake in southern Canada or an unnamed lake in the Arctic Archipelago, climate and anthropogenic effects are captured at regional and global paleo-records. Taxonomic studies using more morphological metrics and even micro-level metrics are hinting that freshwater diatoms are greatly more diverse than expected, although a consistent definition for diatom species still eludes taxonomists. Genetic studies have advanced the most in diatom research. From single gene related sequencing, to multiple sequence comparisons across chloroplasts, nuclear and mitochondria, the study of diatom taxonomy has changed. *Neidium*, *Frustulia*, and *Navicula* genetic studies reveal interesting relationships between morphology and genetics. However, even these DNA approaches are considered old and dated. New questions using larger sequence datasets (even complete genomes) will be the next phase of exploration and discovery. Will we have a better idea about what discrete species are or will we see continuums of ever-changing geneflow. Populations, individuals, or genes, what is driving/controlling freshwater biodiversity. Big-data is here to stay, but it is the right questions or hypotheses that will determine our future understanding of freshwaters and their ecosystem services to earth.

Terrestrial diatoms as indicators of soil conditions

Carlos E. Wetzel

carlos.wetzel@list.lu

Luxembourg Institute of Science and Technology (LIST), Environmental Research & Innovation (ERIN) Department, Observatory for Climate, Environment and Biodiversity (OCEB), 41 rue du Brill, L-4422 Belvaux, Grand-Duché du Luxembourg

Numerous studies have focused on the ecology of aquatic diatoms and their use in assessing water quality over the past decades. Much less is known about the ecological behaviour of terrestrial diatoms and their sensitivity to environmental factors. In this work, we explore the use of diatoms as indicators of soil condition by combining a traditional microscopic approach with high-throughput sequencing (HTS) metabarcoding techniques. We hypothesise that terrestrial diatom communities can be used to indicate anthropogenic disturbance levels and soil fertility. This method could serve as a tool for implementing future policies for protecting and enhancing soil biodiversity, which is still in its infancy. To show some results, we intend to explore the distribution of soil diatoms, providing new information on the physiographic and environmental parameters that control the distribution patterns of these communities. A total of 438 samples were sequenced and include samples collected during the years 2018, 2019 and 2020 in several localities under different land uses (i.e. arable land, grassland and forest) and soil textures [light (L), medium (M) and heavy (S)]. These samples were also clustered into organic (BIO) and conventional (CONV) farming practices and had their own set of soil chemical parameters analysed simultaneously. A second dataset comprises 288 sites collected in 2021 and grouped primarily as arable land, grasslands, and forests in Luxembourg.

A total of 9.74 million rbcL gene reads were acquired for 3960 amplicon sequence variants (ASVs), of which 36.4% were determined to be 'Eukaryota unclassified' (i.e. 1443 non-diatoms). 57.8% of the ASVs were identified as Bacillariophyceae. Almost two-thirds (62%) were placed as 'Bacillariophyceae unclassified'. One hundred and twenty-one diatom names were assigned at the species level from Diat.Barcode. However, this gap can be reduced for key species, as shown by preliminary results on the congruence between the information provided by rbcL gene sequencing and microscopic analysis, where the identity of some 'unclassified' taxa can be assigned using microscopic techniques. The surprising diversity and importance (in terms of genetic variants and total reads, despite their small size) of the genus *Mayamaea* Lange-Bertalot are highlighted and discussed. The establishment of ecological preferences of VSAs for the different parameters and the development of an index that considers fertility classes, integrating biodiversity components are also approached.

Keywords: diversity, soils, grasslands, forests, arable land, rbcL, metabarcoding, Bacillariophyta

Insights into diatom diversity and ecology through DNA metabarcoding

Adriana Zingone

adriana.zingone@szn.it

Stazione Zoologica Anton Dohrn, Naples, Italy

Diatoms are among the most deeply investigated protists in the marine realm. Yet their knowledge has leaped forward with the advent of molecular technologies which have revealed, among other features, a high level of hidden and cryptic diversity. In this respect, eDNA metabarcoding has been proven effective in unveiling diatom occurrence in space and time with a higher taxonomic resolution and precision compared to morphological methods, thus producing detailed appraisals of their actual biogeographical and ecological characteristics. Results obtained span from global overviews of diatom diversity and their driving environmental factors to spatial and temporal distributions of individual genera and species. Despite several limitations, the amount of new information and questions opened by the recent discoveries demonstrate the unique advantages and great potential of molecular approaches, at the same time highlighting the need to deepen the knowledge of diatoms with traditional methods.

Oral presentations

Taxon complex within the *Gomphonema herculeanum*: evaluation of morphological and molecular data

Nélida Abarca[1], Rosalina Stancheva[2], Oliver Skibbe[1], Katherina Schimani[1], Wolf-Henning Kusber[1], Jonas Zimmermann[1] & Regine Jahn[1]

n.abarca@bo.berlin

[1]Botanic Garden and Botanical Museum Berlin-Dahlem, Freie Universität Berlin, Germany, Berlin, Germany
[2]Department of Biological Sciences, California State University San Marcos, San Marcos, California 92096, USA. AND Department of Environmental Science and Policy, George Mason University, Fairfax, VA 22030, U.S.A.

Within the project "German Barcode of Life – Diatoms" diatoms of German waters were isolated and cultivated for integrative taxonomical research. In one of these studies, it was discovered that the genus *Gomphoneis* was not monophyletic. In terms of their molecular data some taxa – such as *Gomphoneis herculeanum* var. *minuta* – clustered next to taxa of the *Gomphonema* core group within the family Gomphonemataceae as expected. Other taxa, such as *Gomphonella olivacea* and *G. tegelensis*, which have been shown to be morphologically close to the generitype *Gomphoneis* – *G. elegans* - clustered outside this family but within the order Cymbellales. Since *G. herculeanum* had been described from North American waters by Ehrenberg 1845, its original material was studied in detail morphometrically and with high-resolution SEM. It was compared to strains and populations of a gomphonemoid taxon isolated from a mountain creek in North California. The molecular data (rbcL and 18SV4) put this species within the taxa clustering next to the *Gomphonema* core group. Since the genus name *Gomphoneis* is tied to the *G. elegans*-group which probably clustered outside the Gomphonemataceae, this group of taxa needs a new genus name. Besides molecular data, the new genus can be separated well also morphologically from *Gomphoneis* and *Gomphonella* in having areolae which are differentiated between the valve and the footpole as well as a single round stigma which is slit-like internally, in contrast to undifferentiated apical poles and no or several stigmoids; in addition, the longitudinal lines are produced by the mantle lamella in *Gomphoneis*. The autapomorphies to *Gomphonema* are clear with well visible longitudinal lines produced by the internal axial plate as well as differently formed perforations covering the external areolae which sit in deep troughs.

Genus level similarities in diatom communities in Antarctic and Alpine habitats

Lane Allen & Diane McKnight

Lane.Allen@colorado.edu

Institute of Arctic and Alpine Research, University of Colorado, Boulder, 4001 Discovery Dr. Boulder CO, 80303, U.S.A.

The McMurdo Dry Valleys (MDV) are the coldest and driest Long Term Ecological Research site in the world with winter temperatures plummeting as low as -60 C˚. Despite of the long dark winters and ephemerality of water bodies, over 50 species of diatoms are known to occur in the lakes, streams, ponds and cryoconites. Modern Antarctic diatom communities of the MDV are dominated by taxa in genera commonly classified as "aerophilic" such as *Humidophila*, *Luticola*, *Orthoseira*, and *Hantzschia*. Samples collected from the high alpine regions (>3,000m a.s.l.) of the Colorado Front Range display a remarkable diversity due to mountaintop biogeography, however because the selective pressures (i.e., extreme cold, long periods of darkness, desiccation events) are similar to those found in Antarctica, many of the species found in alpine habitats belong to genera also found in the Antarctic. In fact, of the 19 genera present in the MDV, at least 12 have representatives in the Colorado Rockies. There are also certain groups that are clearly well adapted to arctic and alpine habitats which are conspicuously absent from the MDV. Notably, the MDV are entirely devoid of araphids and eunotioids. This absence begs the question; what pressures have shaped modern diatom communities within the MDV? In the MDV, maintenance of diverse diatom communities depends on successful aeolian dispersal. In alpine habitats, there is an abundance of unique and isolated habitats, but there is also potential for dispersal by vectors such as pika, marmots, and hikers. The balance between dispersal and selective pressures drives diversity in these habitats, and the isolation of MDV habitats from less extreme habitats may have resulted in the limited diversity found in the MDV today. By studying the diatom communities that have developed at various elevations, we can improve our understanding of the factors that shape communities in these extreme ecosystems. This in turn can ultimately help us predict how diatom communities will respond to climate change in habitats where the effects of climate change are the most drastic.

Palaeoenvironment reconstruction of a medieval embankment at Sint Anna ter Muiden based on the ecology of palynomorphs and diatoms

Coralie André[1], Wim De Clercq[2], Annelies Storme[3], Dante de Ruijsscher[2], Maxime Poulain[2], Frieda Bogemans[4], Koen Sabbe[5], Bart Van de Vijver[6,7] & Stephen Louwye[1]

Coralie.Andre@Ugent.be

[1]Ghent University, Department of Geology, Krijgslaan 281-S8, 9000 Ghent, Belgium
[2]Ghent University, Dept. of Archaeology, Sint-Pietersnieuwstraat 35, 9000 Ghent, Belgium
[3]Ruben Willaert nv, Ten Briele 14.15, 8200 Sint-Michiels, Belgium
[4]Royal Belgian Institute of Natural Sciences, Geological Survey of Belgium, Rue Jenner 13, 1000 Brussels, Belgium
[5]Ghent University, Protistology and Aquatic Ecology Lab, Krijgslaan 281-S8, 9000 Ghent, Belgium
[6]Meise Botanic Garden, Research Department, Nieuwelaan 38, B-1860 Meise, Belgium
[7]University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, 2610 Wilrijk, Belgium

It is generally assumed in the literature that a violent storm in 1134 was responsible for the formation of a large tidal inlet, the Zwin. Afterwards, man reclaimed the landscape via the massive construction of dikes and canals. The region of Bruges, connected to the sea via a network of outer ports, became a major axis of maritime circulation. However, after its heyday, due to the collapse of the economy and the silting up of the Zwin, the harbours fell into disuse and disappeared. A multidisciplinary project now aims the reconstruction of the ecological palaeoenvironment during the Roman and medieval periods in the northern coastal plain of Belgium and the Netherlands.
Two pollen boxes were recently taken at the lost harbour of Sint Anna ter Muiden (Zeeland, the Netherlands), one located in an embankment, and the other including a waste layer dated from the 13th-14th century. A total of 66 samples were studied for palynological and diatom analyses.
The first pollen box shows disturbed mudflat sediments, referred to as clay-sods and dug by man in the coastal plain and used as a levelling layer on which the embankment was subsequently constructed. The terrestrial palaeoenvironment reflects a woodland-dominated landscape and the nearby presence of the coastal plain. The diatom spectrum is dominated by tychoplanktonic marine-brackish species (e.g. *Cymatosira belgica* and *Paralia sulcata*), which indicate a marine influence. Sediment holding a large number of shells was then deposited by man on top of the clay-sods to increase the height of the embankment. This layer holds abundant palynomorphs associated with anthropogenic activities. The tychoplanktonic marine-brackish diatoms remain dominant, and benthic brackish-freshwater species (e.g. *Navicula cincta* and *Hantzschia amphioxys*) become more abundant and reflect dry supratidal conditions, such as a saltmarsh. These results are compared with the diatom

analysis from a dike at Stene (Flanders, Belgium) dated to the Roman period, where dry supratidal conditions predominate.
The second pollen box holds undisturbed mudflat sediments, in which terrestrial and aquatic palaeoenvironments are recorded that are similar to those in the clay-sods. The waste layer overlying these mudflat sediments holds many palynomorphs linked to anthropogenic activities. Epontic and benthic brackish-freshwater species (e.g. *Halamphora coffeiformis* and *Nitzschia capitellata*) become dominant and reflect intertidal conditions, such as a mudflat. Thus, the conditions were wetter towards the waste layer, and although dry supratidal conditions are recorded in the embankment, the dominance of tychoplanktonic marine-brackish diatoms suggest that it was still impacted by the sea.

Morphological and genetic variation across the genus *Anaulus* Ehrenberg

Matt Ashworth

mashworth@utexas.edu

UTEX Culture Collection of Algae, University of Texas at Austin, 205 W. 24th St. biological Laboratories Building, Austin, TX USA

Efforts to include *Anaulus* and *Eunotogramma*, two genera diagnosed in part by internal transverse costae, in studies the evolution of the mediophycean diatoms have illustrated significant variation in morphological ultrastructure and DNA sequence data. While taxa in both *Anaulus* and *Eunotogramma* vary in the location and morphological ultrastructure of transvalvar processes, such as rimoportula, *Anaulus* features additional morphological variation at the valve apices and in the transverse costae. In regard to the apices, *Anaulus* taxa can have increased areolar density, with some having distinct apical pore fields, while other taxa have conical elevations. As for the internal costae, some taxa appear to have deep folds in the valve face—sulci—rather than costae, which can be difficult to distinguish in the LM with only a valve view. Additionally, some species of *Anaulus* appear to have a sternum as their origin of valve morphogenesis, suggesting a fragilariophycean phylogenetic affinity, which is supported by molecular phylogeny. Which of these morphologies corresponds to the type species, *A. scalaris* Ehrenberg, is still unclear, as Ehrenberg's illustrations do not include details about the apical or transvalvar process morphology. A specimen located in the Ehrenberg collection was missing both valve apices, but appeared to be sulcate. Of all the morphologies explored here, the closest match to the type illustrations might be *A. ellipticus* Hendey, which also has not been documented by electron microscopy.

Biodiversity and environmental factors structuring diatom communities of mineral saline springs in the French Massif Central (France)

Aude Beauger[1,2,3], Olivier Voldoire[1], Elisabeth Allain[1], Pierre Gosseaume[1], Christelle Blavignac[4], Lory-Anne Baker[3,5] & Carlos E. Wetzel[6]

aude.beauger@uca.fr

[1]Université Clermont Auvergne, CNRS, GEOLAB, F-63000 Clermont-Ferrand, France
[2]LTSER "Zone Atelier Loire", F-37000 Tours, France
[3]LTSER "Zone Atelier Territoires Uranifères", F-63000 Clermont-Ferrand, France
[4]Centre Imagerie Cellulaire Santé, UCA PARTNER, F-63000 Clermont-Ferrand, France
[5]Université Clermont Auvergne, CNRS, LMGE, F-63000 Clermont-Ferrand, France
[6]Luxembourg Institute of Science and Technology (LIST), Environmental Research and Innovation Department (ERIN), Observatory for Climate, Environment and Biodiversity (OCEB), 41 rue du Brill, 4422 Belvaux, Luxembourg

Springs are present worldwide and are among the most threatened ecosystems on Earth. Thus, it is crucial to better understand their abiotic characteristics and the diatom communities that inhabit these extreme environments, in order to protect and restore them (if necessary). The main aim of this study was to evaluate the biodiversity of seventy-nine mineral saline springs situated in the French Massif Central, focusing on the species richness and the estimated richness and also on the diatom community composition. The influence of physical and chemical factors on both richness and communities was analysed in order to have a better knowledge of the diatom ecological preferences and identify species typical of saline springs. Since December 2014, an on-going inventory of mineral springs has been in progress. For each spring, physical and chemical characteristics were measured, and benthic diatoms were sampled. It appeared that the species richness was the lowest in the springs presenting a man-made construction around the emergence, thereby underlining the need to restore such sites. In the other springs, the highest richness was associated with the lowest lithium, sodium, total dissolved solid concentrations, and conductivity.
Moreover, mineralization and some ions (bromine, calcium, chloride, fluoride, lithium, potassium, and sodium) were found to be the most critical drivers of diatom community composition. Some diatom species were typical of specific abiotic conditions, such as *Navicula sanctamargaritae,* which was associated with the highest potassium concentration. This species could appear as potential bio-indicator of these conditions.

An overview of diatom and bacterial diversity associated with Mediterranean loggerhead sea turtles

Sunčica Bosak, Klara Filek & Lucija Kanjer

suncica.bosak@biol.pmf.hr

University of Zagreb, Faculty of Science, Department of Biology, Horvatovac 102a, 10 000 Zagreb, Croatia

Sea turtles are known for a long time as a habitat for numerous and diverse microbes that happily live on the external and internal surfaces of their different body parts. Shells are especially known to be often covered with various macroepibionts and colourful biofilms formed by diatoms and bacteria. These microbes can be specialized and found almost exclusively associated with sea turtles but also opportunistic and found elsewhere in the turtle environment. In this presentation I am going to show you an overview of results obtained by research conducted within the TurtleBIOME project running in the period of 2018-2023 that involved a lot of very enthusiastic and dedicated participants and we are extremely thankful for their involvement. The main focus of our research was to characterize the microbial communities found in both the external (skin and shell) and the internal (gut, cloaca, oral cavities) habitats provided by loggerheads. We chose this species of sea turtle (*Caretta caretta*) as it is the most common turtle species in the Mediterranean Sea. We collected microbial samples from >120 animals from several locations in the Mediterranean area (Pula, Vis, and Lošinj in Croatia, Bari in Italy, and Amvrakikos Bay and Rethymnos in Greece) and analysed them using amplicon profiling with 16S, 18S, rbcL and ITS as molecular markers. The collected carapace and skin biofilm samples were also analysed using classical microscopical approach and that resulted in the description of several new diatom species. We have also isolated, identified, and maintained ca. 200 non-axenic diatom strains, which were then used in several experiments investigating the ecological preferences of diatoms themselves and their associated bacterial partners. We characterized the bacterial community of turtle-associated diatoms using metabarcoding and cultivation approach. This presentation will summarize these and other results we obtained while exploring the prokaryotic and microeukaryotic communities of loggerheads. Our multidisciplinary investigations provide the first inventory of loggerhead sea turtle endo- and epimicrobiota, revealing high diversity, different levels of host fidelity, and local biogeography of sea turtle-associated microbes.

Effects of climate-based hydrology variations on diatom biodiversity: comparing molecular markers and their effectiveness to digital microscopy

Andrea M. Burfeid-Castellanos

andrea.burfeid-castellanos@uni-due.de

University of Duisburg-Essen, Universitätsstr. 2, 45141 Essen, Germany

Intermittent rivers and ephemeral streams (IRES) are widely distributed and are starting to include usually humid climates, like the continental climate. As the loss of water connectivity and lastly water coverage creates a very selective environment, the organisms of the ecosystem end up adapting to the changing hydrological and consequent chemical changes. In the case of the diatom community, we would expect river characteristic diatoms in the flowing sites, an increase of biodiversity through to an opening of ecological niches for standing sites (pools), and a very select group of subaerophile diatoms should be able to survive the dry state. However, the diatom biodiversity of these ecotones has not been characterised yet. In this presentation, I will show the complementarity of molecular markers (18S V4 and rbcL) and (digital) microscopic biodiversity assessments in such ecosystems. I have measured them within model ecosystems, groundwater fed karstic rivers and streams that dry out periodically and have longitudinal changes in hydrology, presenting flowing parts, pools and dry riverbeds. The results show that the use of molecular markers may cover rarer taxa as microscopy does, but as the markers are not quantifiable, other information is lost. In addition, the quantity of non-identified sequences created a lot of noise for both markers. As two different molecular markers, rbcL and 18S V4 cover a different set of diatom taxa, their use has been justified. Furthermore, as in Mediterranean climates, where many of the IRES studies are based, the preferred marker is rbcL, and in Germany mostly 18S V4 is used in flowing rivers, the use of both facilitates the comparison within the two climates and stream types. As more and more rivers are being subjected to drying in recent years, the monitoring of biodiversity changes responding to the drying stressor. As drying seems to force a homogenization of the biofilm diversity, the loss of biodiversity might be impending if no pool reservoirs are maintained.

Taxonomic and ecological characterization of three symmetric biraphid diatom species from streams in Cyprus

Marco Cantonati[1], Nicola Angeli[2], Olena Bilous[3,4], Ionel Ciugulea[5], Horst Lange-Bertalot[6], Athina Papatheodoulou[7] & Abdullah A. Saber[8]

marco.cantonati@unibo.it

[1]BIOME Lab, Department of Biological, Geological and Environmental Sciences—BiGeA, Alma Mater Studiorum—University of Bologna, Via Selmi 3, 40126 Bologna, Italy
[2]Research & Collections (Limnology & Phycology), MUSE—Museo delle Scienze, Corso del Lavoro e della Scienza 3, 38123 Trento, Italy
[3]Institute of Hydrobiology and Aquatic Ecosystem Management (IHG), University of Natural Resources and Life Sciences, Gregor-Mendel-Straße 33/DG, 1180 Vienna, Austria
[4]Institute of Hydrobiology of NAS of Ukraine, Geroiv Stalingrada 12, 04210 Kyiv, Ukraine
[5]Algae Consulting Inc., Waterford, Ireland
[6]Goethe Universität Frankfurt, Biologicum, Max-von-Laue Straβe 13, 60438 Frankfurt, Germany
[7]I.A.CO Environmental & Water Consultants, Nicosia, Cyprus
[8]Botany Department, Faculty of Science, Ain Shams University, Abbassia Square, Cairo 11566, Egypt

Environmental factors and diatoms were studied in 151 stations in Cypriot streams. Since *Navicula simplex* Krasske [new combination: *Craticula simplex* (Krasske) Levkov] is based on the small–scale drawing of a single valve and the type material is no longer available, we provide additional ecological, morphological, and ultrastructural data, and an epitype for *C. simplex*, which is distinguished by valve outline and stria density, and occurs in small, nutrient-enriched streams. Two other symmetric biraphid species are proposed as new to science based on light (LM) and scanning electron microscopy (SEM), careful comparison with similar established taxa, and on the analysis of our multi-annual databases. *Mastogloia cyprica* Lange-Bert. et Cantonati sp. nov. differs from similar species by raphe undulation, stria density, and rare occurrence in oligo– to slightly–eutrophic streamlets and lakes with medium-high conductivity. *Navicula loumatensis* Lange-Bert. et Cantonati sp. nov. is characterized by the combination of valve outline, central area, and by a high areola density, and occurs in medium-high conductivity, low-N but P-enriched streams. In-depth knowledge of Mediterranean stream diatoms is of pivotal importance in these critical decades of climate change.

Evidence of the Tunguska Event in sediments of Suzdalevo Lake: the diatom response

Barbora Chattová[1], Radana Kavková[2], Daniel Vondrák[3], Eva Svecova[2], Marian Takac[2], Viktor Golias[4], Richard Štorc[2], Carlo Stanghellini[5] & Gunther Kletetschka[2,6]

barbora.chattova@gmail.com

[1]Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czechia
[2]Institute of Hydrogeology, Engineering Geology and Applied Geophysics, Faculty of Science, Charles University, Prague, Czechia
[3]Institute for Environmental Studies, Faculty of Science, Charles University, Prague, Czechia
[4]Institute of Geochemistry, Mineralogy and Mineral Resources, Faculty of Science, Charles University, Prague, Czechia
[5]INAF Istituto di Radioastronomia, Bologna, Italy
[6]Geophysical Institute, University of Alaska Fairbanks, Fairbanks, AK, USA

In this oral presentation, we present the first diatom record from the area exposed to a massive explosion known as the Tunguska Event (TE), which occurred in Central Siberia in 1908 CE. The origin of TE remains widely discussed and environmental impacts are not known in detail. We investigated evidence of the TE in sediments of Suzdalevo Lake, which is located near the explosion epicenter. According to local nomads (Evenkis), Suzdalevo Lake did not exist before the TE and was considered as a possible impact-origin water body. However, apart from oral testimony, there is no evidence of the lake formation process. Two short sediment cores were retrieved from the lake and dated using ^{210}Pb, ^{137}Cs, and ^{226}Ra. The sedimentary record was characterized using magnetic susceptibility, X-ray fluorescence, and the presence of melted magnetic microspherules. To study possible effects of the TE on the lake ecosystem, we performed diatom and freshwater fauna remains analyses. Results indicate that the lake contains sediments that originated before the TE and thus its formation was not related to the impact. Nevertheless, we documented distinct changes in the lake-catchment ecosystem that occurred within a 5-cm-thick depth interval calculated for the best fit depths for the year 1908, using three alternative age-depth models. The TE-related catchment disturbance was evidenced by proxies of increases in terrestrial matter input (abundant plant macroremains, peaks in magnetic susceptibility and the Sr to Rb ratio), diatom taxonomic diversity, productivity, and relative abundance of benthic taxa. The shifts in diatom assemblages were likely caused by nutrient supply and improved water column mixing following a catchment deforestation. The same processes likely affected other lakes in the TE area. Our results demonstrate potential usefulness of the paleolimnological approach to understand the possible environmental consequences of the TE and similar events elsewhere.

Diatoms in the sediments of Hüttwilersee: changes in the nutrient regime during the 20th century

Ieva Grudzinska[1,2], Fabian Rey[2] & Oliver Heiri[2]

ieva.grudzinska@lu.lv

[1]Institute of Biology, University of Latvia
[2]Geoecology, Department of Environmental sciences, University of Basel

During the 20th century, lake pollution and eutrophication were facilitated by agriculture intensification, the use of artificial fertilizers, and the discharge of untreated wastewater. In this study, we analysed the topmost 50 cm of sediments, spanning the last 200 years, at Hüttwilersee, Canton of Thurgau, Switzerland. At 434m asl, Hüttwilersee is one of three lakes located in the Seebachtal. Its maximum depth is 14.8 m and surface area is 34 ha. Sediments of this lake were investigated to understand how human activities in the catchment Hüttwilersee have affected its ecological status.

Changes in diatom composition as well as variations in diatom accumulation rates during the 20th century correspond very well with changes in land use and measures to combat eutrophication in Hüttwilersee. In 1943, extensive melioration was carried out along the Seebachtal to maximise the amount of land available for agriculture. As a result of these efforts, lake level at Hüttwilersee was lowered by about 1.5 m. Before melioration, the lakeshore consisted of moorland, surrounded by sparse forest. Afterwards, strong biochemical peat decomposition occurred in drained mire and resulted in a release of nutrients. Accordingly, this affected the composition of diatoms, evidenced by a decrease of *Pantocsekiella com*ensis and appearance of *Stephanodiscus binatus*, *S. rugosus* and *Fragilaria tenuissima*. Notably, the most remarkable changes in diatom composition were observed in the 1960s and 1970s, when diatom taxa frequently found in nutrient rich waters, such as small *Stephanodiscus* spp., *Stephanodiscus hantzschii*, *Fragilaria saxoplanctonica*, prevailed. Eutrophication of lake in the late 1960s and 1970s can be explained by extensive use of artificial fertilisers as well as by discharge of untreated wastewater into lakes. The ecological conditions improved following the construction of the Seebachtal wastewater treatment plant in 1979, and the group of small *Stephanodiscus* decreased, while *Pantocsekiella delicatula* and *P. ocellata* increased. In 2000, a deep-water discharge was installed at Hüttwilersee to improve the discharge of nutrients from the deep water and to increase oxygen concentrations of the lake. After this effort, the diatom composition did not change significantly; only a slight increase in *F. crotonensis* was observed.

Origin and evolution of two diatom genera from the East African Rift lakes

Elena Jovanovska[1], Jeffery Stone[2], Paul B. Hamilton[3], Friedemann Schrenk[1] & Walter Salzburger[4]

jovanovska.eci@gmail.com

[1]Department of Palaeoanthropology, Senckenberg Research Institute and Natural History Museum Frankfurt, Frankfurt am Main, Germany
[2]Department of Earth and Environmental Systems, Indiana State University, Terre Haute, IN, USA
[3]Phycology Section, Research and Collections Division, Canadian Museum of Nature, Ottawa, Canada
[4]Zoological Institute, Department of Environmental Sciences, University of Basel, Basel, Switzerland

Owing to their ubiquity and high dispersal ability, the diversity of diatoms in ancient lakes is usually shaped by colonization events, followed by occasional speciation. Although adaptive radiation appears to be a common process in a number of animal groups in these systems, its importance in diatoms is still being explored. Using two diatom genera, the benthic *Diploneis* and the epilithic *Afrocymbella*, from East African Rift lakes, we investigated whether, how and when radiation might have occurred in this previously unexplored region. We also looked at differences in the timing and patterns of evolutionary trajectories between these two groups of diatoms. To this end, we constructed a time-calibrated phylogeny of raphid diatoms using 11 genes and 360 taxa in concert with paleontological data from the sediment records of Lake Tanganyika and Lake Malawi. We found that each of the two diatom groups evolved in situ within the rift from a common ancestor in a relatively short time, *Diploneis* c. 22.28 Myr and *Afrocymbella* c. 13.14 My. Accelerated diversification in the former group resulted in much higher species richness. The credibility intervals around the onset of their diversification include the assumed age of the oldest lake in the rift and, in conjunction with sediment-derived fossil data and unique morphological patterns, suggest that in situ diversification most likely resulted from adaptive radiation. Although the adaptive nature of diversification, as well as its causes, remain to be ascertained, this study provides strong evidence that adaptive radiation indeed contributes to diatom diversity.

How to boost diatom research by digitizing analysis and training

Michael Kloster, Andrea Burfeid-Castellanos & Bánk Beszteri

michael.kloster@uni-due.de

University of Duisburg-Essen, Faculty of Biology, Phycology Group, Essen, Germany

Diatoms are one of the most important primary producers, and we need to understand better how they are affected by human impact, climate change and the ongoing biodiversity crisis. This makes it mandatory to upscale our investigations, so that we can assess possible consequences for ecology and hence humankind. One of the most important tools for investigating diatoms is the light microscopy-based assessment of community compositions. We suggest that the time has arrived for a digital transition of the underlying methods to enable a better transparency, upscaling and networking among the decreasing number of experts as well as training of a new generation of them in diatom taxonomy.
For a decade now, our group has been advancing diatom analysis into the digital realm by developing image-based high-throughput methods for microscopy, morphometry, annotation and identification, which we apply for upscaling typical research workflows and use as innovative tools for training and collaborating with (future) diatom experts.
Here, we present an overview of our digital methods and the experiences we made with them especially during the pandemic. We also introduce the newest member of our tool collection, UDE BioSLiDES, a platform for virtual digital microscopy specifically designed for educational purposes. Originally developed for teaching general biology with a focus on botany, it can also serve for training in diatom taxonomy, and we plan to extend into a system for conducting digital intercalibration tests.

Preliminary global patterns in glacier-fed stream diatom communities as revealed by 18S amplicon sequencing

Tyler J. Kohler[1,2], Jan Kollár[1], Hristina Kochoska[1], Kateřina Kopalová[1], Hannes Peter[2], Leïla Ezzat[2], Massimo Bourquin[2], Grégoire Michoud[2], Susheel Bhanu Busi[3], & T.J. Battin[2]

kohlert@natur.cuni.cz

[1]Department of Ecology, Faculty of Science, Charles University, Viničná 7, CZ-12844 Prague 2, Czech Republic

[2]River Ecosystems Laboratory, Alpine and Polar Environmental Research Center, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland

[3]Systems Ecology Group, Luxembourg Centre for Systems Biomedicine, University of Luxembourg, Esch-sur-Alzette, Luxembourg

Glaciers are receding globally, leading to the disappearance of glacier-fed stream (GFS) habitats. Yet, little is known about the inhabitants of GFSs, and our understanding of the diversity that we will lose with these ecosystems remains limited. Coincidentally, GFSs are also excellent model systems to study biogeographical patterns, given their essentially uniform environmental conditions across all of Earth's continents, and their spatial separation between mountain ranges that create 'islands of habitability'. Diatoms are specifically thought to encapsulate a large portion of the eukaryote diversity in GFSs, yet their study at the global scale remains limited. To investigate the global diversity and biogeographical patterns of GFS diatoms, we conducted 18S sequencing on samples collected as part of the Vanishing Glaciers project from 11 major mountain regions around the world, including all continents except Antarctica.

Comparisons of morphological community data with 18S sequences for a subset of samples revealed good congruence between the two methods, inspiring confidence in the metabarcoding approach. Overall, we detected 4,014 diatom amplicon sequence variants (ASVs) in the full unrarefied dataset, with an average of 408 ASVs present in a given mountain range, and ~20 ASVs present in a given GFS. The greatest alpha and gamma diversities were found in South America and Eurasia. Intriguingly, no ASVs were shared among all 11 mountain ranges, and the regional average proportion of endemic ASVs was 78%. New Zealand and Uganda had the greatest proportion of endemic ASVs, with >90% for both.

The most prevalent genera in the dataset were *Pinnularia*, *Mayamaea*, *Psammothidium*, and *Achnanthidium*, and were found among all 11 mountain ranges. The most diverse genus (in number of ASVs) was *Achnanthidium*, followed by *Cymbella* and *Gomphonema*. The genus *Achnanthidium* had the greatest average regional relative abundance, followed by *Gomphonema* and *Diatoma*. When a PCoA ordination was created for the full ASV dataset, samples clustered within mountain ranges. Interestingly, samples from the northern and southern hemispheres clustered apart, and this divergence was most pronounced when ordinations were created at the ASV level, and gradually dissipated at the species and genus taxonomic levels.

These preliminary results suggest both biogeographical patterns and a previously unrecognized high level of sub-species endemism in GFS diatoms, a portion of which is likely to disappear this century with climate change. Yet, these results are preliminary, and more insights are sure to come as we sequence the rbcL gene and complete the morphological characterization for our samples.

On the molecular affairs in diatom research – past, present and future

Jan Kollár, Kateřina Kopalová & Tyler J. Kohler

jan.kollar.phd@gmail.com

Department of Ecology, Charles University, Viničná 7, CZ-12844, Prague, CZ

Diatoms are among the most diverse and environmentally significant protists on Earth, playing important roles in biogeochemical cycles (e.g., silica, carbon) and food webs of many aquatic and semiaquatic ecosystems. However, a large portion of their diversity appears to lie beyond the resolution of the traditional light microscopy-based methods routinely and sometimes exclusively utilized in the investigations of their populations, species and communities. At the same time, the technological and conceptual developments in the fields of molecular biology and bioinformatics unlocked a remarkable opportunity to study diatoms in a previously unimagined depth and breadth, thus promising an unprecedented insight into their diversity, evolution, ecology, biogeography and environmental roles. In this contribution, we shall briefly review the history of molecular research in diatoms (molecular phylogenetics, species delimitation, molecular clocks, DNA barcoding, metabarcoding, genomics and other omics), through analysis of WoS-indexed literature reveal the current state of affairs, and consider their potential for future research.

Old vs. young: landscape scale shifts in Antarctic lake diatom communities

Kateřina Kopalová[1], Jan Kollár[1], Jan Kavan[2,3], Kristýna Vrbická[1], Daniel Nývlt[2], Linda Nedbalová[1], Marek Stibal[1] & Tyler J. Kohler[1]

kopalov1@natur.cuni.cz

[1]Department of Ecology, Faculty of Science, Charles University, Viničná 7, CZ-12844 Prague 2, Czech Republic
[2]Polar-Geo-Lab, Department of Geography, Faculty of Science, Masaryk University, Brno, Czech Republic
[3]Alfred Jahn Cold Regions Research Centre, University of Wrocław, Poland

Glacier recession is leaving behind new waterbodies in proglacial forelands worldwide, including Antarctica. Yet, it is unknown how diatom communities of recently formed 'young' waterbodies (originating decades to a century ago) compare with more established 'old' counterparts (originating thousands of years ago). Here, we compared benthic diatom communities of 'young' and 'old' lakes on James Ross Island, Antarctic Peninsula using light microscopy to make morphological species designations. We found diatom communities significantly differed among lakes belonging to the two age groups, and older lakes hosted almost twice the number of diatom taxa than young ones on average. Ordinations constructed to visualize diatom communities using Bray-Curtis and Jaccard distances both showed strong clustering by lake age, and permutation tests indicated these communities were indeed significantly different. To gain insight into the nature of these differences, an indicator species analysis was performed and identified *Hantzschia amphioxys*, *Humidophila australis*, *Pinnularia australomicrostauron*, *Halamphora oligotraphenta* and *Luticola higleri* as indicator species of the old lakes, while *Nitzschia kleinteichiana* and *Fragilaria capucina* were significantly associated with young lakes. To identify potential environmental mechanisms for these differences, linear models and dbRDA analyses found combinations of water temperature, pH, and conductivity to be the most important factors for both diversity and community structure. These results hint at the importance of thermal, ionic, and physical habitat constraints to community assembly, and suggest that newly formed waterbodies resulting from current and future glacier recession are not likely to share the same level of diversity as already established ones. Collectively, these results improve our understanding of microbial community drivers in Antarctic freshwaters and help predict how the microbial landscape may shift with future habitat creation within a rapidly changing environment.

Distribution of the invasive diatom *Didymosphenia geminata* in the Czech part of the Elbe River basin and its ecological implications

Lucie Kotyzová[1], Jan Špaček[2] & Josef Juráň[3,4] & Jan Kaštovský[3]

lucie.kotyzova@uhk.cz

[1]Faculty of Science, University of Hradec Králové, Hradecká 1285, 500 03 Hradec Králové, Czech Republic
[2]Povodí Labe, state enterprise, Víta Nejedlého 951/8, Slezské Předměstí, 500 03 Hradec Králové, Czech Republic
[3]University of South Bohemia, Faculty of Science, Branišovská 1760, 37005 České Budějovice, Czech Republic
[4]Institute of Botany, Academy of Sciences of the Czech Republic, Dukelská 135, 37982 Třeboň, Czech Republic

The blooms of the invasive benthic diatom *Didymosphenia geminata* (Lyngbye) M.Schmidt have been problematic all over the world for at least last three decades. Therefore, the goal of this study was to map the distribution of *D. geminata* in the largest Czech river, Elbe, and its river basin together with defining the implications of its occurrence and ecological relationships. Statistical analyses of the main environmental factors and the algal community composition possibly influencing the *D. geminata* distribution were carried out based on the data of "The assessment of the ecological status of waters under the Water Framework Directive (WFD)" of the Povodí Labe, state enterprise. The results of these analyses showed some preferences of *D. geminata* for the substrate and physical-chemical parameters of water, or the co-occurrence with other algal taxa. Although the number of *D. geminata* positive samples increased significantly throughout the 15 years of the surveillance, no *D. geminata* blooms have been recorded in Czech part of the Elbe River and its tributaries, thus the potential risk is minuscule.

Development of a collaborative web-based approach for quantifying diatom deformities

Martin Laviale[1,2], Iane Vallanzasca[3], Eric Quinton[3], Sébastien Boutry[3] & Soizic Morin[3]

martin.laviale@univ-lorraine.fr

[1]Université de Lorraine, CNRS, LIEC, F-57000, Metz, France
[2]LTSER-Zone Atelier Moselle, F-57000 Metz, France
[3]INRAE, UR EABX, Cestas

The Biological Diatom Index (BDI) is a regulatory indicator used for the assessment of French water bodies biological quality within the Water Framework Directive. In particular, this index considers the proportion of deformed diatoms, whose presence probability profile is an indicator of stress. Although this is a sensitive criterion, it is however rarely informed as there is no consensual objective approach for attributing a teratological character to a diatom when the deformation is subtle.
In this context, we are developing a collaborative tool, designed and fed by diatomists, to assist in determining the teratological status of an individual diatom. For this purpose, a web interface is currently under development in order to acquire a large image dataset of individual deformed diatoms. This will make it possible to illustrate the specific diversity, or on the contrary the stability, of the types of deformations encountered for French mainland diatom species. Moreover, as this collaborative web platform aims at gathering associated environmental variables, our aim is to draw relevant correlations between deformities and associated stressors. On the long run, the collected images will make it possible to develop a standardized image analysis approach to assess the intensity of the deformations. Overall, sharing knowledge on the observed deformations and its associated environmental conditions will be key to guaranteeing the quality of the existing BDI, by optimizing the use of diatom deformation for the assessment of toxic stress.
In this presentation, we will illustrate a prototype version of the web interface, the type of data of interest, and how artificial intelligence could be useful, especially to fully exploit the image dataset. Although initially designed for the French practitioners, this tool intends to be useful for the overall diatomist community.

From “opics” to “omics”: the Eastern Canadian Diatom Index mutating into a DNA-based water quality index

Isabelle Lavoie[1,2], Nicholas Kiulia[1,2], Martine Grenier[3], Éloïse Veilleux[3] & Vani Mohit[3]

isabelle.lavoie@inrs.ca

[1]Centre Eau Terre Environnement, Institut national de la recherche scientifique, Québec (QC), Canada
[2]GRIL - Groupe de recherche interuniversitaire en limnologie, Montréal, Québec, Canada
[3]Ministère de l’Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, Québec, Canada

Since its creation in the early 2000s, the Eastern Canadian Diatom Index (IDEC: Indice Diatomées de l’Est du Canada) has been used to assess the biological integrity of hundreds of streams and rivers in the province of Québec. Due to an increase in the number of samples to process, laboratories in charge of diatom analyses experience heavy work overloads, shortages of trained taxonomists and needs for regular intercalibration workshops. Several studies suggest that diatom-based assessments can greatly benefit from diatom DNA metabarcoding, especially in terms of providing shorter turnaround times for result delivery, high quantity/quality standardized data and lower costs.

In this study, we used diatom DNA metabarcoding to evaluate its potential to (1) detect nutrient enrichment in Quebec streams, and (2) compare site distribution using the “opics” and “omics” approaches. Among the hundreds of watercourses annually surveyed for IDEC-based water quality assessment in Quebec, 45 sites were sampled for diatom DNA metabarcoding. The 45 sites were visited in August 2019 and in August 2020. Sites were distributed along a nutrient-enrichment gradient reflecting urban and agricultural activities.

Genomic DNA was extracted from periphyton composite samples using the DNeasy PowerSoil Pro Kit (Qiagen). A 312 bp fragment of the marker gene rbcL from diatoms was amplified as described in Vasselon et al. (2017). Library pools were sequenced on an Illumina MiSeq platform (2 × 250 bp paired-end V2) at the McGill Genome Centre (Montreal, Canada). The DADA2 pipeline was used to process the raw reads and infer amplicon sequence variants (ASV) which were annotated using the diat.barcode v10 database. All the ASVs that were not classified as Bacillariophyta at the phylum level were removed prior to downstream analysis. Unassigned ASVs at the genus level were also removed.

Most diatom species identified based on DNA metabarcording were commonly observed with microscopy. There were some dominant diatom species observed under the microscope that were not detected using the molecular approach and vice-versa. Even with these limitations, DNA-based monitoring clearly differentiated the most and the least-disturbed sites along the nutrient gradient. Despite some inconsistencies, the metabarcoding and microscopic approaches resulted in similar site distribution along the nutrient gradient. Based on our results, diatom metabarcoding appears to be a promising tool to complement existing stream biomonitoring methods and could eventually be used to develop a new DNA-based IDEC.

Diversity of freshwater diatoms: from local to global scales

Zlatko Levkov[1], Dušica Zaova[1] & Danijela Mitic-Kopanja[1]

zlevkov@pmf.ukim.mk

[1]Institute of Biology, Faculty of Natural Sciences, Ss. Cyril and Methodius University, Skopje, Arhimedova 3, 1000 Skopje, R. North Macedonia

Diatoms are considered one of the most diverse eukaryotic groups with an estimated 12.000 to one million species. Freshwater diatoms are representing a relatively small portion of the diversity. Recent data reveal that countries with a long tradition of diatom research reported 2100-2800 taxa, not all of them are truly freshwater species. A detailed survey of diatom diversity in North Macedonia was started a decade ago, resulted with recording of 2150 taxa in more than 12.000 samples. Almost 60% of taxa are shared with diatom floras of Germany, USA and UK. The number of common and frequent species (observed on more than 20 localities) is relatively low (ca. 25%) compared to rare and extremely rare (observed on a single or on less than five localities) species (ca. 35%). The highest diversity was observed in high mountain habitats (alpine ponds, glacial lakes, bogs and fens, subaerial habitats) representing more than 40% of flora, following by lowland wetlands (ca. 20%). Based on present observations about 22% (~480 taxa) of diatoms are still unidentified. The largest number of unknown taxa were observed from “extreme habitats sensu lato” such as dystrophic alpine ponds, subaerial habitats and mineral springs. There are several reasons for such results as: these habitats are not frequently studied; species are (very to extremely) rare in the samples and thus omitted; many have valve size about or less than 10 µm and additional SEM is necessary for their proper identification; easily confused with already known species; absence of experience and patience.

Diatom diversity in the freshwater habitats is underestimated and there is a long way to record most of the species even in a small country as N. Macedonia. However, the number of common species is relatively small and many of the new species will remain as rare or infrequently recorded since originate from habitats that are not in the focus of environmental or funding agencies.

Sea turtle-specific diatoms are real

Roksana Majewska[1,2]

proximina@o2.pl

[1]Division of Algae and Microbial Biotechnology, Faculty of Biosciences and Aquaculture, Nord University, 8049 Bodø, Norway
[2]Unit for Environmental Sciences and Management, Faculty of Natural and Agricultural Sciences, North-West University, 2520 Potchefstroom, South Africa

Although diatoms are well known to grow on a variety of submerged and humid surfaces, substratum specificity in diatoms is still a subject of ongoing debate. Do properties of the attachment surface matter, or is it rather the combination of environmental and biological factors prevailing at a certain location? Or is it both or neither of these? In recent years, there has been a growing interest in animal-associated diatoms. Yet the notion of exclusively epizoic diatoms that require their animal hosts to survive is still not easily accepted.
Eight years after the publication of the first report describing diatom communities on sea turtles (Majewska et al. 2015), this talk will summarise several follow-up studies (e.g. Robinson et al. 2016, Majewska et al. 2017, Azari et al. 2020) and unpublished data to answer the question of whether some diatom species prefer sea turtle substratum over other hard surfaces available within their range, including feeding, mating, and nesting areas. Based on hundreds of biofilm samples collected across multiple seasons, sampling locations, substrata, and sea turtle species, the presented data will show that:

a) sea turtle diatom communities differ from those growing on other biotic and abiotic hard surfaces available within the sampling area,
b) there are striking compositional differences between diatom communities inhabiting sea turtle skin and carapace,
c) sea turtle macro-epibionts, such as barnacles, host their own diatom communities that differ from those present on the sea turtle skin and carapace, further increasing the complexity of the epibiotic relationships,
d) some diatom species and genera live only on sea turtles.

The presentation will further discuss these findings in the broader context of diatom epibiosis on animals. It will also provide tentative explanations for why certain aquatic animals host compositionally unique diatom communities, whereas others are inhabited by seemingly opportunistic taxa or do not host any diatoms at all.

References:

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What if Ross was right, that "when a large number of populations are examined... the various forms are found so to intergrade that there seems little justification for the taxonomic recognition of them at any level"?

David G. Mann[1,2]

dmann@rbge.org.uk

[1]Royal Botanic Garden Edinburgh, Edinburgh EH3 5LR, Scotland, UK
[2]Marine and Continental Waters, Institute for Food and Agricultural Research and Technology (IRTA), Crta de Poble Nou Km 5.5, E-43540 La Ràpita, Catalunya, Spain

This presentation focuses on the practice and practicalities of discovering and separating species. The quotation in the title comes from Robert Ross [1963, Bull. Brit. Mus. (Nat. Hist.), Bot., 3(2): 47–92] and referred to *Navicula pupula*, in which Ross noted that the outline was very variable and there was "quite a wide range in the density of its striation." We don't know how many populations Ross studied (he specifies only seven), but it probably was indeed a large number, since diatoms corresponding to the older concept of *N. pupula* – a naviculoid diatom with polar bars and a wide, band-like central area – are abundant in many lotic and lentic freshwaters. Since the 1980s, however, studies looking at *Navicula* (now *Sellaphora*) *pupula* in different ways (phylogenetic, ecological, mating), or using different data sources (LM and SEM morphology, gene sequences), have indicated that Ross's picture of a single intergrading species hides a lot: locally coexisting demes differ with respect to slowly evolving genes, can be reproductively isolated, and experience different intensities of attack by parasitoids; non-coexisting demes sometimes show correlations with ecological conditions (e.g. eutrophic vs mesotrophic); some demes are widely distributed, others apparently more restricted.

Nevertheless, Ross's conclusion about *Sellaphora pupula* – which is in fact what many people apply in practice – would be arguable, were it not for phylogenetic DNA-based evidence that *S. pupula* sensu Ross is paraphyletic with respect to *S. bacillum*. In most diatoms, however, only limited morphological data are available and the sandy-shore *Hantzschia marina* offers a prime example of how difficult it can be to reach any secure conclusion about species separation on this basis. My studies (since the mid 1970s) leave me in little doubt that a real evolutionary entity exists corresponding to *H. marina* as generally understood. However, in any particular locality, two or more demes occur, sharply separated in metric LM characters and ultrastructure – but the demes in one locality often differ from those at other localities. Overall, as more and more samples are studied, gaps in the LM variation pattern seem to disappear. But lacking a general understanding of speciation along a linear habitat, sampling is haphazard; lacking an LM framework, it becomes impractical to gather complementary ultrastructural data; lacking DNA reference sequences and metabarcoding data, no molecular genetic perspective is available; lacking knowledge of reproductive biology, interpretation is crippled. There is no straightforward practical solution. Perhaps Ross's advice is best.

Restoration matters: Diatom community response to the time since the restoration of sewage channels of the Boye catchment (Germany)

Ntambwe A. Serge Mayombo, Michael Kloster[1], Danijela Vidakovic, Andrea Burfeid-Castellanos & Bánk Beszteri

ntambwe.mayombo@uni-due.de

University of Duisburg-Essen, Faculty of Biology, Phycology Group, Essen, Germany

The Ruhr area in western Germany is characterised by high industrialisation and population density. Located in an alluvial plain, some natural rivers have historically been coerced to carry wastewater through concrete channels, as technology has only recently allowed the use of separate sewage systems. Since the 1990s, the morphological and compositional restoration of these channelized rivers has begun and impacted their ecosystems. Our knowledge of how the restoration affects the ecosystems in general and diatoms, in particular, is still limited. Using molecular and digital light microscopy on samples collected in spring 2021 and 2022 from river sites along the Boye catchment, following a time-since-restoration-gradient, we aimed to analyse the effect of restoration on diatom diversity and community composition. Diatom species richness was not significantly higher in samples from natural urban rivers that never contained sewage or were constrained by concrete channelling than in renatured localities. However, using an 18S-V9 marker to characterise the protist biofilm composition, some differences were highlighted. Diatom communities were similar, with a predominance of *Achnanthidium minutissimum* (Kützing) Czarnecki, independent of local differences in hydrology and water composition. The natural sites tended to have a greater predominance of *Planothidium frequentissimum* (Lange-Bertalot in Krammer and Lange-Bertalot) Lange-Bertalot and other taxa. As all sites, from natural to recently restored, are urban rivers and as such are affected by anthropogenic pressures, both microscopy and molecular methods showed some degree of degradation in their ecosystems. The overall water quality of the streams ranged from moderate to very good, indicating the positive impacts of the restoration works conducted in these former sewage channels. In this first study reporting on the recovery of the diatom community in the Boye catchment after restoration following a severe anthropogenic impact, we see that the diatom community is recovering relatively quickly, but only to a stage that indicates that some chemical pollution is likely still present.

Exploring benthic diatom diversity in Antarctica: insights from a morphological and metabarcoding approach

Katherina Schimani[1], Nélida Abarca[1], Oliver Skibbe[1], Heba Mohammad[1], Regine Jahn[1], Wolf-Henning Kusber[1], Gabriela Campana[2] & Jonas Zimmermann[1]

k.schimani@bo.berlin

[1]Botanic Garden and Botanical Museum Berlin-Dahlem, Freie Universität Berlin, Germany, Berlin, Germany
[2]Department of Coastal Biology, Argentinean Antarctic Institute, Buenos Aires, Argentina

Polar regions are among the most extreme habitats on Earth. Organisms in those regions must deal with extreme light and temperature regimes. However, diatom biodiversity is much more extensive and ecologically diverse than previously thought. The objective of this study was to add knowledge to benthic diatom biodiversity via the identification by the means of morphological and molecular methods (DNA Metabarcoding). In addition, a taxonomically validated reference library for Antarctic benthic diatoms was established with comprehensive information on habitat, morphology and DNA barcodes. Benthic samples (biofilm from stones and epipsammic biofilm) from marine, brackish water and freshwater habitats were taken in austral summer 2020 at the Potter Cove (Antarctic Peninsula). A total of 161 clonal cultures were established, resulting in the identification of 59 taxa: 35 of those taxa could be identified to species level and 18 to genus level. Only 5 had already a sequence record in the International Nucleotide Sequence Database Collaboration databases. The morphological analysis found 166 taxa, in contrast to the 810 and 1439 ASVs which were recovered with rbcL and 18SV4 metabarcoding respectively. However, several ASVs were assigned to the same taxon from the taxonomic reference library. Therefore, 59 and 57 genera were found based on rbcL and 18SV4 metabarcoding respectively and 62 genera were detected by morphological identification. In total, 36 genera were retrieved in all datasets. The combination of the total morphological richness of 166 taxa with 74 taxa just assigned by metabarcoding resulted in 240 infrageneric taxa. Of those taxa, 33 were retrieved by all three methods and 112 only by morphology. The barcode reference library of Antarctic species allowed the assignment of 46 taxa by metabarcoding which would have been left unassigned because no matching reference sequences were available before. Non-metric multidimensional scaling analysis of morphological as well as molecular data showed a clear separation of diatom community according to water and substratum type. However, discrepancies between the datasets exist. Many species especially marine taxa have still no record in reference databases. This highlights the need for a more comprehensive library to further improve routine diatom metabarcoding. Furthermore, several bigger species were overrepresented by metabarcoding especially in the 18SV4 dataset due to higher gene copy numbers per cell. Overall, a combination of morphological and molecular methods accompanied by culturing increases the detection and identification of diatoms as the methods provide complementary information on biodiversity of benthic diatoms in this region.

Hidden diversity: Revisiting the genus *Discostella*

Konrad Schultz[1], Mirko Dreßler[1,2], Olivier Jaques[3] & Thomas Hübener[1]

konrad.schultz@uni-rostock.de

[1]Department of Botany, Institute of Biological Sciences, University of Rostock, Wismarsche Str. 44/45, 18051 Rostock, Germany
[2]Physical Geography, Institute for Geography and Geology, University of Greifswald, Greifswald, Friedrich-Ludwig-Jahn Str. 16, 17487 Greifswald, Germany
[3]Laboratoire de paléoécologie aquatique (LPA), Département de géographie, Université Laval, Québec, QC G1V 0A6, Canada

Within thalassiosiroid diatoms, the genus *Discostella* is common in planktonic freshwater communities worldwide. Sixteen extant species are currently known, many of which are morphologically very similar. This is a relatively low number of species in comparison to related genera like *Stephanodiscus*, *Lindavia* or *Pantocsekiella*. In applied taxonomy often only broader concepts of *Discostella stelligera* and *D. pseudostelligera* are used. To assess the species diversity within the genus, more than 60 monoclonal strains from water bodies worldwide were established and investigated using morphometric and molecular methods. Up to 22 operational taxonomic units (OTUs) were identified. For the taxonomic assignment of the OTUs, a detailed morphological analysis including several type materials of critical taxa (*D. stelligera*, *D. tatrica*, *D. woltereckii*, *D. pseudostelligera* and *D. stelligeroides*) was performed. Morphological differentiation between the found groups is challenging, but in many cases possible, mostly relying on ultrastructure features. Up to 15 OTUs did not fit any existing species, revealing a distinct degree of previously undetected diversity in the genus. It seems reasonable to assume that difficulties concerning the taxonomy and morphological differentiation are responsible for the relatively low number of known species rather than a lack of species diversity in the genus. In addition, the intrageneric phylogenetic structure of *Discostella* was explored using four different molecular markers (18S, LSU, rbcL and cox1). A comparison of the different markers revealed hints of a more complex intrageneric structure possibly due to reticulate evolutionary processes.

The diatom collection of Albert Grunow (1826–1914) at the herbarium of the Natural History Museum Vienna (W)

Tanja M. Schuster[1], David M. Williams[2] & Bart Van de Vijver[3,4]

tanja.schuster@nhm-wien.ac.at

[1]Natural History Museum, Department of Botany, Herbarium, Burgring 7, 1010 Vienna, Austria
[2]Department of Life Sciences, the Natural History Museum, Cromwell Road, London, SW7 5BD, UK
[3]Meise Botanic Garden, Research Department, Nieuwelaan 38, B-1860 Meise, Belgium
[4]University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, B-2610 Wilrijk, Belgium

Albert Grunow (1826–1914) was a prolific diatomist, who described thousands of taxa. His work is foundational and greatly improved our knowledge of diatom taxonomy. Grunow's historical collection is still relevant for modern biodiversity research, as it includes many types and other historical material. Thorough taxonomic work considering type and other relevant original material is critical in view of the role of diatoms as aquatic bioindicator species (e.g., for water quality monitoring purposes), Earth's history, and environmental change modelling.
Here, we introduce the Grunow diatom collection at the Department of Botany of the Natural History Museum Vienna (herbarium W), its components and included object types, their organization, and management. The collection is complex for various reasons. For one, it encompasses a great variety of material types (e.g., loose diatomaceous earth in capsules; samples mounted on card, glass, or mica; microscope slides and other preparations; drawings; accession books (= catalogue); literature annotated by Grunow, and others). Second, its components are interlinked and need to be considered together for identifying and locating specimens, which therefore involves a series of steps. Third, Grunow's collection includes a lot of material sent to him by other collectors, resulting in various numbering systems for collector vs sample numbers that need to be reconciled, often across multiple institutions. The aim of this contribution is to detail this complexity for facilitating material requests to the W herbarium by giving a step by step example pinpointing original and other historical material of *Achnanthes inflata* (Kützing) Grunow. This shows how such material is located in the collection, so requesters know which information to supply to speed up a search within the diatom collection.

The diversity of *Halamphora* in Turkey

Cüneyt Nadir Solak[1], Paul B. Hamilton[2], Zlatko Levkov[3], Nesil Ertorun[4], Elif Yılmaz[1,5] & Saúl Blanco[6]

cnsolak@gmail.com

[1]Dumlupınar University, Faculty of Arts and Sciences, Department of Biology, 43000 Kütahya, Turkey
[2]Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, Ontario K1P6P4, Canada
[3]Institute of Biology, Faculty of Natural Sciences, Gazi Baba bb, 1000 Skopje, R. Macedonia
[4]Department of Biology, Science Faculty, Eskişehir Technical University, Eskişehir, Turkey
[5]Institute of Marine and Environmental Sciences, University of Szczecin, Mickiewicza 16, 70-383 Szczecin, Poland
[6]Departamento de Biodiversidad y Gestión Ambiental, Facultad de Ciencias Biológicas y Ambientales, Universidad de León, Campus de Vegazana s/n, 24071, León, España

The genus *Halamphora* (Cleve) Levkov was originally described as a subgenus of *Amphora* Ehrenberg ex Kützing by Mereschkowsky, based on a chloroplast with two more or less longitudinal sinuses (bilobed), with edges not usually returning to the dorsal side. *Halamphora* is currently characterized by the following set of morphological features: i) dorsiventral linear, semi-lanceolate to semi-elliptical valves with irregular but frequently elongated and protracted valve apices; ii) raphe eccentric, located on a ventral, raphe ledge (forming a partial conopeum), with the terminal raphe fissures ventrally curved and the central raphe endings straight or dorsally deflected, terminating internally onto a single helictoglossa fused into one compact structure (rectelevatum) which is elevated inwardly from the rest of the valve; and iii) numerous open girdle bands with one to two rows of perforations. In this study, highly alkaline in Mediterranean and Eastern Anatolian regions, highly acidic environments in Western Anatolia, brackish lakes in Inner Anatolia and lagoon lakes in Black Sea region were investigated the results showed that there is a high diversity of morphologically variable species in extreme environments in Turkey.

Acknowledgement

The work was supported by Kütahya Dumlupınar University Scientific Research Projects Coordination Unit (Grant no: 2022-45) and SEM studies were supported by Eskişehir Technical University Scientific Research Projects Coordination Unit (Grant no: 19ADP073).

An insight into the crenic diatom communities found in several karstic springs (Apuseni Mountains)

Anca-Mihaela Șuteu[1,2], Andreea Rebeka Zsigmond[4] & Mihai Pușcaș[2,3]

anca.ciorca@ubbcluj.ro

[1]Doctoral School of Integrative Biology, Babeș-Bolyai University, Cluj-Napoca, Romania
[2]A. Borza Botanic Garden, Babeș-Bolyai University, Cluj-Napoca, Romania
[3]Faculty of Biology and Geology, Babeș-Bolyai University, Cluj-Napoca, Romania
[4]Department of Environmental Science, Sapientia Hungarian University of Transylvania, Cluj-Napoca, Romania

The geomorphological and hydrological characteristics have shaped springs into being a suitable aquatic habitat for a high number of microorganisms. Diatoms often display distinct preferences for a specific type of available substrate. Thus, the neutral substrate hypothesis was tested on the crenic diatoms found in the eucrenal area. The present study includes qualitative and quantitative diatom samples taken from 30 karstic springs located in the Apuseni Mountains (Romania). A total of 15 diatom samples was taken from each spring, choosing 5 different spots in the eucrenal area for each of the three substrate types: bryophytes, stones, and sand. A total of 227 taxa were identified in the analysed samples, with 18.5% taxa expressing a preference for sand and 17% expressing a preference for bryophytes (from the preliminary data). The number of taxa found in each spring range from a minimum of 19 to a maximum of 69 (in the same number of slides for each aquatic ecosystem). *Gomphonema elegantissimum* and *Caloneis fontinalis*, along with other 13 taxa have been identified for the first time in Romania. Two groups of dominant taxa, according to the type of substrate they prefer, (present in at least 25 springs) have been observed: *Caloneis fontinalis*, *Cocconeis placentula* var. *euglypta*, *Cocconeis lineata*, *Meridion circulare* and *Navicula cryptotenella* in epibryon, followed by *Cocconeis placentula* and *Planothidium lanceolatum* in both, epibryon and epipsammic; three taxa *Achnanthidium minutissimum* and *Amphora pediculus* stand out as a dominant group in the all three types of substrates, but in epilithon samples these were the only dominant taxa. Based on the preliminary data, stones were found to be the neutral substrate for diatoms inhabiting the karstic springs. Only 25% of the total taxa (commonly observed on the other two substrates) were identified in epilithic samples. Whereas the highest number of taxa have been found in the samples collected above the sand and on bryophytes (106 and 86 taxa, respectively).

Palaeoecological changes of glacial lakes from the Late Pleistocene to Early Holocene of the Tatra Mts. (Slovakia)

Marina Vidhya[1], Radovan Pipík[1], Dušan Starek[2] & Rastislav Milovský[1]

vmarina@savbb.sk

[1]Earth Science Institute, Slovak Academy of Sciences, Ďumbierska 1, 97401 Banská Bystrica, Slovak Republic
[2]Earth Science Institute, Slovak Academy of Sciences, Dúbravská cesta 9, 84005 Bratislava, Slovak Republic

The limnic deposits of two glacial lakes of the High Tatra Mts. namely Batizovské pleso (BAT; at 1,884 m a.s.l.) and Nižné Temnosmrečinské pleso (TEM; at 1,677 m a.s.l) of granodioritic bedrock, were examined for fossil diatom assemblages to understand the climatic versus regional influence on these lakes. The cores were acquired with the help of UWITEC hydraulic corer with sediment layers subsampled and used for diatom analysis using standard methods. Few statistical approaches were applied to understand the shift in diatom communities subjected to short climatic oscillations.

The sedimentary log of these lakes composed of facies from varves of Late-Glacial to gyttja correlates to the changing diatom communities. Varve section of both the lakes show poor preservation of diatom frustules with low species diversity. These Late-Glacial facies show dominance of alkaliphilous and eutrophic taxa due to increased nutrient influx and alkalinity propagated by leaching of rocks during the deglaciation (BAT: *Gyrosigma acuminatum*, *Navicula cincta*; TEM: *Lindavia* agg., *Denticula tenuis*, *Amphora copulata*). This varve section terminates in TEM at ~14,500 cal. yr. BP and in BAT at ~13,300 cal. yr BP. Increase in acidophilous-oligotrophic taxa are seen in the short stadial events of Older and Younger Dryas (*Amphora eximia*, *Pinnularia acoricola*, and *Fragilaria tenera*).

With TEM deposits showing a sharp shift to gyttja deposition by mid Younger Dryas (~12,300 cal. yr. BP) was also reflected by sharp decrease in the acidophilous, oligotrophic, littoral diatoms, then replaced by taxa of higher trophic tolerance like *Pseudostaurosira pseudoconstruens*, *P. microstriata*, and *Staurosira construens* var. *venter*. However, gyttja deposition in BAT started by ~8,000 cal. yr. BP, which also consisted of similar dominant taxa as TEM. Although the trend of shifting communities in these two lakes due to the oscillation of interstadial to stadial are similar, TEM diatom communities reflect predominantly alkaline conditions throughout the Late-Glacial to Early Holocene; unlike BAT with diatom communities indicative of climatic influence. A regional to geographical impact in lake TEM could be a plausible factor for the dominance of alkaliphilous taxa and those favouring calcium enriched water.

Diatom diversity in drying river networks across Europe

Annika Vilmi[1], Núria Bonada[2,3], David Cunillera-Montcusí[2,4,5], Thibault Datry[6], Arnaud Foulquier[7], Naiara Lopez-Rojo[7], Heikki Mykrä[1], Romain Sarremejane[8] & Henna Snåre[1]

annika.vilmi@syke.fi

[1]Finnish Environment Institute, Paavo Havaksen tie 3, 90570 Oulu, Finland
[2]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Catalonia/Spain.
[3]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Catalonia/Spain.
[4]Departamento de Ecología y Gestión Ambiental, Centro Universitario Regional del Este (CURE), Universidad de la República, Tacuarembó s/n, Maldonado, Uruguay.
[5]GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Spain
[6]INRAE, UR RiverLy, centre de Lyon-Villeurbanne, 5 rue de la Doua CS70077, 69626 Villeurbanne Cedex, France
[7]Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, LECA, 38000 Grenoble, France
[8]School of Science and Technology, Nottingham Trent University, Nottingham, England, United Kingdom

In the H2020 project DRYvER (Securing Biodiversity, Functional Integrity, and Ecosystem Services in Drying River Networks), six European river networks are studied to understand how drying of streams affects local and network-scale biodiversity, ecosystem functioning, and ecosystem services.
At each of the six river networks, Butižnica (Croatia), Velička (Czech Republic), Lepsämänjoki (Finland), Albarine (France), Bükkösdi-víz (Hungary) and Genal (Spain), at least 20 stream sites were sampled for multiple organism groups altogether six times in 2021. Sediment and biofilm biodiversity was characterized using a metabarcoding approach on environmental DNA (eDNA). All samples were amplified in triplicates, targeting the 18S gene of Eukaryota. Molecular Operational Taxonomic Units (MOTUs) were assigned a taxonomic clade, and a set of reference databases were used to refine taxonomic annotations. The MOTUs belonging to Bacillariophyta were selected for further investigations.
Using hydrological models, various metrics describing flow intermittence were produced. These metrics include, for each river network, the proportion of dry sites during a sampling campaign, and for each site and each campaign, the length of the dry period prior to sampling. In addition, site-specific environmental variables were recorded during each sampling campaign.
The impact of drying on alpha diversity of biofilm and sediment diatoms was analyzed with linear mixed effect models. At the river network scale, the MOTU richness of biofilm diatoms decreased as the proportion of dry sites increased. Furthermore, the longer the dry period prior to sampling, the lower the MOTU richness; this relationship was clearest in Butižnica

and Velička. For sediment diatoms, no similar relationship was observed between MOTU richness and proportion of dry sites in the river networks, but for Albarine, Butižnica and Velička, the longer the preceding dry period, the lower the MOTU richness. Overall, drying had negative impacts on diatom alpha diversity in the studied river networks.
Upcoming analyses will reveal how drying is related to temporal beta diversity and functional groups of diatom communities. This information will help us understand the multi-level impacts of climate change on riverine communities in drying river networks.

Fossils and phylogeny: *Euodia frauenfeldii* Grunow, an account of its phylogenetic relationships as revealed by morphology

David M. Williams[1], Tsvetoslav Georgiev[1,2], Tanja M. Schuster[3], & Carlos E. Wetzel[4]

d.m.williams@nhm.ac.uk

[1]The Natural History Museum, Cromwell Road, London, SW7 5BD, UK London, UK
[2]Imperial College London, Department of Life Sciences, London, UK
[3]Natural History Museum, Department of Botany, Herbarium, Burgring 7, 1010 Vienna, Austria
[4]Luxembourg Institute of Science and Technology (LIST), Environmental Research & Innovation (ERIN) Department, Luxembourg

The species first described as *Euodia frauenfeldii* Grunow has the characteristic 'semi-circular' valves found in most species of *Euodia* J.W. Bailey, but also has conspicuous transapical costae ('transapical ribs'). As a consequence, it was transferred to *Eunotogramma* Weisse. Of the species placed in Euodia since its first description, most have been transferred to *Hemidiscus* Wallich, with a few exceptions, *Euodia frauenfeldii* being one. In this study, herbarium specimens of *Euodia frauenfeldii* have been examined with LM and SEM to document the structure of the valves and girdle. We offer a preliminary cladistic analysis to provide a working hypothesis of its relationships for future studies. We will also offer some comments on how to name *Euodia frauenfeldii* and on the role of fossils and phylogeny in the context of morphological data.

Microevolutionary dynamics in endemic diatom species in Lake Ohrid during the Quaternary period

Dušica Zaova[1], Elena Jovanovska[2], Aleksandra Cvetkoska[3], Bánk Beszteri[4] & Zlatko Levkov[1]

zaovad@pmf.ukim.mk

[1]Faculty of Natural Sciences and Mathematics, Skopje, R.N. Macedonia
[2]Department of Palaeoanthropology, Senckenberg Research Institute, Senckenberganlage 25, 60325, Frankfurt am Main, Germany
[3]Department of Aquatic Ecology, Netherlands Institute of Ecology (NIOO-KNAW), Wageningen, Netherlands
[4]Faculty of Biology, University of Duisburg-Essen, Essen, Germany

Under changing environmental conditions, species may alter their morphology to ensure their survival. While the effects of climate-induced environmental changes on species properties have been studied across different latitudinal gradients, their effects over geological time are much less known.
Here, we investigate if, when, and how environmental changes during the Quaternary affected the morphological properties of planktonic diatoms from Lake Ohrid. To this end, we compared environmental variables inferred from 1.36 million year old sedimentary data from Lake Ohrid with morphological and abundance changes in the most dominant and morphologically variable extinct species *Cyclotella cavitata* sensu lato.
Continuous and discrete morphological traits were used to distinguish 21 different morphological entities (morphotypes). “Standard models” of paleontology like gradualism or punctuated equilibria depict microevolution as a linear process with one morphotype grading into or being replaced by another in a temporal sequence. In contrast, we observed multiple morphotypes co-occurring in the period before ca. 650 ka. It is unclear whether these can be interpreted as co-occurring species or rather as somewhat distinct, perhaps environmentally induced morphological variants within a single species. Morphometric variation in this period can be described as a continuous expansion in morphospace, including a general increase in average and maximum frustule sizes, although the latter trend was interrupted twice during periods of marked environmental change.
We hypothesize that the large and increasing morphological variability might be explained by unstable conditions in the lake before 650 ka related to ontogenetic processes and ongoing deepening of the lake. The appearance and apparent coexistence of several different morphotypes possibly reflects short timescale temporal turnover of different morphotypes inhabiting different niches in a more variable environment. The establishment of more stable conditions accompanying deepening might have led to temporally more homogeneous system providing less distinct niche types, signified by the presence of one single morphotype at a time from ca. 650 ka.

Poster presentations

P27: Comprehensive Revisions to the Antarctic Freshwater Diatoms website

Lane Allen & Diane McKnight

Lane.Allen@colorado.edu

Institute of Arctic and Alpine Research, University of Colorado, Boulder, 4001 Discovery Dr. Boulder CO, 80303, USA

Websites are ideal resources for diatom taxonomy because they can be more comprehensive, accessible, and interactive than journal articles or books. Additionally, websites can easily be updated to reflect changes in primary literature. However, because the taxonomy is updated frequently, websites which are not maintained can become less useful over time. Since the "Antarctic Freshwater Diatoms" website was created primarily in order to aid researchers working on samples from the McMurdo Dry Valleys (MDV), most of the attention and maintenance has been devoted to taxa found in the MDV. On account of this, many of the pages written for taxa that occur outside of the MDV are incomplete, include errors, or are simply out of date. Currently the website requires a comprehensive review, and revisions in order to restore it's utility as a taxonomic resource. The necessary revisions include, but are not limited to; updating outdated taxonomy (i.e. *Diadesmis* spp.), updating *Index Nominum Algarum* links, correcting authorship, correcting citations, and correcting basionyms. Amongst the rather simple corrections, there are a number of issues that will require more attention, such as the taxon currently listed on the website as *Staurosira pinnata*, which belongs in the genus *Staurosirella* and may deserve recognition as a novel taxon. There are also taxa that have been identified as species originally described from material outside of Antarctica and may merit re-examination. *Luticola mutica* for example, was originally described nearly two centuries ago and has suffered extensive species concept drift in the intervening years. The taxon currently identified as *Luticola mutica* from the McMurdo Dry Valleys is not *Luticola mutica* sensu stricto but possibly a novel and endemic taxon. Aside from correcting existing pages, numerous novel taxa have been described from Antarctica and the Antarctic islands in the previous decade, all of which should be uploaded to the website.

P46: Reconstruction of the palaeoenvironment at the Roman castellum of Aardenburg (southern Netherlands) based on palynological and diatom analysis

Coralie André[1], Dante de Ruijsscher[2], Wim De Clercq[2], Frieda Bogemans[3], Bart Van de Vijver[4,5], Annelies Storme[6] & Stephen Louwye[1]

Coralie.Andre@Ugent.be

[1]Ghent University, Department of Geology, Krijgslaan 281-S8, 9000 Ghent, Belgium
[2]Ghent University, Department of Archaeology, Campus Ufo, Sint-Pietersnieuwstraat 35, 9000 Ghent, Belgium
[3]Royal Belgian Institute of Natural Sciences, Geological Survey of Belgium, Rue Jenner 13, 1000 Brussels, Belgium
[4]Meise Botanic Garden, Research Department, Nieuwelaan 38, B-1860 Meise, Belgium
[5]University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, 2610 Wilrijk, Belgium
[6]Ruben Willaert nv, Ten Briele 14.15, 8200 Sint-Michiels, Belgium

The Roman *castellum* of Aardenburg lies strategically on a Pleistocene sandy ridge bordering the coastal plain in Zeeland, the Netherlands. The dynamic character of the coastal plain was rather attractive and offered the opportunity for specific economic activities. Although many archaeological excavations took place at Aardenburg, palaeoenvironmental research was limited to the macrobotanical analysis of a Roman well and a medieval pit. Two pollen boxes at two sites were recently sampled at Aardenburg, and 37 samples were studied for palynological and diatom analyses aiming at the reconstruction of the terrestrial and aquatic palaeoenvironments. At the base of the pollen box "Burchtstraat", located on the edge of the defence ditch surrounding the Roman castellum, a peat bog corresponds to the Middle Holocene ombrotrophic peat layer of the coastal plain. This signal is not visible in the pollen box "Peurssensstraat" located more to the north. Instead, a "siliciclastic" peat formed dominated by trees and shrubs, and benthic brackish-marine diatoms (e.g. *Diploneis didyma* and *Tryblionella navicularis*), reflecting a mudflat. The overlying Roman waste layer records the same woodland-dominated landscape along with a disturbed environment. The diatoms are dominated by tychoplanktonic marine-brackish species (e.g. *Paralia sulcata* and *Cymatosira belgica*), indicating a marine influence. Furthermore, halophytes and dinoflagellate cysts are recorded in the Roman waste layer and increase in the above-lying marine clay deposits, suggesting the proximity of the coastal plain and an increase in tidal influence. The high percentages of spores (e.g., Sphagnum) are linked to peat excavation for fuel and to reworked peat eroded transported by tidal channel activity. The clay overlying the Middle Holocene peat bog at Burchtstraat holds marine and freshwater palynomorphs and diatoms, indicating that the ditch was receiving seawater via a tidal channel and freshwater most probably via the river Ee. This signal disappears in the overlying high medieval waste layer, where woodland and (reworked) peat dominate the pollen sum. The construction of ramparts in 1299 halted the marine influence. The coastal environment is less visible in the presumably (post-) medieval top silt layer at Peurssensstraat, which holds high numbers of anthropogenic palynomorphs, suggesting that the area was already embanked.

P48: Climatic instability in the middle Late Pleistocene inferred from diatom distributions in Lake Nkunga and Sacred Lake, Mount Kenya

Leila Ben Khelifa[1], F. Alayne Street-Perrott[2], Daniel O. Olago[3] & Katherine J. Ficken[2]

leila.ben_khelifa@sorbonne-universite.fr

[1]ISTeP-UMR7193, Sorbonne Université, 4 place Jussieu, 75005 Paris, France
[2]Dept. of Geography, Faculty of Science and Engineering, Swansea University, Swansea SA2 8PP, UK
[3]Dept. of Earth and Climate Sciences, University of Nairobi, PO Box 30197, Nairobi, Kenya

Lake Nkunga (1820m asl) and Sacred Lake (2350m asl) are shallow, swampy, freshwater lakes occupying volcanic craters within montane rainforest. We compare the middle Late Pleistocene sections of cores NK1 and SL1/2. Core NK1 from Lake Nkunga exhibits a major hiatus between ~35ka and ~1ka (cal. yr BP). The basal silty organic muds (2118-1925cm) display quasi-annual laminations with alternating *Aulacoseira* and planktonic, needle-shaped Nitzschia, implying changes in productivity and light intensity within a deep stratified lake, which was surrounded by dry, C3 forest vegetation. The laminated section may represent MIS 5a. *Aulacoseira granulata* and varieties*, Aulacoseira ambigua* and *Aulacoseira* sp are well preserved and most common in the basal brown layers, indicating eutrophic conditions. *Nitzschia* species dominate the basal white layers, particularly at levels 2024cm (75.5%) and 1938cm (95%), corresponding to the maximum water depth. From 1925 to 562cm (>38ka), the organic lake muds are rich in grass and high-altitude pollens, as well as aquatic-macrophyte biomarkers, suggesting colder, drier, shallower conditions. However, large, millennial-scale fluctuations in organic C, δ13C and detrital content indicate marked climatic instability. The diatom distributions also reflect instability, with complete disappearance of *Nitzschia* at 1808cm, replaced by *Staurosirella pinnata* and *Staurosira construens* and varieties. Acidophilous species suggest unstable wet phases with variable pH conditions. At 1660cm, *Aulacoseira ambigua* is dominant; the palaeolake was shallower with water temperatures of 20-28°C (cf. Gasse, 1986). *Aulacoseira*/*Staurosirella* competition continued up to 1320cm. From 1278 to 562cm, tolerant species *Sellophora pupula* and epiphytic *Encyonema muelleri* dominant reflect low water levels, but instability persists with *Staurosirella* dominant at 1170, 1136 and 564cm. The assemblage with *Staurosirella*/*Staurosira* lasts until lake desiccation before the Last Glacial Maximum. In Sacred Lake, the base of the highly organic lake muds and peats in core SL1 is dated ~49ka (Loomis et al, 2012). Parallel cores SL1 and SL2 contain a group of trachytic ashes dated ~27-35ka, associated with a single dominance of *Aulacoseira* spp. Instability is inferred from the alternation of *Aulacoseira*/*Staurosira*; the assemblages reflect pH fluctuations in a lake that was persistently nutrient-poor, apart from episodes of allochthonous sediment input from local eruptions or periglacial debris flows from the crater walls. Although only limited overlap exists between NK1 and SL1/2, we conclude that during the middle Late Pleistocene, this equatorial mountain experienced large, millennial-scale climatic fluctuations, similar to Antarctic ice cores (Spahni et al, 2005).

P03: Sample size and diatom morphometry: a plea for taxonomic diagnoses

Saúl Blanco[1,2] & Adriana Olenici[2,3]

sblal@unileon.es

[1]Department of Biodiversity and Environmental Management, University of Leon, E24007 Leon, Spain
[2]Laboratory of Diatomology, La Serna 58, E2400 Leon, Spain
[3]Babes-Bolyai University, Faculty of Environmental Science and Engineering, Cluj-Napoca, Romania

We discuss the use of morphometric and meristic parameters in the diagnosis of new taxa. The usual aim is to provide the "normal" range of these parameters, but the actual meaning of these intervals is unclear in most cases. Subsequent studies may correct or broaden these ranges, but identification at a specific level of these organisms is usually based on these parameters. However, some diagnoses are based on a small sample size or a single individual, leading to incorrect identification and inaccurate biomonitoring studies. Few papers dealing with descriptions or morphological studies of diatoms specify sample sizes. The determination of minimal sample size required for characterizing a population is a classic topic in biostatistics. However, few diatom morphometric parameters follow normal distributions and many taxa have a multimodal distribution in cell length, making it challenging to determine the tolerance interval. Nonparametric tolerance intervals offer a simple, robust tool for assessing the probable sample set coverage. The communication discusses the determination of the minimal sample size (MSS) required to accurately characterize a population of diatoms. Nonparametric tolerance intervals are a useful tool for assessing the probable sample set coverage. We also provide a formula to calculate the MSS needed to account for a specified interpercentile range with a given probability. In the case of diatom length, to obtain a range of values with a probability of 0.95 and a confidence level of 0.05, N=59 individuals should be measured.

P34: Distance decay in similarity between diatom populations: the case of *Achnanthidium minutissimum*

María Borrego-Ramos[1,2], Eloy Bécares[1,2], Eugenia Cordero-García[1] & Saúl Blanco[1,2]

mborr@unileon.es

[1]Diatom Lab, University of León - Universidad de León, IMARENABIO, La Serna St., 58, 24006 León, Spain
[2]LIMNO Group, Department of Biodiversity and Environmental Management, Faculty of Biological and Environmental Sciences, University of León - Universidad de León, 24007 León, Spain

The inverse relationship between geographic distance and similarity has been well established in the literature for several biological groups, including diatoms, but usually at the community level. This study explores the hypothesis that two populations of the same species will be more dissimilar the farther apart they are located in terms of gene sequences and average frustule shape.
We selected 77 Mediterranean shallow lakes within the Spanish part of the Duero River Basin with a wide chemical variability. In each pond, physical parameters were measured in situ and water samples were taken to determine nutrient levels in the laboratory. Diatom samples were also collected for simultaneous identification both by light microscopy and DNA metabarcoding (using rbcL marker).
In this study, we analysed for the first time the relationship between which part of the variability within the *Achnanthidium minutissimum* species is explained by morphological factors, genetic factors, environmental variables or geographical distances. To test these four approaches: morphological variability was studied by means of geometric morphometry, genetic differences by genetic distances, geographical component was measured by geographic coordinates and for the effect of environmental variables. With all these data, a Mantel test was carried out to determine what is the determining factor in population differences in the studied shallow lakes.

P30: Mediterranean intermittent streams – how to monitor multiple stressors on diatom and macroinvertebrate ecology and biodiversity

Andrea M. Burfeid-Castellanos[1] & Armin Lorenz[2]

andrea.burfeid-castellanos@uni-due.de

[1]University of Duisburg-Essen, Department of Phycology (Beszteri Lab), Universitätsstr. 2., 45141 Essen, Germany
[2]University of Duisburg-Essen, Department of Aquatic Ecology, Universitätsstr. 2, 45141, Essen, Germany

Mediterranean intermittent streams are characterized by low flow to dry ecosystems which sporadically have high flow peaks, cycling through four characteristic fluvial stages. The dry summers provide a process of flow contraction, fragmentation (loss of connectivity), desiccation (lacking surface water) followed by expansion (reconnection of surface water due to rainfall). This has a selective effect on the organisms living in the ecosystem, that is further increased by anthropogenic pressures like effluents or adjacent land use. Nonetheless, these types of streams still need to adhere to the Water Framework Directive and reach at least good ecological quality. In order to monitor this, a fitting monitoring tool is needed and is the aim of this project. Using macroinvertebrates and diatoms from Spain, France, Italy, Israel and Tunisia sampled during the wet hydrological phase we identified them through imaging and molecular tools to capture their biodiversity and ecological status. Although the responses changed according to regions, in general invertebrates responded to organic pollution through species richness and diversity reduction, while diatom species richness increased. On the other hand, salinity emerged as an important stressor reducing diatoms species richness and diversity and creating very distinct species compositions. Through the results of this survey, we aim to identify the metrics that respond to the combined effect of flow intermittency and other external (mostly anthropogenic) stressors.

P22: The terrestrial diatom flora of Horseshoe and Lagotellerie Islands, Marguerite Bay; preliminary results

Tereza Cahová & Barbora Chattová

cahova.tereza@gmail.com

Department of Botany and Zoology, Faculty of Science, Masaryk University, Kotlarska 2, 61137 Brno, Czech Republic

This project summarises the preliminary results of the recent terrestrial diatom diversity survey on the Horseshoe and Lagotellerie islands. Horseshoe Island, with 60 km2, is the third largest island of Marguerite Bay, located south-central to the Antarctic Peninsula. It is surrounded on three sides by land higher than itself, and glaciers, semi-perennial ice, and snow cover about 66% of the island's surface. Lagotellerie Island is a small island of 1.5 km2, about three kilometres west of the south end of Horseshoe Island. It is designated as ASPA no. 115, primarily for protecting terrestrial flora and fauna, also focusing on the occurrence of the only two Antarctic vascular plants *Deschampsia antarctica* and *Colobanthus quitensis*. Nevertheless, there is still a lack of information on the diatom diversity of both islands. The presented study aims to bring the first general overview of both islands' current terrestrial diatom flora, focusing on species richness and diversity.

In 2019, 39 soil samples from Horseshoe Island and ten samples from Lagotellerie Island were collected. The observed diatom flora consists of 97 taxa from Horseshoe Island and 39 from Lagotellerie Island (excluding varieties and morphotypes). Based on presence/absence data, the most abundant species are *Humidophila vojtajarosikii*, *Pinnularia borealis*, *Luticola contii*, *Luticola truncata* and *Psammothidium rostrogermainii* on Horseshoe Island, and *Luticola muticopsis*, *Hantzschia amphioxys*, *Luticola truncata*, *Pinnularia borealis* and *Achnanthes muelleri* on Lagotellerie Island. Not all species could be identified using the current literature on the species level, and some species appear new to science; among those species are *Achnanthes* sp. or *Encyonopsis* sp. Furthermore, the genus *Luticola* showed high species diversity on Horseshoe Island; however, not as such on Lagotellerie Island.

The preliminary results revealed very diverse diatom flora, consisting of species characteristic to Maritime Antarctica and possibly species endemic to these islands. The presence/absence data showed a different spatial distribution of observed species, perhaps connected to the diverse geomorphology of both islands, providing various habitats with different environmental conditions. However, both islands deserve more attention and research, e.g. quantification of all samples, to determine diatom communities, their species composition, and their environmental requirements.

P37: A novel diatom-based biomonitoring method for Ecuadorian lotic habitats

Susana Chamorro[1,5], Jennifer Moyón[1], José Salazar[1], Karina Chamorro[2], Zaira Vicuña[2], Paula Cordero[3], Juan Carlos Navarro[4], Eloy Bécares[5] & Saúl Blanco[5]

sblal@unileon.es

[1]Facultad de Ingenierías y Ciencias Aplicadas, Universidad Internacional SEK, Avenida Alberto Einstein y 5ta Transversal, Carcelén, Quito, Ecuador.
[2]Microempresa Asociativa de Promotores Ambientales Cutín, Paseo peatonal3 de noviembre, casa Vélez, sector el Barranco, Cuenca, Ecuador.
[3]Grupo de Geociencia, Ambiente y Recursos Naturales. Universidad Católica de Cuenca, Avenida de Las Américas y Humboldt, Cuenca, Ecuador
[4]Facultad de Ciencias de la Salud, Universidad Internacional SEK, Avenida Alberto Einstein y 5ta Transversal, Carcelén, Quito, Ecuador.
[5]Departamento de Biodiversidad y Gestión Ambiental, Facultad de Ciencias Biológicas y Ambientales, Universidad de León, Campus de Vegazana s/n, León, España. Current address: Laboratorio de Diatomología. La Serna 58, 24007, León, España

Diatoms are widely used as ecological indicators of water quality, and diatom-based metrics are effective in monitoring freshwater ecosystems. However, in South America, microalgal assemblages have only recently been used for water quality assessment. The study aims to design and validate a new diatom metric, the Ecuador Diatom Index (EDI), on a regional scale, to improve water quality assessment in Ecuadorian river basins. The EDI reflects the overall limnological condition of a river measured through several abiotic parameters, integrated using a Water Quality Index (WQI). Biological sampling was conducted in 110 stations, and statistical analyses showed that the EDI, which considers optimum and tolerance, as well as specific frequency of occurrence and goodness-of-fit, outperformed the commonly used Specific Pollution Sensitivity (SPI) index.

P43: Diversity and seasonal flux of diatoms and other micro-planktonic organisms in SE Ionian Sea (Eastern Mediterranean)

Marie Cueille[1,2], Koen Sabbe[1] & Taniel Danelian[2]

marie.cueille@univ-lille.fr

[1]Ghent University, Lab. Protistology & Aquatic Ecology, Krijgslaan 281-S8, B-9000 Gent, Belgium
[2]University of Lille, UMR 8198 –Evo-Eco-Paleo, F-59000 Lille, France

The marine ecosystem of the enclosed and nutrient poor Eastern Mediterranean Sea (Emed) is expected to be strongly impacted by global climate change. Based on sediment trap material collected at 700m depth, this study presents seasonal data on the diatom assemblage of the eastern Ionian Sea between January and October 2015. The diatom data are then compared with other microplanktonic proxies.
We identified about 30-35 diatom taxa. Centric diatoms are dominant, with ca. 91% on average of the total diatom abundance. *Coscinodiscus radiatus*, *Asteromphalus marylandicus*, *Aulacoseira granulata* and *Ardissonea* cf. *crystallina* are the most common species and major contributors to the total flux. The vertical export of diatoms and other proxies show a seasonal signal controlled by climatic and oceanographic changes, such as water column mixing and/or SST variations. The diatom flux is highest in the late winter-early spring mixing period (up to 6.9 x 105 m-2 day-1). The lowest values are recorded in October (2.2 x 104 m-2 day-1). Early summer seems to be an important turning point for several taxa, with species newly appearing, export values decreasing, and a sudden increase in resting spores. Despite a majority of marine diatoms, the presence of freshwater species such as *Aulacoseira granulata* and *Stephanodiscus medius* would indicate a significant riverine influence, in agreement with the site's proximity to the coast of the Peloponnese.
Radiolarians and planktonic Foraminifera are very abundant in the sample. Both show the highest vertical export values in February, and then follow the same pattern as the diatom flux. Silicoflagellates contribute significantly to the total flux, with values up to 1.9 x 106 m-2 day-1, but show their highest flux values in June. Seasonal oceanographic changes in this coastal area seem to have a differential impact on the various microplanktonic organisms, depending on their size, mineral (cell wall) and trophic needs. More material from different sites in the EMed will be analysed to better understand seasonal pattern of EMed planktonic communities.

P35: Diatom communities in restored rivers at the Boye catchment

Mimoza Dani, Andrea M. Burfeid-Castellanos & Bánk Beszteri

mimoza.dani@stud.uni-due.de

University of Duisburg-Essen, Department of Phycology, Universitätsstr. 2, 45141 Essen, Germany

The Boye is a tributary to the Emscher river, that flows through the Ruhr area in North Rhine-Westphalia in western Germany. Since the 1860s and the beginning of the industrialisation, the streams were canalized and used to discharge the untreated wastewater of industries, agriculture and coal mining. When coal mining came to an end, Emscher and its tributaries started being restored with the aim to reach a good ecological status, as part of the effort directed towards the European Water Framework Directive (2000/60/CE).
In order to assess the effect of restoration based on benthic diatom communities, we sampled 9 sites in five restored rivers of the Boye. The sites differ in time since restoration and were sampled between 9 and 27 years after restoration. The main aim of this study was to assess the ecological status and to show the seasonal differences between samplings in summer and spring.
The diatom communities at the Boye catchment in summer comprised 119 species. In the downstream sites a higher species richness was found comparing to upstream and middle stream. Moreover, there was a high diversity and dissimilarity between the sites according to the species. To see the seasonal differences between the samplings, we observed the most common species in summer and in spring. But according to the permutation test, the season did not have a significant effect on diatom community composition and on abundance at the Boye catchment. As we saw, the ecological status was in summer as good as in spring, so this could be an effect of restoration. In our analyses, time since restoration, had a significant effect on abundance of diatom communities at the Boye catchment. The species richness of diatom communities showed variation, it went up and down between the sites, which were restored in different years. We didn't find seasonal differences between the diatom communities and the abundance at the Boye catchment by this observation.
The next step will be to observe more different years of restoration in order to have better results, including recently restored and reference rivers (never canalized), so we can see more precisely the differences between the time of restoration. This is a preliminary study which preceded the project described in Ntambwe A. Serge Mayombo's presentation (Restoration matters: Diatom community response to the time since the restoration of sewage channels of the Boye catchment (Germany)).

P01: The Walker Arnott samples and notes, a valuable part of the Van Heurck collection in Meise Botanic Garden

Myriam de Haan[1] & Bart Van de Vijver[1,2]

myriam.dehaan@botanicgardenmeise.be

[1]Meise Botanic Garden, Research Department, Nieuwelaan 38, BE-1860 Meise, Belgium
[2]University of Antwerp, Department of Biology, ECOSPHERE, Universiteitsplein 1, 2610 Wilrijk, Belgium

In 2006 the entire Henri Van Heurck collection, including his famous diatom gatherings, was donated by the municipality of Antwerp (Flanders, Belgium) as a permanent loan to the National Botanic Garden of Belgium. When the latter became Meise Botanic Garden in 2016, the Van Heurck collection became property of the Garden. This very valuable diatom collection comprises samples and notes from several prominent diatomists of the 19th century such as William Smith, Friedrich T. Kützing and Albert Grunow. In 2020, we started to digitize as much as possible of the collection data, a laborious work not in the least because the catalogue notes are handwritten with key words often abbreviated.
In this poster, we highlight a collection Van Heurck acquired: the George Arnott Walker Arnott gathering, together with the digitization of the corresponding notes and species lists. George A. Walker Arnott (1799–1868) was Professor of Botany at the University of Glasgow (Scotland, UK), who in the last part of his life focused on diatoms. He gathered a collection of about 2000 samples, often sent to him by a number of the active famous British diatomists of that time, such as R. Cresswell, Dr. Greville, W. Gregory, F. Kitten, F. Okeden, J.T. Norman, G. Norman, J.G. Rylands, and W. Smith. The importance of this collection is exceptional, because many of the samples are considered duplicates of type specimens that in some cases are missing from the original collection, housed in Royal Botanic Garden of Edinburgh (Scotland, UK). During the digitization we especially check the localities and provide extra information by combining data from several sources. When finished we intend to make this complete work freely available for the scientific community.

P44: The recent history of a protected soft-water site in north-eastern Belgium

Luc Denys, Jo Packet, An Leyssen & Floris Vanderhaeghe

luc.denys@inbo.be

Research Institute for Nature and Forest (INBO), Havenlaan 88 bus 73, BE-1000 Brussels, Belgium

Northern Belgium is still among the areas with the highest atmospheric nitrogen deposition in Europe. High deposition coincides with intensive livestock farming, adding to the problem. As in the neighbouring Netherlands, the Flemish Regional Government set out a Nitrogen Reduction Plan to alleviate this pressure on sensitive protected habitats, with mid-term goals in 2030 and 2045. Alongside, nature restoration is implemented in the most impacted areas, focussing, among others, on heathlands and the remaining shallow soft-water bodies situated within them.

The 'Zwart Water' (5.3 ha, Zmax. c. 2 m; Turnhout) lies within one of the most strongly debated Special Areas of Conservation in the north-eastern cover-sand area. Until recently one of the few sites with *Lobelia dortmanna* in Belgium, and still recognized as an important site for the conservation of 'Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae*' and *Luronium natans*, it is a focal site within a large-scale restoration project continuing already for several decades. Using diatom, macrophyte and water-chemistry data we tracked its environmental history over the last ninety years, documenting its least-impacted condition and subsequent acidification, as well as its response to restoration measures and partial recovery.

P32: Exploring the environmental factors driving the proliferation of *Achnanthidium delmontii* in Mediterranean streams (NW-Italy)

Elisa Falasco[1,2], Valentina La Morgia[3], Anna Risso[4], Marta Sacco[1], Marta Zoppi[1,2] & Francesca Bona[1,2]

elisa.falasco@unito.it

[1]DBIOS, University of Turin, Via Accademia Albertina, 13, I-10123 Turin, Italy
[2]ALPSTREAM, Alpine Stream Research Center/Parco del Monviso, I-12030 Ostana, Italy
[3]Institute for Environmental Protection and Research, Department for Environmental Monitoring and Protection and Biodiversity Conservation, via Ca' Fornacetta, 9, I-40064 Ozzano Emilia, Bologna, Italy
[4]ARPAL, Direzione Scientifica U.O. Pianificazione Strategica, Via Bombrini 8, I-16149 Genova, Italy

The aim of the present study is to investigate which physico-chemical parameters and hydromorphological features drive the presence and abundance of the invasive diatom *Achnanthidium delmontii* Pérès, Le Cohu and Barthès in some Mediterranean rivers of Liguria (NW-Italy). *Achnanthidium delmontii* was detected for the first time in 2013 and since that time, it has been rapidly spreading in several rivers, often becoming the dominant taxa within the community. We analysed diatom samples collected from 2008 to 2020, in 91 sampling sites, for a total of 210 records. Through a statistical model we highlighted that *A. delmontii* presence is strongly influenced by its occurrence in upper sections of the watershed or previous sampling campaigns: once established in a certain site the species no longer disappears. Moreover, we highlighted that *A. delmontii* prefers alkaline waters (optimum for pH = 8.34), medium-high water temperatures (optimum for T = 16.9°C) and that its abundance is significantly related to the percentage of agricultural surrounding land use. *Achnanthidium delmontii* abundance is also positively correlated with hydrological disturbance (i.e., extreme water scarcity events during summer, the presence of dams along the watercourse, significant water abstractions), but negatively affected by hydropeaking events. One of the most obvious consequences of *A. delmontii* appearance is the steep decrease, in some cases even disappearance, of *Achnanthidium pyrenaicum* (Hustedt) Kobayashi, one of the most widely spread and abundant species recorded in Liguria so far. Our results proved that the conservation of a good habitat integrity and heterogeneity, coupled with the maintenance of a natural flow represent important defence strategies against the establishment and proliferation of this species.

P33: Are the current Italian thresholds for nutrient concentrations suitable to define the "good" ecological status based on diatoms?

Elisa Falasco[1,2], Valentina La Morgia[3], Marta Zoppi[1,2] & Francesca Bona[1,2]

elisa.falasco@unito.it

[1]DBIOS, University of Turin, Via Accademia Albertina, 13, I-10123 Turin, Italy
[2]ALPSTREAM, Alpine Stream Research Center/Parco del Monviso, I-12030 Ostana, Italy
[3]Institute for Environmental Protection and Research, Department for Environmental Monitoring and Protection and Biodiversity Conservation, via Ca' Fornacetta, 9, I-40064 Ozzano Emilia, Bologna, Italy

The aim of the present study is to estimate a range of phosphorus and nitrate concentrations suitable to define the "good" ecological status of Italian rivers, basing on diatoms. We here analyzed data collected in the framework of the biomonitoring programs carried out in the Po river basin, the largest hydrographic system in Italy, between 2009 and 2019, for a total of 4086 samples. The relationships between the Italian Intercalibration Common Metric index (ICMi) and total phosphorus and nitrate concentrations were analyzed through regression analyses. The results indicate that the currently used quality standards for these two nutrients, which are based solely on chemical criteria, appear inadequate to support the objectives of the Water Framework Directive, particularly for total phosphorus, whose value should be roughly halved for all river macrotypes. For nitrates, we highlighted different results according to river macrotype: the estimated thresholds are much more stringent than those currently in use for siliceous Alpine and Mediterranean rivers. Finally, communities' analyses and the calculation of species optima for nutrients provided useful information concerning the autecology of some important diatom species. The identification of ecologically sound thresholds represents an important step toward improving the ecological status of one of the most impacted basins in Europe through appropriate measures to contain nutrient loads.

P17: New taxa of Rhaphoneidaceae Forti (Bacillariophyta) from the middle Eocene

Cécile Figus & Jakub Witkowski

cecile.figus@phd.usz.edu.pl

Institute of Marine and Environmental Sciences, University of Szczecin, ul. Mickiewicza 18, 70-383 Szczecin, Poland

Araphid diatoms are geologically ancient and became common in marine assemblages from the Eocene onward. Numerous new genera and species of araphids appeared in the middle Eocene. The Family Rhaphoneidaceae Forti includes the earliest forms of araphid diatoms found in sediments. The Rhaphoneidaceae currently have 15 genera, including two new middle Eocene taxa from the Blake Nose, western North Atlantic. The purpose of this presentation is to describe these two new genera and species, and to provide a comparison to other species in the Family Rhaphoneidaceae. Indeed, only a careful examination of our samples allowed us to identify and distinguish these taxa from other rhaphoneid species. *Adoneis pacifica* Andrews & Rivera, *Dickensoniaforma arctica* Scherer and *Rhaphoneis amphiceros* (Ehrenberg) Ehrenberg share some common characteristics with our new species. Examination of the assemblages is therefore important to avoid confusion in the identification of taxa.

P45: Diatom responses to climatic and anthropogenic disturbances on annually laminated lake sediments from Holzmaar (Germany)

M. Luján García, Stella Birlo & Bernd Zolitschka

garcia@uni-bremen.de

University of Bremen, Institute of Geography, GEOPOLAR, Germany

The frequency and severity of cold and warm events as well as of increased precipitation (flooding) events potentially can transform natural and socio-economic systems. It is not easy to detect such events of the past if these climatic deteriorations have occurred before the start of instrumental climate records, i.e. prior to the 19th century. During the Holocene, several climatic fluctuations from multidecadal to multicentennial scales occurred. In this study, we will focus on the time window from 500-800 BCE. During this period, one of the grand solar minima occurred (the Homeric minimum) and it was followed by a pronounced cultural shift from Bronze Age to Iron Age. Lacustrine environmental archives with annually laminated (varved) sediments, which make available a calendar-year chronology, are ideal for studying such short-term events. We present multiproxy analyses of varved sediments from Holzmaar (West-Eifel Volcanic Field, Germany) for this time window, including a diatom stratigraphy as well as physical and chemical proxies with decadal resolution. We aim at providing insights into climate-derived diatom biodiversity patterns, such as shifts of diatom assemblages related to changes in thermal stratification, e.g. blooms of *Stephanodiscus minutulus*. Moreover, diatom flora changes are supported by proxies relating to the source of organic matter, to allochthonous minerogenic input and to lacustrine productivity. Thus, we disentangle climatic mechanisms from anthropogenic influences. This contribution from Holzmaar is the starting point for a study comparing this short-term cold and wet event from different Central European varved lake records in order to establish a regional assessment for impacts of the Homerian Climate Anomaly.

P24: A voucher flora of diatoms from fens in the Tanana River floodplain, Alaska

Veronica A. Hamilton[1], Sylvia S. Lee[2], Allison R. Rober[3], Paula C. Furey[4], Kalina M. Manoylov[5] & Kevin H. Wyatt[6]

vahamilton2@bsu.edu

[1]Department of Biology, Ball State University, Muncie, Indiana 47306 USA
[2]Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC 20460, USA
[3]Department of Biology, Ball State University, Muncie, Indiana 47306 USA
[4]Department of Biology, St. Catherine University, St. Paul, MN, USA
[5]Department of Biological & Environmental Sciences, Georgia College & State University, Milledgeville, GA, USA
[6]Department of Biology, Ball State University, Muncie, Indiana 47306 USA

Climate change and human activities may alter the structure and function of boreal peatlands by warming waters and changing patterns in hydrology. Algal assemblages, especially diatoms can be used to assess or track these changes. However, effective biomonitoring requires consistent, reliable identification. To address the need for resources to support biomonitoring, this study evaluated the distribution of diatom species across a boreal fen gradient with the goal of building a voucher flora for interior Alaskan peatlands. Composite diatom samples were collected weekly during the summer growing season in 2017 from three peatland complexes (a rich, moderate, and poor fen), using natural transitions in water chemistry (e.g., pH) and vegetation assemblages that distinguish fen types. Cleaned diatom samples were imaged and assembled to capture the morphological range of each taxon. The fen diatom flora contained 35 genera comprised of 184 unique taxa. Across all peatland types, the most prevalent genera included *Eunotia* (45), *Gomphonema* (24), and *Pinnularia* (23). *Tabellaria* was common in the rich and moderate fens but became sparse in the poor fen. *Eunotia* showed the opposite trend. Twenty-five percent of the species matched those with at risk or declining status on the diatom Red List (developed in Germany), highlighting the conservation value of boreal wetland ecosystems. This voucher flora not only expands the regional knowledge of diatom biodiversity, but also provides an updated source of verifiable taxonomic information of inland Alaskan diatoms to build on Foged's treatment in 1981. This flora strengthens the potential to effectively track changes in water quality in boreal ecosystems sensitive to climate-related temperature and hydrological shifts and anthropogenic stressors.

P39: Freezing stress tolerance of freshwater Pinnulariaceae: comparison of strains from polar, alpine and temperate habitats

Eva Hejduková[1,2] & Linda Nedbalová[1,2]

hejdukova.eve@gmail.com

[1]Department of Ecology, Faculty of Science, Charles University, Viničná 7, 128 44 Prague 2, Czech Republic
[2]Institute of Botany of the Czech Academy of Sciences, Dukelská 135, 379 82 Třeboň, Czech Republic

Recent studies emphasized differences in survival between diatom strains from polar and temperate areas. Temperate diatoms originating from freshwater habitats appeared to be sensitive to environmental stresses such as freezing, heating or desiccation, and the only surviving species were strains belonging to the *Pinnularia borealis* species complex. This study focused on freshwater strains of *Pinnularia* from polar, alpine and temperate habitats. In total twelve strains were exposed to freezing down to: –4, –10, –20, –40, –80, and –196 °C (liquid nitrogen) as vegetative cells. Survivability was assessed by light microscopy observation and measurement of basal fluorescence of chlorophyll. Only the "mild" freezing treatment to –4 °C was survived by all the tested strains. The strains from alpine and polar regions showed a higher survival rate in comparison to temperate ones. From all the strains tested, only the polar strain of *P. catenaborealis* survived all the freezing treatments. Remarkably, –10 °C treatment appeared to be more harmful for this strain in comparison with –80 °C and liquid nitrogen treatment. We conclude that vegetative cells of freshwater benthic diatoms from the Pinnulariaceae family are able to survive mild freezing to –4°C mostly without being lethally injured or seriously harmed, though they are sensitive to deeper freezing, which could be related to environmental conditions of their original aquatic habitat.

P38: Influence of mine water effluent on diatom communities

Christina Jasinski, Andrea M. Burfeid-Castellanos, Bánk Beszteri

christina.jasinski@stud.uni-due.de

University of Duisburg-Essen, Faculty of Biology, Phycology Group, Essen, Germany

The German Ruhr area is known for a highly concentrated mining activity that started in the mid 1800´s and continued until 2018. As the area is found within the catchment of the river Ruhr, the abandoned mines tend to get filled with water, which has to be returned to the surface via pumping to maintain structural integrity of the mines. The effect that these heavy metal and salt containing waters have on ecosystems in general and diatoms in particular, had not been investigated yet. For this purpose, the communities of three mines in the Ruhr catchment area were examined in spring 2022. The aim of this study was to consider the influence of mine water effluent on diatom community structure, morphological health and biodiversity in various water bodies on the Ruhr area in Germany.

To survey their biodiversity, diatom communities were observed using digital microscopy. The water chemistry, focussing on saline and metal ions, was analysed using ion chromatography and multi-element analysis.

The chemical and physicochemical analyses showed an increased salinity, as well as an increased conductivity and increased chloride ion values. The heavy metals -iron and manganese- occur in concentrations that are three orders of magnitude higher than other metals.

We found that species composition differed significantly from non-polluted waters in the area. The sites at each mine-effluent influenced ecosystem conserved a similar diatom community structure. On the other hand, the individual aspect of salinity and the resulting increased chloride content and increased conductivity has an important effect on the community composition. However, metals only played a subordinate role.

In only one sample one predominant taxon with clear valve teratologies was found (*Fragilaria famelica* (Kützing) Lange-Bertalot) and it accounted for 49% of the valves. Other samples contained lower rates of teratologies, always under 2%, and with a variety of taxa affected.

The diversity is not lower in all samples than at other sites in the region, as only one of the three sample locations showed reduced diversity.

To sum up, we found that the mine effluent (heavy metals) had a lower impact on diatom morphology and biodiversity than we expected. However, the effluent had an important influence on community structure and composition.

P10: A review of some *Frustulia* species occurring in freshwaters of Britain and Ireland with documentation of the types of *Frustulia saxonica* and *Frustulia crassinervia*

Ingrid Jüttner[1], Bart Van de Vijver[2,3], David M. Williams[4], Eileen J. Cox[4], Carlos E. Wetzel[5]

ingrid.juettner@museumwales.ac.uk

[1]Amgueddfa Cymru – Museum Wales, Department of Natural Sciences, Cathays Park, Cardiff, CF10 3NP, UK
[2]Meise Botanic Garden, Research Department, Nieuwelaan 38, 1860 Meise, Belgium
[3]University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, 2610 Wilrijk, Belgium
[4]The Natural History Museum, Department of Life Sciences, London, SW7 5BD, UK
[5]Luxembourg Institute of Science and Technology (LIST), Environmental Research and Innovation Department (ERIN), Observatory for Climate, Environment and Biodiversity (OCEB), 41 rue du Brill, L–4422 Belvaux, Luxembourg

The morphology of eight species in the genus *Frustulia* from freshwaters in Scotland and Wales was investigated in light and scanning electron microscopy. They include *F. krammeri* Lange-Bertalot & Metzeltin, the types of *F. saxonica* Rabenhorst and *F. crassinervia* (Brébisson) Lange-Bertalot & Krammer, *F. quadrisinuata* Lange-Bertalot, *F. erifuga* Lange-Bertalot & Krammer, *F. amphipleuroides* (Grunow) Cleve-Euler, *F. vulgaris* (Thwaites) De Toni, and a *Frustulia* species which resembles *Berkella alpina* (Amossé) Carter (1993).
Frustulia krammeri, *F. saxonica*, *F. crassinervia* and *F. quadrisinuata* have rhombic, rhombic-lanceolate, lanceolate or elliptic-lanceolate valves which differ in the projection and width of the valve ends. *Frustulia erifuga* and *F. amphipleuroides* are larger species with lanceolate valves, and frustules of *F. vulgaris* and *B. alpina* are smaller with linear or linear-elliptic valves with subrostrate ends. *Berkella alpina* was based on *F. spicula* var. *alpina* Amossé (1972) nom. inval., a species described as *Berkella linearis* Ross & Sims (1978). The latter taxon is currently regarded as a synonym of *F. amosseana* Lange-Bertalot, together with *F. vulgaris* var. *capitata* Krasske, *F. spicula* var. *alpina* and *F. spicula* var. *spicula* partim (Rumrich et al. 2000). *Frustulia vulgaris* var. *capitata* and other illustrated specimens of *F. amosseana* have capitate apices and do not resemble *Berkella alpina* ≡ *F. spicula* var. *alpina* ≡ *Berkella linearis* as illustrated from France, Scotland and Wales. These specimens have subrostrate valve ends and it is suggested that *Berkella alpina* should be transferred to *Frustulia*. In the population from Wales, found on subaerial bryophytes on a wall behind a waterfall, two types of valves were observed, one almost without structure; these might be formed as an adaptation to protect the cells from desiccation in subaerial habitats. Depressions on either side of the raphe in some specimens are erosions of the external valve surface.

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P06: The genus *Tabularia* (formerly described as *Synedra*) in the William Smith Collection housed in Meise Botanic Garden

Lucija Kanjer[1], David M. Williams[2] & Bart Van de Vijver[3,4]

lucija.kanjer@biol.pmf.hr

[1]University of Zagreb, Faculty of Science, Department of Biology, Horvatovac 102a, 10000 Zagreb, Croatia
[2]Natural History Museum, Department of Life Sciences, Cromwell Road, London SW7 5BD, UK
[3]Meise Botanic Garden, Research Department, Nieuwelaan 38, B-1860 Meise, Belgium
[4]University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, B-2610 Wilrijk, Belgium

Friedrich Kützing originally used the name *Tabularia* as a subgenus of *Synedra*. He included eleven species and one variety, most of which were found in marine or brackish realm. Williams & Round (1986) considered the subgenus better treated as a genus and transferred four species into it, with *T. barbatula* as typus generis. Three distinct morphological groups were separated within *Tabularia*, based on morphological features, and subsequent work shows it to be a paraphyletic assemblage. In addition, a large number of taxa have been described as new for the genus or transferred into it. The large morphological variation demands the need for a revision of the genus. One way to better document this variability is to investigate the original material of historic diatom collections, mainly from the nineteenth century.

One of the larger collections containing members of the genus *Tabularia*, is the William Smith collection, mainly conserved in Meise Botanic Garden (Belgium) and the Natural History Museum in London (UK). Reverend Williams Smith's two-volume monograph A synopsis of the British Diatomaceae, published in 1853 and 1856, has been the most comprehensive work on British diatoms for over a century. The monograph was based on a large collection of UK samples collected by Smith in collaboration with various national and international phycologists. Smith described and/or documented many new taxa, including several *Synedra* species, nowadays placed in *Tabularia*.

The present poster will illustrate the different *Tabularia* taxa found in the William Smith Collection that is housed in Meise Botanic Garden. Based on observations of different *Tabularia* taxa, we will indicate how the genus *Tabularia* may be revised, making our study an incentive for further research on the genus. Overall, the study highlights the importance of careful analysis and revision of original material when making taxonomic transfers. This study will provide valuable insights into the diversity of *Tabularia* and highlight the need for a revision of the genus.

To sum up, we found that the mine effluent (heavy metals) had a lower impact on diatom morphology and biodiversity than we expected. However, the effluent had an important influence on community structure and composition.

P25: The Finnish benthic diatom data is opened for research

Satu Maaria Karjalainen, Päivi Korhonen, Jouko Rissanen & Annika Vilmi

satu.maaria.karjalainen@syke.fi

Finnish Environment Institute, Finland

Phytobenthos is one of the quality elements in water framework directive. In Finland, benthic diatoms have been used to estimate the ecological status of rivers since 2007. Couple of years later the lakes were also surveyed for benthic diatoms in littoral zones to supplement the national monitoring in Finland. Since then, there has been a need for a database where all taxonomic and sampling site data of benthic diatoms from Finnish rivers and lakes are collected.

The Benthic Diatom Information System (PIIRE) was developed to collect all Finnish benthic diatom data into one system. This system is linked to the Finnish Macroinvertebrate Information System (POHJE), where all the sampling sites of macroinvertebrates and benthic diatoms are placed. The taxonomic information of diatom taxa is obtained from the Finnish Biodiversity Information Facility (laji.fi), where new diatom taxa can be added with new species observations from Finnish rivers and lakes.

The Diatom Information System contains qualitative diatom data from environmental administration's monitoring programmes and operational monitoring in inland waters. In addition, it contains data from the research projects of the Finnish Environment Institute and other research organizations, the earliest data being from the 1980s. The information system contains species-by-site data and ecological values of species. The system also calculates several indices (e.g. IPS, ACID, TDI and % PT, TI and SI) and pH values. The material is mainly intended for researchers, environmental administrations, and consultants.

The material belongs to the Finnish Environment Institute's open materials (Creative Commons By 4.0 International). The system can be accessed through the Environmental Information Systems of Open information services of Finnish Environment Institute (Syke) (https://www.syke.fi/en-US/Open_information).

P04: UDE BioSLiDES – Virtual digital microscopy as a potential tool for taxonomy training and intercalibration

Michael Kloster, Andrea Burfeid-Castellanos & Bánk Beszteri

michael.kloster@uni-due.de

University of Duisburg-Essen, Faculty of Biology, Phycology Group, Essen, Germany

We developed UDE BioSLiDES, a system for virtual digital microscopy specifically designed for educational purposes, enabling realistic emulations of light microscopy-based investigations of different organisms. Currently it covers mostly plants, but also animals and protists such as diatoms, by more than 200 digital slides. These represent high-resolution scans of entire objects of examination or, in the case of smaller organisms, up to hundreds of them, over various focal planes. These scans are supplemented by additional information about the organism(s), different anatomical structures, sample preparation and microscopy technique.

The web browser-based viewer allows for interactively examining the specimen, whereby especially focal plane changes provide the possibility of working out three-dimensional structures – thus enabling a deeper insight into the object of investigation. All digital slides and supplemental data are freely available as Open Educational Resources in different formats for versatile use and repurposing.

Although originally designed for a different purpose, UDE BioSLiDES also has a potential use as a tool for diatom taxonomy training, with the option to extend it into a system for intercalibration and quality control.

P05: The amazing diversity in the genus *Orthoseira* on Papua New Guinea

Natalia Kochman-Kędziora[1] & Bart Van de Vijver[2,3]

bart.vandevijver@plantentuinmeise.be

[1]Department of Ecology and Environmental Protection, University of Rzeszów, Zelwerowicza 4, 35-601 Rzeszów, Poland
[2]Meise Botanic Garden, Research Department, Nieuwelaan 38, 1860 Meise, Belgium
[3]University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, 2610 WIlrijk, Belgium

During a survey of the aerophilic diatom flora on some localities in Papua New Guinea (Karkar Island, Boïsa Island), several morphologically distinguishable *Orthoseira* taxa have been observed by means of light and scanning electron microscopy. The genus *Orthoseira* is characterized by its typical central carinoportulae, the rather deep mantle and the well-developed girdle structure, composed of several broad copulae. Most species are typically found in aerophilic habitats such as the spray zone of waterfalls, moss carpets on tree trunks and soils.
At least four different taxa have been observed. They can be separated from each other based on the shape and structure of their linking spines, the structure of the carinoportulae, the valve surface structure composed of ridges, spines, rimmed areolae or simply large hyaline zones, and the girdle structure. The latter is often a neglected feature in the separation of the different morphological groups within *Orthoseira*. The ornamentation of the copulae varies in number and size of perforations and superficial warts and papillae. Additionally, the structure of the valvocopula also plays a distinct role in the characterization of the different taxa.
At present, none of the different observed taxa could be identified based on the currently available literature. Recently, the structure of the type of *Orthoseira roeseana* (Rabenhorst) Pfitzer was analysed showing that most records of the latter should be revised given its unique morphology (Kochman-Kędziora et al. 2023).
The present poster illustrates the different *Orthoseira* taxa on Papua New Guinea and compares their morphology with that of the type of *O. roeseana*.

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P40: Diatoms in a glacier-fed stream on the Mountains of the Moon (Rwenzori, Uganda)

Hristina Kochoska[1], Tyler J. Kohler[1,2], Jan Kollár[1], Kateřina Kopalová[1], Leïla Ezzat[2], Hannes Peter[2], Massimo Bourquin[2], Grégoire Michoud[2], Susheel Bhanu Busi[3] & T.J. Battin[2]

hristinakochoska@yahoo.com

[1]Department of Ecology, Faculty of Science, Charles University, Prague, Czechia
[2]River Ecosystems Laboratory, Alpine and Polar Environmental Research Center, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
[3]Systems Ecology Group, Luxembourg Centre for Systems Biomedicine, University of Luxembourg, Esch-sur-Alzette, Luxembourg

Glaciers are rapidly shrinking as a result of ongoing global warming. The most affected seem to be equatorial glaciers, particularly on the African continent. Since the second half of the 19th century we have lost >90% of African glaciers, and they may vanish completely in the next few decades. One of the glaciers that still exists in Africa is on the peaks of the Rwenzori Mountains, a mountain range bordering Uganda and Congo. The Rwenzori Mountains have long been considered an important area for biodiversity and endemic species. With the disappearance of the glaciers, the water-bodies they feed will diminish too, especially the glacier-fed streams (GFSs). In this study we investigated diatom community composition in a GFS from the Rwenzori Mountains, which represents an understudied site with unique environmental conditions. We sampled two reaches of the Mt. Stanley GFS and collected three benthic sediment samples in both reaches (six samples total). The samples were analyzed with traditional approaches including light microscopy (LM) and scanning electron microscopy (SEM), as well as sequencing of 18S amplicons. The number of species identified from 18S sequences corresponded with the number of species identified morphologically, with 23 species identified through LM and 21 species identified through sequencing. The morphological analysis revealed that the communities were composed the following genera (ordered by the number of species within each): *Achnanthidium* (4 species), *Psammothidium* (3), *Pinnularia* (3), *Eunotia* (2), *Neidium* (1), *Cymbopleura* (1), *Mayamaea* (1), *Hantzschia* (1), *Luticola* (1), *Staurosirella* (1), *Cyclostephanos* (1), *Diadesmis* (1), *Thalassiosira* (1), *Reimeria* (1), and *Nitzschia* (1). Concerning the relative abundance of species, the most abundant species belonged to the genus *Psammothidium* (average = 50%), followed by *Neidium* (25%), *Cymbopleura* (13%) and *Eunotia* (4%), while the species from the remaining genera listed above were present at lower abundances. Finally, species present between the two reaches were almost identical, though the relative abundances differed somewhat. The Rwenzori GFSs exhibit uniqueness in their diatom composition, likely due to its unique environmental conditions, as well as an ecological 'island effect' given their isolated geographical position. Comparing our results with former studies made on nearby areas shows significant dissimilarities in the diatom community composition, as well as a few species potentially new to science. Analysis on the diatom composition from Rwenzori Mountains GFSs has never been conducted before, and this study therefore gives us insight into a unique ecosystem that will likely disappear within our lifetimes.

P14: The genus *Sellaphora* Mereschkowsky from the Poltava Plain phycofloristic district (Ukraine)

Olha Kryvosheia-Zakharova[1,2] & Agata Z.Wojtal[1]

olha_krivosheia@ukr.net

[1]Institute of Nature Conservation PAS, Karol Starmach Department of Freshwater Biology, al. Adama Mickiewicza 33, 31-120 Kraków, Poland
[2]M.G. Kholodny Institute of Botany NASU, Department of Phycology, Lichenology, and Bryology, st. Tereshchenkivska 2, 01601 Kyiv, Ukraine

Sellaphora is one of the morphologically very variable genera and is characterized by large diapason of length and structure variability. The species of this genus can be found from oligotrophic mountain lakes to eutrophic low-land ponds but many species still are for this moment without clear information about their ecological requirements. According to the literature data, on the territory of Ukraine, we have 33 Sellaphora species and 35 intraspecific taxa (Algae of Ukraine, 2009). On the territory of the Poltava plain phycofloristic district, before our study, were only 4 Sellaphora taxa: *S. atomoides* (Grunow) Wetzel & Van de Vijver, *S. bacillum* (Ehrenberg) Mann, *S. laevissima* (Kützing) Mann, *S. pupula* (Kützing) Mereschkowsky found. This territory includes the Poltava region, partly south of the Sumy and Chernihiv regions. Formed by a dense river network (more than 150 rivers), oxbow lakes, a few swamps, reservoirs (92), and ponds (about 4 thousand). Carbonate and carbonate-sulphate salinization and salt marshes in floodplains are typical for soils in the investigated area. Research materials (440 samples) were collected during 2012-2018. For investigation used a light microscope Olympus BX-53 and a scanning electron microscope JSM-6060 LA. As a result of our investigation, we found 19 *Sellaphora* species [*S. americana* (Ehrenberg) Mann, *S. krsticii* Levkov, Nakov & Metzeltin, *S. bacillum* (Ehrenberg) Mann, *S. insolita* (Manguin ex Kociolek & De Reviers) Hamilton & Antoniades, *S. pupula* (Kützing) Mereschkovsky, *S. blackfordensis* Mann & Droop, *S. obesa* Mann & Bayer, S. pseudopupula (Krasske) Lange-Bertalot, *S. lanceolata* Mann & Droop, *S. capitata* Mann & McDonald, S. mannii Reichardt, *S. auldreekie* Mann & McDonald, *S. laevissima* (Kützing) Mann, S. mutatoides Lange-Bertalot & Metzeltin, *S. perlaevissima* Metzeltin, Lange-Bertalot & Nergui, *S. pseudomutatoides* Levkov & Metzeltin, *S. bacilloides* (Hustedt) Levkov, Krstic & Nakov, *S. weinzierlii* (Schimanski) Reichardt, *S. nigri* (De Notaris) Wetzel & Ector] and some other taxa that we keep under question (*S.* cf. *pupula* 1, *S.* cf. *pupula* 2, *S.* cf. *lanceolata*, *S.* cf. *mannii*, *S.* cf. *fusticulus*). Our study made the Sellaphora list of taxa larger – 22 species, for the flora of Ukraine – appropriately 43 species and 45 intraspecific taxa. In the list of identified taxa, there are many of those whose exact ecological conditions and distribution are unknown today e.g. *S. auldreekie*, *S. blackfordensis*, *S. capitata*, *S. krsticii*.

The study was supported by grants R-2022/01/3/NZ8/00099 and “Own research fund for financing participation in scientific internship and development training for scientists employed at the Institute and participants of the Doctoral School of Natural and Agricultural Sciences for 2023”

P09: Insights into the evolutionary diversification of the genus *Frustulia*

Jana Kulichová[1] & Pavla Urbánková[2]

vesela6@natur.cuni.cz

[1]Charles University, Faculty of Science, Department of Botany, Benátská 433/2, CZ 12800 Prague, Czech Republic
[2]Jan Evangelista Purkyně University, Faculty of Science, Department of Biology, Pasteurova 3632/15, CZ 40096 Ústí nad Labem, Czech Republic

For more than a century, species identification of diatoms has been based solely on the morphology of their frustules. The molecular revolution and the use of morphometric techniques have made it possible to analyse species boundaries less subjectively. At the same time, however, the weaknesses of the morphological species concept have become more apparent, as morphological convergence and phenotypic plasticity often obscure the evolutionary signal. Using a multidisciplinary approach, we studied populations of the genus *Frustulia* Rabenhorst to determine whether phylogenetic diversification is accompanied by divergence in morphology, ecology, and/or distribution. Sequencing of *Frustulia* isolates confirmed the monophyletic origin of many of the nominal species, while the remaining lineages could not be clearly identified due to overlapping morphological variation. Reconstruction of the phylogeny showed that the geographic signal is less pronounced than general trends in morphology. Some New Zealand lineages, for example, were phylogenetically closely related to morphologically similar lineages isolated from different geographic regions, but not to each other. Furthermore, lineages of the genus *Frustulia* have different distribution patterns, likely related to differences in their dispersal ability and/or the breadth of their ecological niches. Consistent with de Queiroz's view on speciation, the lineages of the genus *Frustulia* have evolved in their own way, and thus some lineages do not show morphological and/or ecological divergence, especially when they are in the early stages of their divergence.

P11: A new *Dorofeyukea* species (Bacillariophyta) from a thermo-mineral spring of Sardinia (Italy)

Giuseppina Grazia Lai[1], Bachisio Mario Padedda[1] & Carlos E. Wetzel[2]

laigg@uniss.it

[1]University of Sassari, Department of Architecture, Design e Urban Planning (DADU), 4 via Piandanna, 07100 Sassari, Italy (laigg@uniss.it)
[2]Luxembourg Institute of Science and Technology (LIST), Department of Environmental Research and Innovation (ERIN), 41 rue du Brill, L-4422 Belvaux, Luxembourg

A new *Dorofeyukea* species is described from diatom samples collected in a small thermo-mineral spring of Sardinia (Italy). We present here the structural features of the species on light (LM) and scanning electron (SEM) microscopy and a comparison with other similar species of the genus *Dorofeyukea*. The new species shares similarities with *D. grimmeioiodes*, *D. rostellata* and *D. septata* which were formerly included into the genera *Navicula*, and *D. calcarea*, recently described from Brazilian freshwater environments. The new *Dorofeyukea* species stands out mainly for striation pattern, shape and pattern of areolae, and shape and striae of the central area. The species was found in slightly alkaline waters with sodium-chloride composition, medium-high mineralization level and fluoride and phosphorus enrichment. The relative abundance values of the new species in the analysed samples seem to indicate the fine sediments as the most suitable substrate for the species and its possible preference for warmer waters (water temperatures around 27 °C). Based on published images observed during our literature survey, we also propose the transfer of *Stauroneis valderostrata*, described from the Yucatan peninsula, Mexico, to the genus *Dorofeyukea*.

P15: The *Nitzschia sigma* (Kützing) W.Smith complex

Horst Lange-Bertalot[1] & Bart Van de Vijver[2,3]

bart.vandevijver@plantentuinmeise.be

[1]Biologicum Institute for Ecology, Evolution, Diversity, Goethe-University Frankfurt, Max-von-Lane Str. 13, 60438 Frankfurt am Main, Germany
[2]Meise Botanic Garden, Research Department, Nieuwelaan 38, B-1860 Meise, Belgium
[3]University of Antwerp, Deptarment of Biology, ECOSPHERE, Universiteitsplein 1, B-2610 Wilrijk, Belgium

The exact taxonomic identity of *Nitzschia sigma* (Kützing) W.Smith remained an enigma. The species was originally described as *Synedra sigma* Kützing from Denmark, but the type material and the original Kützing slide from 'Ostsee bei Hofmannsgave' could no longer be found. A minority of authors, however, follow William Smith who in 1853 discussed and depicted a marine and brackish water specimen based on material from Pevensey Beach (south-east England between Hastings and Brighton, UK) as *Nitzschia sigma*. Kützing (1849) had listed in addition to the locality in Denmark, two other samples where he found *N. sigma*: the English Channel and material he received from his friend Alphonse de Brébisson from the Calvados region. This latter material is present in Meise and London and can be used to choose a neotype for this species. Based on the accompanying diatom flora in the sample, N. sigma is a typical marine species, making observations in freshwater samples doubtful.
The general confusion is due to two largely overlooked taxa, now almost forgotten. The first, *Nitzschia sigma* var. *rigida* Grunow in Van Heurck, was originally described as *Amphipleura rigida* Kützing, an illegitimate name however, by Kützing (1844). Grunow also described *N. sigma* var. *rigidula* Grunow to Van Heurck, from a sample collected by Charles-Henri Delogne in Brussels. While the var. *rigida* can be considered a slightly brackish taxon, var. *rigidula* is a typical freshwater species.
The poster discusses the taxonomic history of this *Nitzschia sigma* complex illustrating the different populations used to disentangle this problematic group.

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P23: Evaluation biodiversity of epiphytic diatoms in the Euphrates-Tigris-catchment area using morphology and DNA metabarcoding

Heba Mohammad, Katherina Schimani, Nélida Abarca, Regine Jahn, Wolf-Henning Kusber, Oliver Skibbe & Jonas Zimmermann

h.mohamad@bo.berlin

Botanic Garden and Botanical Museum Berlin-Dahlem, Freie Universität Berlin, Germany, Berlin, Germany

The Euphrates-Tigris-Catchment area is one of the most important regions in the history of human civilization and one of the major drainage basins in southwestern Asia. However, recent wars and overuse of its waters have brought this region to the brink of ecological devastation. Iraq suffers from salinisation due to the loss of water caused by i.a. the water policy during the Iraq War and the building of dams in Turkey.
Worldwide, diatoms are among the most commonly used bioindicators of water quality. Correct taxonomic identifications are critical to their use as bioindicators. However, diatom identification based on morphology requires highly specialized taxonomic skills. To optimize diatom identification, DNA metabarcoding is increasingly used because it is generally less time consuming and may be more accurate than morphological identification. To date, however, no DNA metabarcoding diatom studies have been conducted in the Euphrates-Tigris-Catchment. One of the goals of this project is to establish DNA-based methods in close collaboration with colleagues from this region.
We studied epiphytic diatoms from Iraq in combination with morphological and metabarcoding techniques, and compared the diatoms identified and quantified by each method. Epiphytic diatoms (53 samples) from freshwaters were taken in summer 2019 and winter 2020/ 21, at 7 sampling sites from three different water bodies in Iraq: River Tigris in City Al- Qurnah, River Euphrates in City Al-Midaina, and River Shatt Al-Arab in Abu Flos. The morphological analysis of environmental samples resulted in the identification of 112 infrageneric taxa in 40 genera. The metabarcoding approach resulted in the identification of 1530 ASVs (Amplicon sequence variants), comprising 51 genera, 104 species with several ASVs belonging to the same taxa. Many species have still no record in reference databases. This emphasizes the need to obtain a more comprehensive library to further improve routine diatom metabarcoding. Furthermore, large disparities existed between relative abundances based on valve counts and sequence reads of the most abundant taxa. In spite of demanding issues, we conclude that the combination of morphological and molecular methods will increase the detection and identification of diatom assemblages and will therefore lead to a better understanding of the ecological patterns in this region.

P31: The effect of extreme weather events on diatoms of temporary streams

Phillip Mones & Andrea M. Burfeid-Castellanos

phillip.mones@stud.uni-due.de

University of Duisburg-Essen, Faculty of Biology, Phycology Group, Essen, Germany

Temporary streams show different water stages such as flowing sites, stagnant pools and dry riverbeds, with different living conditions for organisms. Temporary streams in the Paderborn plateau are subject to a "rewetting-drying-cycle" due to the karst, which leads to the formation of the lotic, lentic and terrestrial habitat types. Due to the habitat diversity and characteristics of these streams, diverse effects on aquatic ecosystems can be expected; for example, the loss of connectivity leads to the spread of phytoplankton, which can partially affect the biodiversity caught by the sampled phytobenthos. To date, very little research has examined primary producers in temporary streams of temperate climates and the effects of stressors, such as extreme weather events in this case, on diatoms are largely unknown. Our results show that extreme weather events have different effects, on the ecology of sampled streams. The terrestrial habitat type and its stressors showed lower impacts on diversity and species richness than the flooding of the lotic habitat, which resulted in lower diversity and species abundance. The lentic habitat, as anticipated because of ecological niche breadth, shows the greatest diversity, as well as the greatest species richness. Furthermore, it could be shown that streams in nature reserves harbour significantly more endangered species, while the stream in the catchment area of urban and agricultural areas showed higher diversity with a lower proportion of endangered species. In addition, it could be shown, that different states within a stream are more similar than similar states of different streams. These results thus demonstrate the negative effects of increasing climatic changes and human interventions in stream ecosystems.

P28: Benthic diatom community in Lake Maggiore (Italy) investigated by morphological and molecular approach

Simona Musazzi[1], Ester Eckert[1], Giulia Borgomaneiro[1], Angela Boggero[1] & Aldo Marchetto[1,2]

simona.musazzi@cnr.it

[1]CNR-Water Research Institute, Largo Tonolli 50, 28922 Verbania, Italy
[2]National Biodiversity Future Center (NBFC), 90133 Palermo, Italy

The use of diatoms as bioindicators to detect human-induced change is a globally accepted monitoring tool. Nevertheless, available data on benthic diatoms in Lake Maggiore are scarce. This work represents the first floristic study attempting to evaluate the biodiversity of littoral phytobenthos using both a morphological and molecular approach in Lake Maggiore. DNA metabarcoding is an effective complementary tool to standard microscopic methods for species identification, providing reliable and timeous diatom assessments in aquatic ecosystems. This study evaluated the suitability of the DNA metabarcoding approach for diatom monitoring in Lake Maggiore, exploring advantages and weaknesses compared to the traditional microscopy-based analysis. Composition, structure, and environmental factors influencing benthic diatom communities were investigated. Samples were taken following a European wide standardized sampling protocol. by scraping five stones and macrophytes from the littoral zone, in 9 stations identified along the perimeter of the lake. For each sample, at least 400 valves were identified and enumerated at microscope. Metabarcoding was performed on the first replicate of each sample, using the rbcl gene as a molecular marker. Sequencing was done using Illumina technology; bioinformatics was performed using a script and public databases (https://github.com/fkeck/DADA2_diatoms_pipeline).

This study highlighted significant differences in terms of α- and β-biodiversity and species richness between the sampled sites. Both, morphological and molecular methods indicated higher diversity in epilithic biofilm than in periphyton. Nevertheless, results obtained from morphological and molecular methods indicated a low similarity in term of taxonomical identification. Light microscope analysis identified more species than molecular analysis. The latter, however resolved some taxonomic uncertainties. The difference between the methods was expected given the challenges pertaining to the incomplete molecular reference database. Furthermore, the presence of colonial species, with a high number of units, revealed a greater variability of the results.

While the molecular method was unable to identify the presence of all the dominant diatom species, it provided promising complementary tool to determine the relevant community diversity estimates required for the application of diatomic water quality indices.

P49: Endemic fossil diatom flora from the Topola Formation, NE Bulgaria, with special reference to palaeoclimatic implication

Nadja Ognjanova-Rumenova, Marlena Yaneva, Elena Koleva-Rekalova & Peter Nikolov

nognjan@geology.bas.bg

Geological Institute, Bulgarian Academy of Sciences, Acad. G. Bonchev Str. Build. 24,1113 Sofia, Bulgaria

The Neogene sedimentary rocks built a significant part of NE Bulgaria. The Neogene sediments fill the shallow inland Varna-Balchik Bay of the vast Euxinian Basin. Four structural palaeogeographic regions within this area are distinguished. Seven formal and two informal lithostratigraphical units for the Miocene Series were introduced within the realm. The studied material was collected from the clayey sediments related to the Topola Formation. The Topola Foprmation consists of aragonite sediments and clayey aragonitites with massive and laminated structures. They are interbedded with hard micritic limestones, dolomicrites, as well as diatom-spongolithic clays and silty clays. The thickness of the formation is 45-90m, the chronostratigraphic range: Upper Bessarabian-Lower Chersonian stages, Sarmatian s.l.
The investigated outcrop is located along the cliff at the area Zelenka, SE of the village of Balgarevo. Detailed description of the studied section is published in previous publications elsewhere. Fossil diatoms are determined in the uppermost clayey sediments, whereas the aragonite crystals are very rare. Species characteristic for the association of the *Achnanthes baldjikii* var. *podolica* Subzone have indicated: *Achnanthes baldjikii* (Bright) Grun., *Achnanthes baldjikii* var. *podolica* Miss., *Campylodiscus fastuosa* var. *baldjikiana* (Grun.) Van Landingham, *Navicula palpebralis* var. *semiplena* Greg., *Grammatophora h*ungarica Pant., *Cocconeis scutellum* var. *inaequalipunctata* Miss., *Navicula cancellata* Donk. Its stratigraphic range is within the Sarmatian Stage (Bessarabian Substage). During the Late Sarmatian Stage (Khersonian Substage) the changes in the number of species and genera are gradual. Subzone *Navicula zichyi* has indicated. It is characterized by a great species diversity of genera *Navicula* Bory sensu lato, *Amphora* Ehr. ex Kütz., *Achnanthes* Bory sensu lato, *Rhopalodia* O. Müll., and *Cocconeis* Ehr.
During the latest Bessarabian the climate was predominantly arid with some humid periods, and during the earliest Khersonian it was seasonal. The climate had a significant influence on the type of sedimentation in the Varna-Balchik Bay, as well as on the existence and disappearance of the diatom species and mollusk fauna.

Acknowledgements:
This work has been carried out in the framework of the National Science Program “Environmental Protection and Reduction of Risks of Adverse Events and Natural Disasters”, approved by the Resolution of the Council of Ministers № 577/17.08.2018 and supported by the Ministry of Education and Science (MES) of Bulgaria (Agreement No. DO1-271/09.12.2022).

P50: The effect of climate variability on mountain lake diatom communities, the Rila Mts., Bulgaria

Nadja Ognjanova-Rumenova[1] & Ivan Botev[2]

nognjan@geology.bas.bg

[1]Geological Institute, Bulgarian Academy of Sciences, Acad. G. Bonchev Str. Build. 24,1113 Sofia, Bulgaria
[2]Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Gagarin Str. 2, 1113 Sofia, Bulgaria

The Rila National Park covers the highest parts of the Rila Mts. (altitude of 1000–2925 m a.s.l.) and it is the largest National Park in Bulgaria. This area is remarkable by its 140 glacial lakes, which are close to the Central European alpine lakes regarding their age and evolution. The investigation of the diatom flora of the Rila glacial lakes is interesting from the ecological and floristic point of view because the Rila Mts. is one of the Southwestern European mountains with glacial lakes of an alpine type.

The aim is to investigate and compare the diatom diversity of lakes, using benthic and sedimentary assemblages. To explore the effects of climate change on mountain lakes we examine palaeolimnological records from 7 lakes located in Cirque “Seven Rila lakes”. Sediment short cores (14–17 cm) were collected from the lakes. Living diatom communities (epilithon) were also collected from all seven lakes in the last 20 years. Inside each lake, three different littoral stations were sampled.

- In the more alkaline deep lakes – “Okoto”, “Babreka” and “Bliznaka”, several benthic *Fragilaria* sensu lato species are identified, especially *Pseudostaurosira pseudoconstruens* (Marc.) Williams et Round, *Staurosira venter* (Ehr.) Cleve et J.D.Möller and *Staurosirella pinnata* (Ehrenb.) Williams et Round, as well as the indifferent species *Encyonema minutum* (Hilse) Mann.
- In the highest lake – “Salzata”, the planktonic north-alpine species *Aulacoseira alpigena* (Grun.) Krammer is dominant.
- In the three shallower lakes – “Detelinata”, “Ribnoto” and “Dolnoto”, the biodiversity index is lower due to the active anthropogenic activity affecting this part of the Cirque “Seven Rila lakes”, as well as the abundant distribution of macrophytes.
- 38 (19.5%) of the established diatom species are listed as endangered to varying degrees according to the Red List of Algae.
- For now, there is no data on invasive diatom species. *Didymosphenia ge*minata (Lyngbye) M.Schmidt was found, but only in one of the sites of lake “Bliznaka” in 2000 and in one site of lake “Detelinata” in 2015. The findings are from single valvae and it is difficult to define as "invasive presence”.

Acknowledgements:

This work has been carried out in the framework of the National Science Program “Environmental Protection and Reduction of Risks of Adverse Events and Natural Disasters”, approved by the Resolution of the Council of Ministers № 577/17.08.2018 and supported by the Ministry of Education and Science (MES) of Bulgaria (Agreement No. DO1-271/09.12.2022).

P47: East African Diatom flora – A comparison between the East African Diatom Database and diatomite beds from 150,000 years ago

Cécile A. Porchier[1,2], David M. Williams[2], Eileen J. Cox[2], Tom Hill[2,3], Françoise Chalié[4], Mark A. Maslin[1] & Martin H. Trauth[5]

cecile.porchier.18@ucl.ac.uk

[1]Department of Geography, University College London, North-West Wing, Gower Street, WC1E 6BT, London, United Kingdom
[2]Natural History Museum, London, United Kingdom
[3]PalaeoEnvironmental Research and Consultancy Services, United Kingdom
[4]CNRS-CEREGE, Europôle Méditerranéen de l'Arbois, P.O. Box 80, 13545 Aix-en-Provence Cedex 04, France
[5]Universität Potsdam, Institut für Geowissenschaften, Campus Golm / Haus 27, Karl-Liebknecht-Str. 24-25, 14476 Potsdam, Germany

Diatoms are sensitive to changes in lake-water chemistry such as pH, salinity, anion and cation ratio as well as temperatures. These microorganisms can therefore be used to study past changes in a lake system and provide insights into past hydrological cycle variability. Diatom assemblages provide a primary analysis of a lake system that can be further improved by applying diatom-based transfer functions to reconstruct the past variability of different lake water chemistry parameters.
In this study, we are using exposed diatomite beds dating back to 150,000 years ago to reconstruct the East African climate variability at annual to decadal timescales. Diatom assemblages for one of the highstands present in the sedimentary sequences have been determined by counting an average of 400 diatom valves per sample. A comparison between the assemblages obtained and the diatom flora described in the East African Diatom Database (Gasse, 1986) is presented here as well as the methodology we will apply in the future to use the diatom-based transfer functions developed by Gasse et al. (1995) using the modern diatom flora from the East African Diatom Database.

P19: Studies on small-celled and finely striated *Amphora* sensu lato taxa from the Adriatic and the Black Seas

Margaux Pottiez[1,2], Ralitsa Zidarova[3], Myriam de Haan[1], Plamen Ivanov[4] & Bart Van de Vijver[1,2]

Margaux.pottiez@outlook.be

[1]Meise Botanic Garden, Research Department, Nieuwelaan 38, B-1860 Meise, Belgium
[2]University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, B-2610 Wilrijk, Belgium
[3]Institute of Oceanology – Bulgarian Academy of Sciences, Department of Marine Biology and Ecology, Parvi May Str. 40, 9000 Varna, Bulgaria
[4]Institute of Biodiversity and Ecosystem Research – Bulgarian Academy of Sciences, Department of Aquatic Ecosystems, Mayor Yurii Gagarin Str. 2, 1113 Sofia, Bulgaria

Due to the paucity of studies and the lack of recently developed regional floras for marine benthic diatoms, we face challenges to identify the species in marine benthic samples. In addition, taxonomically complicated genera, such as *Amphora* (sensu lato), often form the majority of species in the samples. We studied some small-celled and finely striated taxa belonging to *Amphora* s.l. in samples from the Adriatic Sea and the Black Sea. The Adriatic samples originated from Pula, Croatia, and were taken from both environmental benthic habitats and turtle carapaces. Samples from the Black Sea included the biofilm on plexiglass tiles placed at two sites off the southern Bulgarian coast. Combining both light (LM) and scanning electron microscopy (SEM), we differentiated nearly 30 small-celled and/or finely striated *Amphora* s.l. taxa. A few taxa were shared between the studied seas and substrates, such as *Halamphora coffeaeformis*, *H. kolbei*, *H. bistriata*, several other *Halamphora* species with uncertain identity, and an unknown *Seminavis* taxon. The diversity among the small-celled taxa in SEM was higher than the one we observed in LM. In the group of *Halamphora pseudohyalina* two taxa were discovered. Five taxa were distinguished in SEM from a provisionally single taxon identified as "*Amphora crenulata*" in LM. Often, it was impossible to clearly relate the species observed in SEM to those observed in LM, especially the different small-celled "*Halamphora coffeaeformis*"- like taxa present in the Black Sea samples. Zidarova et al. (2022) attempted to separate these taxa, but this study indicated that some of them represent complexes in LM. Finally, there were also taxa that we discovered only in SEM, and they did not match any of the taxa or complexes observed in LM. Survey of the older literature showed that some of the species might have been described in the past from the Black Sea, but since these taxa were never (re)studied in SEM, their identities are uncertain. Apart from a few such exceptions, most of the small-celled *Amphora* s.l. taxa that we observed are apparently unknown and yet to be described.

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P02: An introduction to the catalogue of Albert Grunow's 19th century diatom collection at W including a palaeographic aid

Tanja M. Schuster[1], Paul B. Hamilton[2], Verena Haring[3], Mark B. Edlund[4] & Bart Van de Vijver[5,6]

tanja.schuster@nhm-wien.ac.at

[1]Natural History Museum, Department of Botany, Herbarium, Burgring 7, 1010 Vienna, Austria
[2]Paul B. Hamilton, Canadian Museum of Nature, Research Division, PO Box 3443, Station D, Ottawa, ON, Canada, K1P 6P4
[3]Verena Haring, Karl-Franzens-Universität, Institute of Biology, Division of Plant Sciences, Holteigasse 6, 8010 Graz, Austria
[4]Mark B. Edlund, St. Croix Watershed Research Station, Science Museum of Minnesota, MN 55047, United States of America
[5]Meise Botanic Garden, Research Department, Nieuwelaan 38, B-1860 Meise, Belgium
[6]University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, B-2610 Wilrijk, Belgium

The diatom collection of Albert Grunow (1826–1914) is rich in taxonomic types and important, not only for Grunow's own material (slides, samples) and species, but because it also contains a great deal of historical material collected by early phycologists (e.g., de Brébisson, Kützing, William Smith). The collection is housed at the Department of Botany of the Natural History Museum in Vienna (herbarium W). Grunow's collection is accompanied by a catalogue listing all samples Grunow studied and is organised by ascending sample numbers. The information contained in the catalogue includes species lists, collection localities, the origin of the material (such as marine or fossil), collectors and their collection numbers, crossreferences to exsiccata containing the same material, preparation types, or the coordinates of particular valves on his slides, and is therefore important to access for current taxonomists. However, one hurdle is deciphering Grunow's handwriting in German cursive script ('Kurrent').
Hence, the goals of this contribution are twofold: 1) to provide insights into Grunow's curation methods and available materials, as laid out in eleven pages of instructions (in German) written by Grunow about the collection and the catalogue and 2) to function as a palaeographic aid, in order to facilitate reading the instructions and catalogue. The latter is done by pairing Grunow's instructions with their transcription and by providing handwriting samples for each letter of the alphabet. The first is achieved by giving an English translation of the instructions and some comments on the materials and methods he used. We also include two tables listing historical measurement units and their conversions to the metric system, as well as abbreviations used by selected authors.

P20: Psychrophile diatoms in Turkish glacial lakes

Cüneyt Nadir Solak[1], Paul B. Hamilton[2], Łukasz Peszek[3], Małgorzata Bąk[4], Elif Yilmaz[1,4] & Nesil Ertorun[5]

cnsolak@gmail.com

[1]Faculty of Arts and Science, Department of Biology Dumlupınar University, 43000, Kütahya, Turkey
[2]Research Division, Canadian Museum of Nature, P.O. Box 3443, Ottawa, ON K1P 6P4, Canada
[3]Department of Agroecology and Forest Utilization, Institute of Agricultural Sciences, Land Management and Environmental Protection, University of Rzeszów, Zelwerowicza 8B, 35-601 Rzeszów, Poland
[4]Institute of Marine and Environmental Sciences, University of Szczecin, Mickiewicza 16, 70-383 Szczecin, Poland
[5]Department of Biology, Science Faculty, Eskişehir Technical University, Eskişehir, Turkey

Cold environments are considered extreme biomes and historically thought to be barren to species poor and unproductive. However, investigations show that some of coldest regions in the World represent unique biodiversity hotspots. Biogeographically, Turkey is a subtropical region with two prominent glacial ecozones (southern Taurus and northeastern Anatolian Mountains). In this study, glacial lakes in the Kaçkar Mountains, northeastern Anatolia are evaluated noting the importance of genera, containing psychrophic taxa of smaller diatoms, with smaller diatom taxa including *Genkalia*, *Psammothidium* and *Eunotia*. The presence of genera like *Genkalia* and cold environment species such as *Psammothidium subatomoides*, highlight the isolation of alpine biomes in subtropical regions. Broad biogeographic distributions of biological diversity from polar to alpine are considered and a number of taxa within *Eunotia* and *Psammothidium* are recorded for the first time in Turkish freshwater diatom flora.

Acknowledgement:
The work was supported by Kütahya Dumlupınar University Scientific Research Projects Coordination Unit (Grant no: 2021-13 and 2022-45) and SEM studies were supported by Eskişehir Technical University Scientific Research Projects Coordination Unit (Grant no: 19ADP073).

P21: Rare or poorly known diatoms in Salda Lake

Cüneyt Nadir Solak[1], Łukasz Peszek[2], Mateusz Rybak[2], Paul B. Hamilton[3], Elif Yilmaz[1,4] & Nesil Ertorun[5]

cnsolak@gmail.com

[1]Faculty of Arts and Science, Department of Biology Dumlupınar University, 43000, Kütahya, Turkey
[2]Department of Agroecology and Forest Utilization, Institute of Agricultural Sciences, Land Management and Environmental Protection, University of Rzeszów, Zelwerowicza 8B, 35-601 Rzeszów, Poland
[3]Research Division, Canadian Museum of Nature, P.O. Box 3443, Ottawa, ON K1P 6P4, Canada
[4]Institute of Marine and Environmental Sciences, University of Szczecin, Mickiewicza 16, 70-383 Szczecin, Poland
[5]Department of Biology, Science Faculty, Eskişehir Technical University, Eskişehir, Turkey

Salda Lake is located in southwestern Anatolia, in Turkey. The diatoms were collected seasonally from four stations in the lake between 2016 and 2020, from different substrata (epipelic, epiphytic, and epilithic). The lake, a depression basin formed by the effect of tectonism at the end of the Neogene, is one of the deepest soda lake in the world. In this study, some rarely known taxa (*Achnanthidium anatolicum* C.N.Solak et al., *A. barlasii* C.N.Solak et al., *A. dumlupinarii* C.N.Solak et al., *Caloneis latiuscula* (Kützing) Cleve, *Craticula simplex* (Krasske) Levkov, Cymbella peraffinis Tynni, *Encyonema lacustre* (C.Agardh) D.G.Mann, *Navicula subalpina* Reichardt and *Rhoicosphenia baltica* (Schumann) Levkov) were documented by using LM and SEM. A systematic diverse community assemblage including rare species highlights the unique diversity of Salda Lake.

Acknowledgement:
SEM studies were supported by Eskişehir Technical University Scientific Research Projects Coordination Unit (Grant no: 19ADP073).

P42: Preliminary diatom data on estuarine ecosystem development in the south-eastern Baltic Sea

Irina Sosnina & Vaida Šeirienė

irina.sosnina@gamtc.lt

Nature Research Centre, Institute of Geology and Geography, Akademijos st. 2, LT-08412, Vilnius, Lithuania

Diatoms are excellent bioindicators that respond quickly to environmental changes. Water level, salinity, pH, and trophic state are important factors in the development of diatom assemblages, making diatom analysis one of the basic methods used to detect environmental changes. The current study presents a diatom record of a core collected in the southeastern part of the Baltic Sea near the Curonian Spit (E 20.73°, N 55.51°). Five-meter long sediment core was processed in the laboratory following standard procedures (Battarbee et al. 2001). A qualitative (statistical techniques) and quantitative diatom analysis of 15 samples with lithological description provides a preliminary interpretation of palaeoenvironmental and climatic changes. The diatom assemblages were identified as genera and species (Krammer and Lange-Bertalot 1986-1991, Snoeijs et al. 1993-1996) and integrated into ecological groups (Van Dam 1994). Diatom assemblage zones (DAZ) were subdivided according to changes in diatom flora composition throughout the section and clustered by CONISS.

Along the entire core, the most abundant forms were planktonic. The studied section contains several sediment levels with a predominance of freshwater and a sporadic number of brackish species. In the lowest part of the section, the most frequent diatom taxa were *Ellerbeckia arenaria* preferring deep water and sandy bottoms. The benthic group includes Amphora pediculus, *Cocconeis disculus*, *Opephora martyi*. The diatom record in the middle part of the section shows rather a quite unstable ecological conditions which is demonstrated by a large number of fragmented valves. Only a few specimens of a marine species of the genus *Hyalodiscus* were found. The successive period could be characterized by very high species diversity and concentration. It was, apparently, warm, with plenty of nutrients, and favorable conditions for algae to flourish. Freshwater species predominated. *Aulacoseira* sp. and *Stephanodiscus* sp. dominated the upper part of the core. The species composition changed with an increase in the concentration of eutrophic species, representing a change in the trophic state of the water body.

Changes in the qualitative and quantitative composition of diatoms directly indicate a change in environmental and hydrological conditions. Presumably, as a result of climate change, open-water communities have subsequently been replaced by near-shore complexes with higher concentrations of benthic species.

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P07: A new *Actinella* species (Bacillariophyta) from the Tshopo Province, Democratic Republic of the Congo

Jonathan C. Taylor[1,2] & Christine Cocquyt[3]

Jonathan.Taylor@nwu.ac.za

[1]Unit for Environmental Science and Management, North-West University, Potchefstroom, South Africa
[2]South African Institute for Aquatic Biodiversity, Makhanda, South Africa
[3]Meise Botanic Garden, Research Department, Nieuwelaan 38, B-1860 Meise, Belgium

The Congo basin is largely underexplored in terms of freshwater biodiversity, although diatoms have been studied in some depth at various times through the previous century. However, the last decades taxonomic interest revived but there remains considerable biodiversity to be discovered in the region. Here we present a new diatom species, which belong to the genus *Actinella* F.W.Lewis, discovered in the Man and Biosphere Reserve at Yangambi, (Tshopo Province, Democratic Republic of the Congo) and studied using light and scanning electron microscopy.

Representatives of the genus *Actinella* grow on mucilage stalks and are usually attached to a solid substratum (plant material, other algae etc.) and occur almost exclusively in acidic biotopes with low nutrient concentrations. The presence of *Actinella* taxa is therefore indicative of good water quality conditions with limited impact. The most closely related genus to *Actinella* is *Eunotia* Ehrenberg which is also commonly found in acidic waters. Unlike *Actinella*, *Eunotia* has a very high diversity in the African tropics with many species still undescribed. *Actinella* differs from *Eunotia* by the presence of marginal spines, its heteropolar shape and often distinctive terminal spines. There is only a single rimoportula found at one apex in *Actinella*, *Eunotia* usually has two, one at each apex. The raphe is rather short and carried on the valve face while that of *Eunotia* is found mostly on the valve margin and longer.

Comparison is made of the new *Actinella* taxon from the Congo basin with morphological related taxa described from other tropical regions, such as *A. disjuncta* Metzeltin & Lange-Bertalot, and *A. eunotioides* Hustedt and *A. pseudohantzschia* Metzeltin & Lange-Bertalot from Brazil and *A. modesta* Gerd Moser, Lange-Bertalot & Metzeltin from New Caledonia.

Taxonomic studies of tropical diatoms, such as the one discussed, are important for the eventual implementation and use of diatom-based water monitoring techniques in central tropical Africa.

P08: A new species of freshwater *Diploneis* from Kruger National Park. South Africa

Jonathan C. Taylor[1,2], Anatoliy Levanets[1] & Ruan Koen[1]

Jonathan.Taylor@nwu.ac.za

[1]Unit for Environmental Science and Management, North-West University, Potchefstroom, South Africa
[2]South African Institute for Aquatic Biodiversity, Makhanda, South Africa

The genus *Diploneis* Ehrenberg ex Cleve, 1894 currently includes 307 accepted species, 3 subspecies, 88 varieties and 23 forms. Taxa withing this genus have a clearly visible silica thickening of the cell wall, continuing from the central region of the cell to the apex. Most taxa live in marine (predominantly epipelic) habitats, while comparatively few inhabit freshwater habitats. Apart from aquatic habitats, some species of *Diploneis* are also known from aerophilic environments such as mosses, colonizing wet rocks in the spray zone of waterfalls.

During routine investigations of thr diatom flora of the Kruger National Park in South Africa, a mass development of *Diploneis* was observed in several samples from Sand River collected in 2016 and again in later years. In-depth observations by optical microscopy and scanning electron microscopy, and then comparative analyses with similar taxa illustrated in the literature, have provided evidence that this is a species new to science belonging to the genus *Diploneis*.

Morphologically this diatom is closest to *Diploneis zanzibarica* (Grunow) Hustedt 1937 (Synonyms: *Navicula interrupta* (W. Smith) Schmidt in Schmidt *et al*. var. *zanzibarica* Grunow in A.W.F. Schmidt 1875; *Diploneis interrupta* (Kützing) Cleve var. *zanzibarica* Grunow 1875 in Cleve 1894; *D. interrupta* var. *zanzibarica* (Grunow) Cleve 1894; *D. interrupta* var. *zanzibarica* Cleve 1894; *D. clepsidra* Cleve 1894).

The main morphological differences of newly discovered species from panduriform *D. zanzibarica* and *D. interrupta* (Kützing) Cleve 1894 are: valve apices are broadly rounded even completely round; central valve area is widely open; longitudinal canal consists of elongated canal pores with a very specific structure, loculate areolae comprising the striae are of irregular perforated shape and structure due to external occlusions.

This taxon also occurs only in freshwaters with low electrolyte content and becomes dominant in some of the small streams in the Eastern parts of the Kruger National Park.

The cell external and internal structures are illustrated by both LM and SEM images.

P26: Diatom research in the Caribbean, recent progress

Emmeken van den Dungen, Romée van der Kuil, Kees Nooren, Francesca Sangiorgi & Timme Donders

e.s.vandendungen@students.uu.nl, r.vanderkuil@students.uu.nl

Utrecht University, Faculty of Geosciences, Princetonlaan 8a, 3584 CB, Utrecht, the Netherlands

Despite the advantages of diatom research in the field of e.g. water quality monitoring and palaeoclimatology, it has hardly been applied in the Caribbean. Here we report on the recent progress in the study of diatoms recovered from sediment cores taken at several coastal lagoons in Sint Maarten, Aruba, Bonaire, and Curaçao.

In one of our projects, we focus on the reconstruction of the recent eutrophication of coastal lagoons on these four islands. Quantitative data on the state of these ecosystems is essential for effective land and water management. Here we present the diatom record from a sediment core taken at Fresh Pond, Sint Maarten. Diatom concentration and assemblage changes over the past approximately 50 years are related to recent land-use changes in the catchment, and indicate changes in the nutrient level of the lagoonal waters.

In another project we focus on the reconstruction of a diatom-based palaeoprecipitation record for the island of Bonaire. Periods of droughts are a serious problem on the island, and we would like to know how frequent they occurred in the past. Our aim is to establish a high-resolution diatom record for the past 3000 – 4000 years. Therefore, an automated detection and counting method for diatoms is under development. The machine learning approach will be developed by elaborating on a similar tool created for the detection and counting of pollen. The procedure is demonstrated on sediment samples from Fresh Pond. We present the diatom record based on manual counts, and discuss the advantages of the automatic counting technique. If successful this technique will be applied on a long sediment core that will be taken in 2023 at Saliña Bartol, Bonaire.

P16: Metabarcoding and morphological data of *Mayamaea* species from soda pans in Serbia

Danijela Vidaković[1,4], Zlatko Levkov[2], Jelena Krizmanić[3], Bank Beszteri[4], Bojan Gavrilović[5] & Miloš Ćirić[1]

daca.vidakovic89@gmail.com

[1]University of Belgrade, Institute of Chemistry, Technology and Metallurgy, National institute of the Republic of Serbia, Njegoševa 12, Belgrade 11000, Serbia
[2]Institute of Biology, Faculty of Natural Sciences, Ss Cyril and Methodius University, Arhimedova 3, 1000 Skopje, R. Macedonia
[3]University of Belgrade, Faculty of Biology, Studentski trg 16, 11000 Belgrade, Serbia
[4]University of Duisburg-Essen, Faculty of Biology, Phycology Group, Universitätsstr. 2, 45141 Essen, Germany
[5]Institute of Forestry, Kneza Višeslava 3, 11030 Belgrade, Serbia

Soda pans located in the northern part of Serbia are alkaline and very shallow water habitats influenced by seasonal drying. Due to the rareness, vulnerability, and specific biota, these saline habitats have high conservation priority according to the EU Habitats Directive (92/43/EC).
Since 2017, ten soda pans have been intensively studied with the aim to determine the diatom biodiversity and to evaluate ecological conditions. Diatom samples were collected from mud and reed, and samples for molecular analyses were additionally collected in 2021. The diatom community is mostly composed of species that prefer alkaline conditions and high conductivity. Some of the most dominant genera are *Nitzschia* and *Navicula*. Among the recorded diatoms, *Mayamaea permitis* and one unknown *Mayamaea* species were recorded in two soda pans (Okanj bara and Bela bara). The unknown *Mayamaea* can easily be distinguished from similar species by the valve outline and shape of the central area using light and scanning electron microscopy. In a metabarcoding (partial 18S rRNA gene sequence) data set from the same sample, we could identify two amplicon sequence variants showing affinities to the genus *Mayamaea*, one of them matching published sequences from *M. permitis*, the other without exact matches in the Diat.barcode and NCBI databases. We conclude that the latter probably belongs to the new *Mayamaea* species observed by microscopy, which indicates that the unknown *Mayamaea* species is closely related to but different from *Mayamaea terrestris*.
Based on morphological features and molecular analyses, we consider the unknown *Mayamaea* species as a species new to science. Bearing in mind the vulnerability of soda pans due to anthropogenic threats and climate change, knowing which species inhabit these habitats is the first step in preserving these unique ecosystems.

P41: Diatom and bacteria assemblages in saline habitats (Vojvodina, Serbia)

Danijela Vidaković[1,2], Ivica Dimkić[3], Jelena Krizmanić[3], Tamara Janakiev[3], Bojan Gavrilović[4] & Miloš Ćirić[1]

daca.vidakovic89@gmail.com

[1]University of Belgrade, Institute of Chemistry, Technology and Metallurgy, National institute of the Republic of Serbia, Njegoševa 12, Belgrade 11000, Serbia
[2]University of Duisburg-Essen, Faculty of Biology, Phycology Group, Universitätsstr. 2, 45141 Essen, Germany
[3]University of Belgrade, Faculty of Biology, Studentski trg 16, 11000 Belgrade, Serbia
[4]Institute of Forestry, Kneza Višeslava 3, 11030 Belgrade, Serbia

Soda pans are restricted to the Carpathian Basin and differ from other similar saline waters mainly due to the dominant presence of Na+, HCO3–, and CO32– ions. These shallow and temporary aquatic habitats are inhabited by a number of species that can thrive in extreme environments. In Serbia, saline habitats are rare, endangered, and most common in the territory of Vojvodina. One of the most investigated group of organisms in soda pans is diatoms. Due to ecophysiological plasticity, they can survive and tolerate extreme environmental conditions which gives them a competitive advantage over other algae. Quite the opposite, prokaryotes in saline habitats are not sufficiently studied and data are scarce. Thus, samples from 6 soda pans were collected in March 2021 aiming to determine diatom (microscopic and molecular analysis, 18S rRNA gene) and bacterial community (16S rRNA gene).

Most of the recorded diatom taxa are neutrophilic to alkalibiontic, mostly halophilic, and eutrophic species. The species richness diversity index was the highest in Velika Slatina and Slatina, while it was lowest in Mala Rusanda. The genus *Nitzschia* was one of the most represented and numerous according to morphological analyses (24 taxa, 4 dominant), while molecular analyses indicate 11 different species with low abundances and mainly with unassigned sequences. The biggest discrepancy in these two approaches was observed in Mala Rusanda and Okanj bara. Metabarcoding analysis indicated *Halamphora veneta* as the dominant taxa, while morphological analyses have shown a predominance of *Nitzschia supralitorea* and *Surirella brebissonii* in Mala Rusanda, and *N. austriaca* in Okanj bara.

Estimated richness and alpha diversity indices showed the highest bacterial diversity in Velika Rusanda and Okanj bara, while the lowest richness was in Mala Rusanda. Representatives of the phylum Proteobacteria were detected predominantly in Pečena Slatina, *Bacteroidota* in Velika Slatina, *Actinobacteria* in Okanj bara, while representatives of *Firmicutes* were most abundant in Slatina, Velika Rusanda, and Mala Rusanda. At the genus level, 515 different genera were detected, and some of the most dominant were: *Luteolibacter*, unidentified genera from the family Bacillaceae, *Actibacter*, etc.

Further investigations will be required to overcome the problem of the reference barcoding library incompleteness for halophilic and alkaliphilic species in these habitats and try to reveal the unknown relationship between diatoms and bacteria.

P36: Diatoms and macroinvertebrates in a small river in Tanzania

Luna Vlaminck[1,2], Britt Gogne[1,2], Gabrielle Hoogsteyns[1,2], Levente Van de Velde[1,2], Lies Teunen[2], Sija A. Kabota[3] & Bart Van de Vijver[1,2]

bart.vandevijver@plantentuinmeise.be

[1]Meise Botanic Garden, Research Department, Nieuwelaan 38, 1860 Meise, Belgium
[2]University of Antwerp, Department of Biology – ECOSPHERE, Universiteitsplein 1, 2610 Wilrijk, Belgium
[3]Department of Crop Science and Horticulture, Sokoine University of Agriculture (SUA), P.O. Box 3005 Chuo Kikuu, Morogoro, Tanzania

In the summer of 2022, the diatom and macroinvertebrate communities in a small river system near the town of Morogoro (Tanzania) have been sampled and analysed. On 10 localities, diatom samples were collected from submerged stones, sediments and, when present, aquatic plants. On each locality the macroinvertebrate population was sampled using a hand net.
The results of the diatom analysis showed that a rather diverse diatom flora was encountered in the different samples. Based on the ecological preferences of the composing flora, the river can be characterized as a rather polluted river, as shown by the large number of *Nitzschia*, *Tryblionella* and *Navicula* taxa, all typical for higher electrolyte contents and eutrophic conditions. The analysis of the macroinvertebrates and the resulting water quality calculation indicates a similar trend, although not every locality seemed equally affected.
During the analysis, an unknown *Planothidium* taxon has been observed that could not be identified using the currently available literature. Based on detailed light and scanning electron microscopy observations and a comparison with other *Planothidium* taxa worldwide, resulted in the description of the taxon as a new species: *P. af*ricanum Van de Vijver et al. The new species shows some resemblance to *P. incuratum*, *P. rostratum* and *P. biporomum*, and was found in some alkaline streams with a higher electrolyte content and β- to α-mesosaprobic conditions, pointing to a high degree of pollution (Van de Vijver et al. 2023).

References

Van de Vijver B., Gogne B., Hoogsteyns G., Van de Velde L., Vlaminck L., Kabota S.A., Teunen L. & Wetzel C.E. (2023). *Planothidium africanum* sp. nov., a new freshwater diatom (Bacillariophyta) species from Tanzania. *Phytotaxa* 585 (4): 281–286.

P29: The diversity and structure of diatom communities in Glacial Floodplain Streams of Swiss Alps

Tereza Vošická[1], Tyler J. Kohler[1,2], Jade Brandani[2], Jan Kollár[1], Hristina Kochoska[1], Kateřina Kopalová[1], Hannes Peter[2], Massimo Bourquin[2], Grégoire Michoud[2], Leïla Ezzat[2], Susheel Bhanu Busi[3], & T.J. Battin[2]

tereza.vosicka@natur.cuni.cz

[1]Department of Ecology, Faculty of Science, Charles University, Viničná 7, CZ-12844 Prague 2, Czechia
[2]River Ecosystems Laboratory, Alpine and Polar Environmental Research Center, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
[3]Systems Ecology Group, Luxembourg Centre for Systems Biomedicine, University of Luxembourg, Esch-sur-Alzette, Luxembourg

Climate change induced glacier melt causes changes in glacier-fed streams that influence the composition of microbial communities, further influencing water properties and species composition downstream. Diatoms are one of the few primary producers able to survive in these harsh conditions, giving them great significance in terms of element cycling and providing the basis for the food chain. Yet, the diatom species diversity and composition of this habitat type is poorly explored despite rapid change, and little is known how these communities might look in the future.

Here we compare the diversity and structure of diatom communities between glacier-fed streams and their corresponding non-glacial tributaries from 131 patches from three different proglacial floodplains in the Swiss Alps. Since the glacial-fed streams have glacial meltwater as their main water source, whereas the tributaries are fed by precipitation and groundwater, through time the characteristics of the glacier-fed streams are expected to more closely resemble those of tributaries as glaciers recede. Thus, determining the differences between the glacier-fed streams and their tributaries creates a space-for-time substitution that allows us to view the likely diatom communities of glacier-fed streams in the future.

For diatom species identification, we are characterizing diatom communities from frozen sediment samples utilizing both morphological observations with light microscopy as well as 18S rDNA and rbcL amplicon sequencing. To determine the abiotic drivers of diatom communities, we also measured water properties at some of these sites.

Preliminary results so far indicate that glacier-fed streams host a unique diatom flora distinct from non-glacier tributaries, though with fewer species overall. These results indicate that diatom communities may host more diatom species in the future, but it is still unclear which species will prevail. Our research will give us a better picture of microbial community structure in proglacial floodplain streams overall, but also improve our ability to predict their future in the light of climate change.

P12: *Craticula vanensis* sp. nov., a new diatom species from the highly alkaline Lake Van (Turkey) displays an extra-long mitochondrial genome with several copies of the rRNA operon

Elif Yılmaz[1,2], Romain Gastineau[1], Cüneyt Nadir Solak[2], Claude Lemieux[3], Monique Turmel[3], Christian Otis[4], Brian Boyle[4], Matt Ashworth[5], Andrzej Witkowski[1] & Horst Lange-Bertalot[1]

elif.yilmaz@phd.usz.edu.pl

[1]Institute of Marine and Environmental Sciences, University of Szczecin, Szczecin, Poland
[2]Department of Biology, Arts and Science Faculty, Dumlupınar University, Kütahya, Turkey
[3]Département de biochimie, de microbiologie et de bio-informatique, Institut de Biologie Intégrative et des Systèmes, Université Laval, Québec, Québec, Canada
[4]Plateforme d'Analyse génomique, Institut de biologie intégrative et des systèmes, Université Laval, Quebec City, Quebec, Canada
[5]Department of Molecular Biosciences, The University of Texas at Austin, Austin, TX, USA

The diatom genus *Craticula* was described by Grunow (1867). In 1991, Mann & Stickle diagnosed the characteristic of *Craticula* in detail to better separate *Navicula* sensu stricto and *Craticula*. The genus occurs in various habitats from acidic oligotrophic waters to alkaline, saline, eutrophic and heavily polluted waters. Algaebase lists 72 taxonomically accepted species for *Craticula*. So far, 11 of these species have been recorded in Turkey.
A new species of *Craticula* has been discovered in Lake Van (Anatolia, Turkey), which is the largest soda lake in the world, in a frame of a PhD thesis dedicate to the biodiversity of the diatoms from this extreme environment. *Craticula vanensis* has been described based on its morphology combined with molecular markers. The complete plastid and mitochondrial genomes have been sequenced. Only long-reads sequencing could resolve the complexity of the extra-long mitochondrial genome, which is characterized by an alternative genetic code and the presence of several copies of the rRNA operon.

P13: *Craspedostauros nazmii* sp. nov., a new diatom (Bacillariophyta) species from Black Sea (Turkey)

Elif Yılmaz[1,2], Andrzej Witkowski[1], Neslihan Özdelice[3], Cüneyt Nadir Solak[2], Romain Gastineau[1] & Turgay Durmuş[3]

elif.yilmaz@phd.usz.edu.pl

[1]Institute of Marine and Environmental Sciences, University of Szczecin, Szczecin, Poland
[2]Department of Biology, Arts and Science Faculty, Dumlupınar University, Kütahya, Turkey
[3]Istanbul University, Faculty of Science, Department of Biology, 34134, Istanbul, Turkey

The genus *Craspedostauros* was erected by Cox (1999) to include marine species previously included in the genera *Stauroneis* Ehrenberg and *Stauronella* Mereschkowsky, based on cytological (shape and numbers of chloroplasts) and morphological (characteristics of the frustule) features.
The genus is relatively small with currently 15 taxonomically accepted species described from different regions of the World, the most recent discoveries having been done mostly in the Southern Hemisphere (e.g. Majewska et al., 2022; Zidarova et al., 2022).
The current poster describes *Craspedostauros nazmii* sp. nov., a new epilithic species from the Turkish coasts of the Black Sea, based on light and scanning electron microscopy. *Craspedostauros n*azmii sp. nov. is characterized by valves lanceolate to narrow lanceolate, slightly constricted near the apices with uniseriate striae parallel throughout the whole valve and composed of areolae on the valve face and on the mantle. Although *Craspedostauros* spp. have been observed in the Eastern Mediterranean, Aegean and Marmara Sea, *C. nazmii* sp. nov. seems to be the first species of the genus ever found in the Black Sea.

P18: An illustrated catalogue of marine benthic diatoms from two sites off the southern Bulgarian Black Sea coast

Ralitsa Zidarova[1] & Plamen Ivanov[2]

zidarova.r@gmail.com

[1]Institute of Oceanology – Bulgarian Academy of Sciences, Department of Marine Biology and Ecology, Parvi May Str. 40, 9000 Varna, Bulgaria
[2]Institute of Biodiversity and Ecosystem Research – Bulgarian Academy of Sciences, Department of Aquatic Ecosystems, Mayor Yurii Gagarin Str. 2, 1113 Sofia, Bulgaria

Marine benthic diatoms of the Black Sea have been repeatedly studied over a period of more than hundred years. Most reports came from the northern and north-western coasts. At the Bulgarian coast (the western Black Sea) studies are scarce, and in the last 30 years even no studies have been done at all. We placed artificial substrata (plexiglass) at two sites near the southern coast of Bulgaria, differing in wave action impact and anthropogenic disturbance levels. Substrata were held at position and sampled regularly between July and September 2020. A high diversity of 255 diatom taxa, including a few centric species, was discovered during the LM observations of the samples. However, the actual diversity may be even higher, since some of the taxa we observed in LM seem to represent complexes. Most of the species belonged to taxonomically complicated genera. *Amphora* sensu lato (incl. *Amphora*, *Halamphora*, *Tetramphora*, *Seminavis*) formed nearly 25% of all taxa in the samples. Other diverse genera included *Navicula* (10% of the taxa), *Cocconeis* sensu lato (8%), Nitzschia (7%), followed by *Diploneis* and *Mastogloia*. Survey of older literature showed that some of the taxa that we found could have been described in the past from the Black Sea. Unfortunately, most of these taxa are still only known from their original drawings or low-quality microphotographs, and nowadays it is impossible to separate them from other known taxa with certainty. Other taxa have been repeatedly identified in the past as some "common and widespread" marine species. Currently, identifications under the names of such taxa are considered uncertain if they cannot be verified. Many taxa had small valve dimensions, sometimes making impossible to point their generic affiliation in LM. Most of the small taxa are not illustrated in the older literature from the region. Further, during the survey of the existing iconographic material we found complexes of taxa identified earlier as a single taxon. All this shows that older literature is unreliable for identification of the Black Sea marine benthic diatoms, and the diversity was underestimated in the past reports. It is clear that more efforts should be made to study the Black Sea marine benthic diatoms in order to find their identities and correct names. At present, we could only illustrate the taxa in our samples, as a reference for future research.

Author Index