Diatomededelingen 33

2009

The joint

40^{th} Meeting of the Dutch-Flemish Society of Diatomists (NVKD)
and
3^{rd} Central European Diatom Meeting (CE-DiatoM)

26-29 March 2009

Utrecht, The Netherlands

Nederlands-Vlaamse Kring van Diatomisten

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ORGANIZATION

The conference is jointly organized by TNO Built Environment and Geosciences and the Palaeoecology Group of the Institute of Environmental Biology at Utrecht University.

Organization committee

Prof. Dr. André F. Lotter	Utrecht University
Dr. Holger Cremer	TNO Built Environment and Geosciences
Marjolein Mullen	Utrecht University
Rasa Vasiliauskiené	TNO Built Environment and Geosciences
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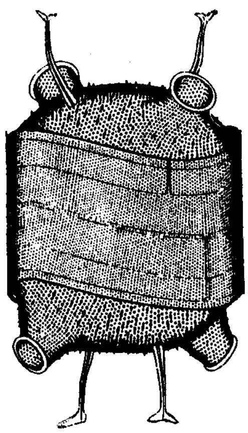

Nederlands Vlaamse Kring van Diatomisten


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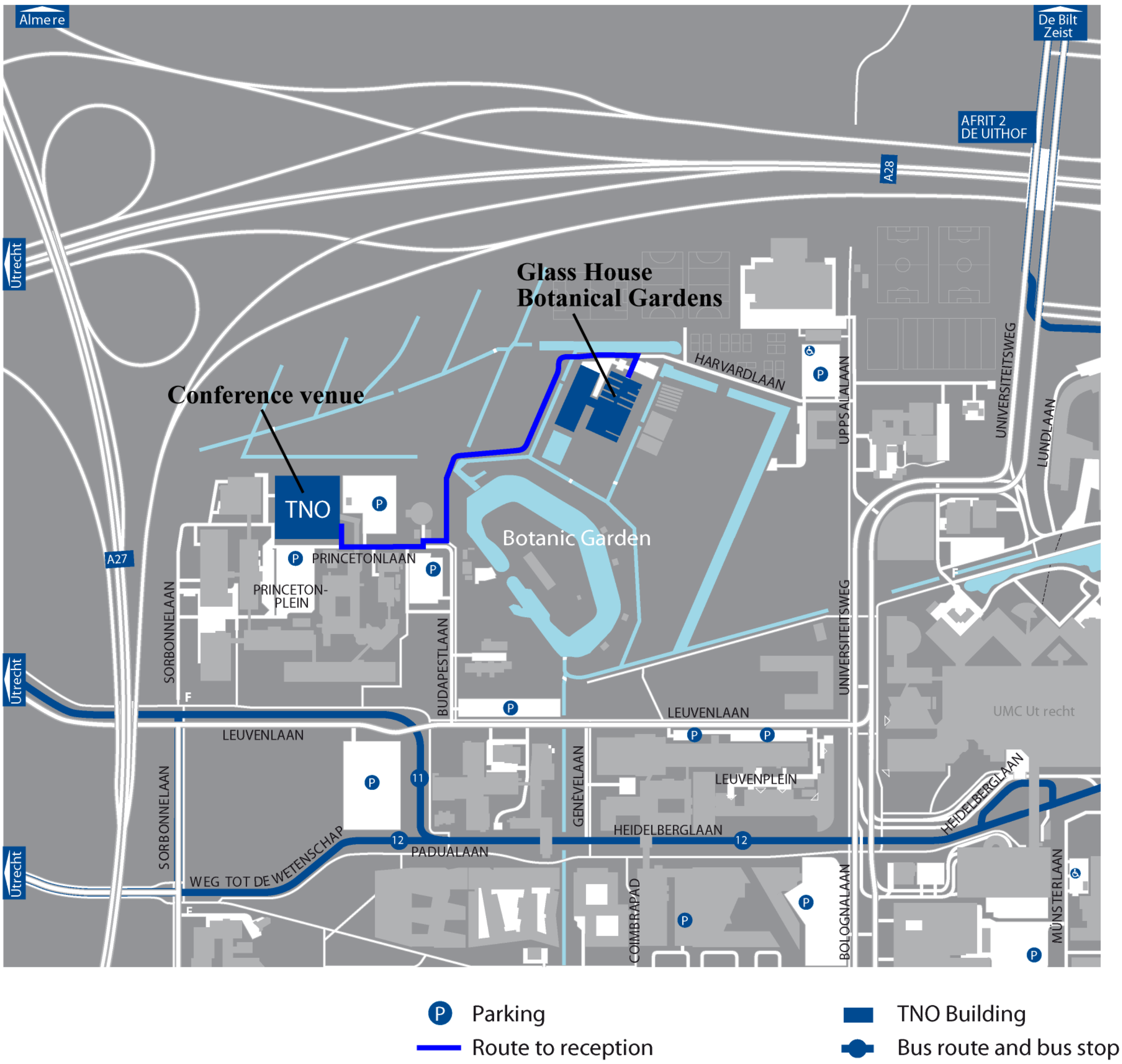
LOCATION

Busses no. 11 and 12 ride frequently from Utrecht Central Station to *De Uithof*, the University Campus. It's only a 5 min. walk from the bus stops *Botanische Tuinen* (bus no. 11) and *Padualaan* (bus no. 12) to both the Botanical Gardens and TNO.

Addresses:
Glass House of Botanical Gardens, Harvardlaan 10, 3584 CV Utrecht, The Netherlands

TNO Built Environment and Geosciences, The Geological Survey of the Netherlands, Princetonlaan 6, 3584 CB Utrecht, The Netherlands



PROGRAM

Thursday, 26 March 2009

18:00 – 21:00 Icebreaker and Registration in the glass house of Utrecht University's Botanical Gardens (see map on page 13)

Friday, 27 March 2009

08:00 – 09:00 Coffee and registration (Foyer of the TNO Building, see map on page 13)
Posters should be mounted on the poster boards on the Atrium before 09:00 according to the numbers on pages 19 and 20. Tape will be provided by the organizers.

09:00 – 09:20 Welcome addresses by Dr. Ir. Chris te Stroet (TNO Built Environment and Geosciences) and Prof. Dr. André F. Lotter (Utrecht University)

1st Session: The European Water Framework Directive — Chairperson: André F. Lotter

09:20 – 10:00 Herman van Dam
Keynote lecture: *Diatoms and the European water Framework Directive: state of the art*

10:00 – 10:20 Martyn Kelly
Beyond surveillance monitoring: diatom-based indices and the Water Framework Directive

10:20 – 10:40 Thomas Hübener, S. Adler, P. Werner
How far back in time do we have to go for lake-type specific reference conditions? – Paleolimnological examples from lowland lakes and their implications for the EU-WFD

10:40 – 10:50 Holger Cremer
Opening of the *Diatom Microarts Exhibition* exposed by Appy Bonis

10:50 – 11:30 Coffee (Atrium TNO Building)

2nd Session: Diatoms as ecological indicators — Chairperson: Bart Van de Vijver

11:30 – 11:50 Raffaela Zorza, N. Miani, G. Mattassi
Diatom communities as ecological indicators of some reference sites in Friuli Venezia Giulia

11:50 – 12:10 Joanna Picińska-Faltynowicz, J. Blachuta
Assessing the ecological status of running waters in Poland by diatom phytobenthos – the present state of the method

12:10 – 12:30 Agata Wojtal, A. Witkowski, B. Scharf
Assessing environmental changes and reference conditions for springs in South Poland using subfossil diatoms

12:30 – 14:00 Lunch (cafeteria Minnaert Building, Utrecht University), afterwards
Coffee (Atrium TNO Building)

13:30 – 14:00 *General assembly of the NVKD (Dutch-Flemish Society of Diatomists) in the auditorium (TNO Building) chaired by Bart Van de Vijver*

3rd Session: Diatom life cycle, functional morphology and fossil diatoms

Chairperson: Koen Sabbe

14:00 – 14:20	Wim Vyverman, V. Devos, V. Chepurnov, D. Inze, M. Vuylsteke, K. Sabbe *Transcriptome and exometabolisme analysis of sexual reproduction in diatoms*
14:20 – 14:40	Ludmila Bukhtiyarova *Diatom frustule functions and approach to the functional morphology of the diatoms*
14:40 – 15:00	Nadja Ognjanova-Rumenova, R. Jahn *Re-investigation of the fossil diatom flora from Jastraba deposits, Ehrenberg Collection, Germany*
15:00 – 15:20	Krisztina Buczkó, E.K. Magyari, M. Braun, M. Bálint *Late Glacial and Holocene diatoms from glacial lake Taul dintre Brazi Mt. Retezat, Romania*
15:20 – 15:40	Emiliya Kirilova, O. Heiri, P. Bluszcz, A.F. Lotter *Seasonal dynamics of diatom assemblages as revealed by varved sediments*
15:40 – 17:00	Coffee and **1st Poster session** (Atrium TNO Building)
19:15 – 22:00	Conference dinner in the Academy Building, Domplein, Utrecht

Saturday, 28 March 2009

08:00 – 09:00 Coffee (Atrium TNO Building)

4th Session: Diatom taxonomy **Chairperson: Wim Vyverman**

09:00 – 09:20	Tsang-Pi Chang Discostella *(*Cyclotella*)* nana *(Hustedt) Chang, a primitive centric diatom species*
09:20 – 09:40	Koen Sabbe, G. Casteleyn, W. Vyverman *Species structure and biogeography of the marine planktonic diatom* Pseudo-nitzschia pungens
09:40 – 10:00	Aleksandra Zgrundo, P. Lemke, R. Majewska *Diatoms of the Vistula River mouth – taxonomy and ecological interpretation*
10:00 – 10:20	Bart Van de Vijver, A. Jarlman *Non-marine diatoms from Swedish rivers*

10:20 – 10:50 Coffee (Atrium TNO Building)

5th Session: Epiphytic and epilithic diatoms **Chairperson: Regine Jahn**

10:50 – 11:10	Marco Cantonati, D. Spitale, A. Scalfi, M. Battistotti *Epiphytic (on the rhodophyte* Bangia atropurpurea*) and epilithic littoral diatoms of Lake Garda (Italy) studied in the frame of the ACE_SAP Project (2008-2011)*
11:10 – 11:30	Katarzyna Bobrukiewicz, B. Szulc *A comparison of the diatom communities of selected peat bog pools with different pHs during autumn at Fenn's and Whixall Mosses in the United Kingdom*
11:30 – 11:50	Luc Denys, T. De Bie, S. Declerck, E. De Roeck, L. Colson *Distribution and diversity of diatoms in the Tommelen pool complex*
11:50 – 12:10	Prakash Nautiyal, R. Nautiyal, J. Verma *Diatom flora of the Gangetic drainage in the Indian Highlands: a biogeographic perspective*
12:10 – 12:30	Maxim Kulikovskiy, N. Shkurina *Species composition and pecularities of the centric diatom flora from the waterbodies and watercourses of Kamchatka (Russia)*

12:30 – 15:00 Lunch & Coffee and **2nd poster session** (Atrium TNO Building)

6th Session: Diatoms as biomonitors **Chairpersons: Thomas Hübener**

15:00 – 15:20	Adéla Moravcová, L. Nedbalová, O. Rauch, J. Lukavský *Benthic diatom communities in mountain streams: response to anthropogenic pollution*
15:20 – 15:40	Cüneyt Solak, É. Àcs, H. Dayioglu *The application of diatom indices in Felent Creek (Porsuk-Kütahya)*
15:40 – 16:00	Maria Kahlert *Diatoms as biomonitors in Sweden*
16:00 – 16:20	T. Cibic, Oriana Blasutto, C. Falconi *Living marine benthic diatoms as indicators of nutrient enrichment*

16:20 – 18:30 Drinks and student awards (Atrium TNO Building)

Sunday, 29 March 2009

10:30 – 12:30	Excursions in the city of Utrecht (see city map for meeting points)
12:45 – 14:00	Lunch at Aal Restaurant, Utrecht (http://www.aalrestaurant.nl/)
14:00	End of the conference

POSTER SESSIONS

All Poster sessions take place on the Atrium in the TNO Building. Posters should be fixed on the appropriate board indicated by the poster number below. Two official poster sessions will be organized. Authors are asked to stand at their posters during the poster session.

1st poster Session, Friday 17 March 2009, 15:40 – 17:00

Topic: River diatoms

1.	I. Alvarez Blanco et al.	*Autoecology of epilithic diatoms in the Duero rivers Basin*
2.	M. Frankova et al.	*Diatom treasures of the Western Carpathian spring fens*
3.	E. Rott & D. Gesierich	*Interesting diatoms from lotic headwaters in the central Eastern Alps*
4.	V. Üveges et al.	*Photosynthetic activity of benthic stream algae on natural and modified stream sections of the Torna stream (Hungary)*
5.	A. Wojtal et al.	*Diatom assemblages in calcareous mountain springs in Poland and Turkey*
6.	P. Spierenburg et al.	*Shifts in macrophyte composition in response to elevated* CO_2 *in softwater lakes*

Topic: Diatom paleoecology

7.	A. Besse-Lototskaya et al.	*Diatoms as indicators of flooding events: paleoreconstruction of floodplain lakes along river IJssel (The Netherlands)*
8.	H. Cremer et al.	*300 years of environmental change reflected in sediments of a deep dike burst lake in the Netherlands*
9.	U. Hoff et al.	*Holocene environmental change on Kamchatka, Eastern Russia – from diatoms in lake sediments*

Topic: Diatom floras

10.	B. Chattová et al.	*Diatoms of turfy fish pond margins of the Třeboň basin, Southern Bohemia*
11.	I. Jüttner et al.	*Cymbelloid diatoms from aerial habitats in the Gokyo Valley, Everest (Sagarmatha) National Park, Nepal*
12.	K. Kopalová et al.	*The diatom flora of lakes on James Ross Island (Antarctica)*
13.	W.-H. Kusber et al.	*Databasing diatoms - Experiences with 3 generations of data input tools*
14.	H. Lange-Bertalot et al.	*Diatoms in the Mongolian* Sphagnum *ecosystem: significance for formation of regional flora and comparison with the same ecosystem of Eurasia*
15.	P. Lemke & A. Zgrundo	*Studies on planktonic diatoms – methodological aspects*
16.	A. Mertens et al.	*Interesting brackish taxa from the Antwerp harbour docks*
17.	R. Müller	*Influence of storm "Kyrill" induced deforestation on the silica supply of the Sorpe Dam*

2nd poster Session, Saturday 18 March 2009, 12:10 – 14:00

Topic: Diatoms and water quality assessment

18. É. Ács et al.	*Implementation of the European Water Framework Directive to assessment the water quality of Hungarian running waters with diatoms*
19. W. Gabriels & G. Verhaegen	*Set-up of diatom monitoring programs in surface waters in Flanders (Belgium) for the Water Framework Directive*
20. S. Gottschalk & M. Kahlert	*Littoral diatoms as indicators for water quality in Swedish lakes*
21. R. Stancheva Hristova et al.	*Application of epilithic diatoms in water quality assessment of rivers Vit and Osum, Bulgaria*
22. B. Szulc & K. Bobrukiewicz	*Benthic diatom communities in the biological assessment of water quality in the Middle section of the Pilica River (Central Poland)*

Diatom taxonomy

23. L. Bukhtiyarova	*The review on rare species from the Caspian Sea. I*
24. C. Cejudo Figueiras et al.	*The taxonomy of* Fragilaria construens *var.* subsalin*a (Hustedt) and two morphologically related new taxa*
25. C. Cocquyt & D. Verschuren	*The algal flora of Lake Kaitabarago, a small Ugandan crater lake, with special attention to the diatoms*
26. R. Jahn et al.	*Illustrating diatoms: how, when and why?*
27. A. Jarlman et al.	*The genus* Neidium *in Sweden*
28. H. Lange-Bertalot et al.	*New and interesting species of the genus* Navicula *in northern and western Europe*
29. K. Stachura-Suchoples et al.	*On freshwater, extinct taxa in the genus* Thalassiosira *with observations on* Thalassiosira *sp. from Pliocene deposit in Oregon, USA*
30. S. Smirnova & U. Ulanova	*Initial and non-initial cells in* Meridion circulare *complex: variation in size and shape*
31. C. Stenger-Kovács et al.	*Morphological study of a rare diatom species occurring in Lake Balaton (Hungary)*
32. A. Ulanova & P. Snoeijs	*A morphological study of the giant* Licmophora *species from the Greek Mediterranean coast*
33. P. Urbánková et al.	*Molecular diversity in* Frustulia saxonica *sensu lato*
34. R. van Wezel et al.	*Diatoms and Microscopy: a contrasting combination?*

CONFERENCE DINNER

Date and time: Friday, 27 March 2009 at 19:15
Meeting point: Domplein in front of the Academy Building

The conference dinner will take place in the historical Senate Hall of Utrecht University's Academy Building in the centre of Utrecht, close to the Dom Tower. In a medieval academic atmosphere we shall have a cosy get-together enjoying a rich buffet.

The Academy Building on the Domplein represents the heart of Utrecht University. It is the oldest building of the University. Teaching, graduations, thesis defense ceremonies, inaugural lectures and conferences have been taking place here since 1634. The Auditorium (*Aula*) dates back to 1461 and is the oldest part of the building. It was the stage for the conclusion of the Treaty of Utrecht in 1579, often seen as the inception of the Dutch democratic state. The frontal part of the building situated at the Domplein was built between 1891-1894 in the Dutch Renaissance style and was a gift of the City of Utrecht. The "Academiegebouw" houses a large collection of portraits of academics and governors that have been collected since the 17^{th} century. The collection comprises more than 500 oil paintings, pen drawings, etchings and sculptured busts. A large part of the unique collection is accessible to the public. The University Hall also includes the 15^{th} century Chapter Room which has been used as lecture room since 1634.

EXCURSIONS

Historical Utrecht and botanical highlights

Guide	Bert Maes
Date and time	Sunday, 29 March 2009 at 10:30
Meeting point	Mariaplaats, Utrecht City Centre (see city map)
Description	This excursion will be guided by a recognised expert in the ecology and cultural history of the town. The walk will include stops at the 14th century Dom tower, the Mariaplaats with its Romanesque churchyard and a special herb garden, and one of the oldest European public parks (constructed in 1826) with many monumental trees. Participants will also visit the small but nice old botanical garden (1730) with an enormous *Gingko* that is claimed to be the first one planted in Europe. Worth seeing are also an orangery from 1730 and an original greenhouse from 1906.

Historical Utrecht and geological highlights

Guide	Wim Dubelaar
Date and time	Sunday, 29 March 2009 at 10:30
Meeting point	Domplein, Utrecht City Centre (see city map)
Description	This walk will be guided by a geologist who is an expert for natural stones and their use as building material. The city walk will guide the participants to a number of buildings (Dom, City Hall, Pieterskerk, façades along the Oudegracht) that often not only have an interesting history but also are made of special natural stones like the Roman tuff, the Bentheim sandstone or travertine.

STUDENT AWARDS

What	The best three student contributions (oral contribution or poster) will be awarded a cash prize and a nice souvenir.
Jury members	Marco Cantonati Herman van Dam Ingrid Jüttner

Oral contributions

Bobrukiewicz, Katarzyna	*A comparison of the diatom communities of selected peat bog pools with different pHs during autumn at Fenn's and Whixall Mosses in the United Kingdom*
Kirilova, Emiliya	*Seasonal dynamics of diatom assemblages as revealed by varved sediments*
Moravcová, Adéla	*Benthic diatom communities in mountain streams: response to anthropogenic pollution*

Posters

Alvarez Blanco, Irene	*Autoecology of epilithic diatoms in the Duero rivers Basin*
Cejudo Figueiras, Cristina	*The taxonomy of* Fragilaria construens *var.* subsalina *(Hustedt) and two morphologically related new taxa*
Chattová, Barbora	*Diatoms of turfy fish pond margins of the Třeboň basin, Southern Bohemia*
Frankova, Marketa	*Diatom treasures of the Western Carpathian spring fens*
Gottschalk, Steffi	*Littoral diatoms as indicators for water quality in Swedish lakes*
Hoff, Ulrike	*Holocene environmental change on Kamchatka, Eastern Russia – from diatoms in lake sediments*
Kopalová, Kateřina	*The diatom flora of lakes on James Ross Island (Antarctica)*
Lemke, Paulina	*Studies on planktonic diatoms – methodological aspects*
Smirnova, Svetlana	*Initial and non-initial cells in* Meridion circulare *complex: variation in size and shape*
Spierenburg, Peter	*Shifts in macrophyte composition in response to elevated CO_2 in softwater lakes*
Szulc, Boguskaw	*Benthic diatom communities in the biological assessment of water quality in the Middle section of the Pilica River (Central Poland)*
Urbánková, Pavla	*Molecular diversity in* Frustulia saxonica *sensu lato*
Üveges, Viktoria	*Photosynthetic activity of benthic stream algae on natural and modified stream sections of the Torna stream (Hungary)*

ABSTRACTS

Contributions are listed in alphabetical order.

Implementation of the European Water Framework Directive to assessment the water quality of Hungarian running waters with diatoms

Ács, É.[1], Borics, G.[2], Fehér, G.[3], Kiss, K.T.[1], Reskóné, N.M.[4], Stenger-Kovács, Cs.[5], Várbíró, G.[2]

[1]Hungarian Danube Research Station of Ecological and Botanical Institute of HAS, Göd
[2]Environmental Protection, Nature Conservation and Water Authority of Transtiszanian Region, Debrecen
[3]Lower Danube Walley Water Directorate, Baja
[4]Environmental Protection, Nature Conservation and Water Authority of Central Trans-Danubian Region, Székesfehérvár
[5]University of Pannonia Department of Limnology, Veszprém

INTRODUCTION

As benthic algae are sessile, physical, chemical and biological interactions, disturbances in the given water have a great effect on the formation of their communities.

Therefore, they can be used in water quality assessment and biological monitoring as well. Diatoms are one of the most important groups in lotic ecosystems, major parts of benthic algae are diatoms (often 90-95 %), and accordingly they have become a substantial factor in water quality monitoring. They can be found almost in all aquatic habitats, in all periods, which is a remarkable advantage. Another important aspect is that collected diatoms can be stored until unlimited time as permanent slides or treated samples, and they can be investigated again if needed. Concept of individual can be easily defined, so species and relative abundances that belong to them can be given unambiguously. Water Framework Directive the third directive of the European Union (EU) (European Parliament, 2000, directive 2000/60/EC) require to survey and assess ecological conditions of surface water bodies. Until 2007, development of national biomonitoring systems according to WFD have begun or completed in almost every member states of the EU, and examination of benthic diatoms have become an element of these systems. Surveillance monitoring in Hungary started in 2007, previously, periphyton samples were collected from the whole country during the ECOSURV project. (Van Dam et al. 2007). In the present study, we supervised the actual qualification system (Szilágyi et al. 2008), and being in the possession of a larger data set than previously, we were able to improve it.

MATERIAL AND METHOD

The analyses were based on 1161 benthic datasets from the WFD biotic database of the Hungarian Ministry of Water and Environment. Samples were collected from 398 different Hungarian rivers during the vegetation period (from May to October) in 2005, 2006 and 2007. The diatoms were treated with H_2O_2 and HCl (according to CEN 2003), washed three times in distilled water, and mounted with Naphrax® mounting medium.

Pearson -correlations were calculated between diatom indices and chemical parameters.

RESULTS AND DISCUSSION

In Hungary 22 river types (+ three for the Danube which has 3 different types as set by the IPCDR) were separated according to the „B" typology (Table 1). The 26th type contains the heavily modified rivers. The river types are described in MoEW (2005).

In the first step we determined which diatom indices correlate significantly with the majority of investigated chemical parameters.

These indices were IPS, SID and TID, except in the case of river type 1, 23, 24 and 25. In the next step, correlation between the multimetric index made from the three mentioned indices (IPSITI= (IPS+SID+TID)/3) and chemical parameters were calculated. In this manner we received significant correlation in even more cases. In the case of river types 1, 23, 24 and 25, qualification was made with IPS. Index categories of IPSITI were constituted at the mean of the index categories of the three basic indices.

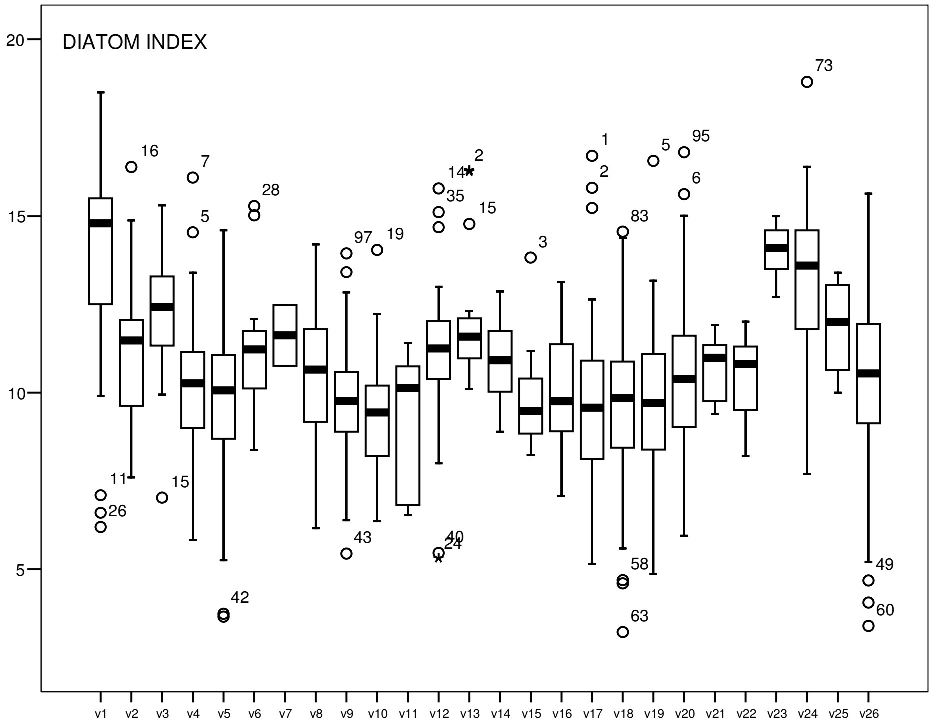


***Figure 1**. Values of diatom indices in the case of each river types. Five basic data of the box-plot: minimum, lower quartile (25%), median, upper quartile (75%), maximum. Outlier values are marked with circles, extremely outlier ones are marked with stars.*

As it shown on Figure 1., index values of highland streams (type 1-10) are higher than the ones of lowland steams (type 11-22), but it is also conspicuous that index values of large and very large rivers with rough bed-material (type 6, 7, 13, 14) are higher than the others both in the case of highland and lowland streams. From the watercourses with fine bed-material only the very large ones (type 20) have higher index values. Consequently, the most vulnerable rivers are the slow, lowland streams with small catchments areas. Index values of heavily modified water bodies are similar to those of lowland ones, but they vary between wide ranges.

Considering the original index boundaries, in each type we selected sampling points which had good values on the basis of chemistry and indices, too. If several samples from the same site were at our database, we worked with the best index value, except in the case of large rivers, when we used all of them. Omission of bad index values in the case of small streams was reasonable, since these waters may show worse values because of autosaprobity, lack of water, or shading effect of macrophytes.

25^{th} percentile of index values of the selected water bodies was considered the boundary between excellent /good (H/M) quality. Additional index boundaries were made with dividing the remainder into four parts.

EQR boundaries were determined with normalization, that it should have values between 0 and 1, with equal categories. Values constructed in this manner, were plotted against index boundaries. (EQR

H/G= 0,8; G/M= 0,6; M/P= 0,4; P/B= 0,2) EQR can be calculated from the observed index value and the equation of the line that best fit for the given points. (Table 1., Y is the value of EQR, X is the observed index value).

Table 1. *Equations for calculating EQR values within each type.*

type	equation	R^2
1.	Y=0.0528x-0.028	0.9978
2.	y=0.0531x-0.0219	0.9966
3-20. and 26.	y = -0.0014x2 + 0.0807x - 0.0653	0.9977
23-24.	y = 0.0528x - 0.0808	0.9978
25.	y = 0.0529x - 0.0471	0.9991

Among the 398 investigated water bodies, there were 15 with high, 204 with good, 165 with moderate, 11 with poor and 3 with bad condition (Figure 2). Categories determined by diatom indices reflected well to improving values of chemical variables (for instance, correspondence between chemical oxygen demand and water quality classes is presented on figure 3.) It is well known that diatoms can be used effectively to monitor organic pollution and eutrophication, but our result suggest that in the case of lower categories (especially in the case of heavily polluted water bodies), qualification with benthic diatoms may loose its relevance.

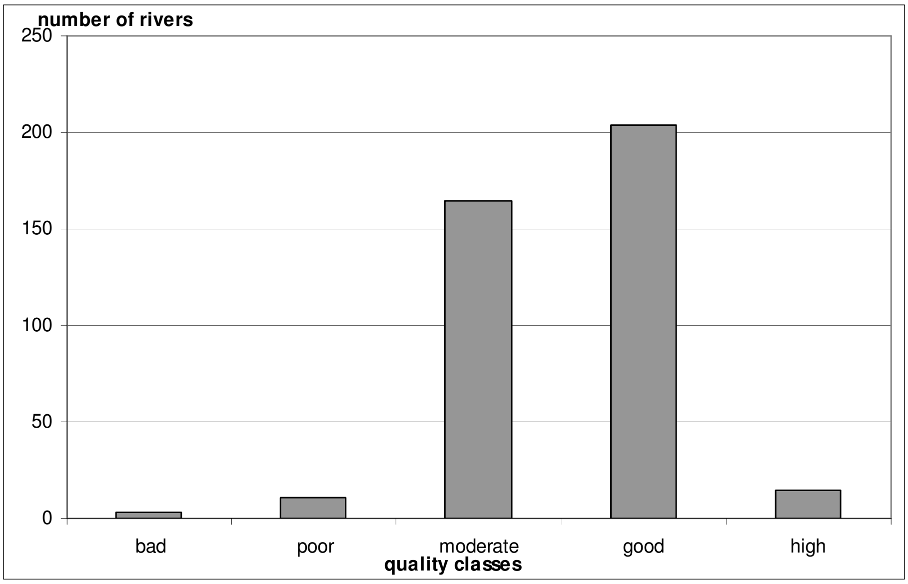


Figure 2. *Water quality of the investigated Hungarian streams based on benthic diatom investigations.*

SUMMARY

By the analysis of the benthic diatom data of the Hungarian national database, an EQR based qualification system has been developed, of which results are presented in this paper. The values of the new multimetric diatom index showed that lowland streams are in worse ecological status than highland streams in Hungary. Our most vulnerable rivers are slow, lowland ones with small catchments areas.

More than the half of the 398 investigated streams achieved the level of good ecological status. Our results also suggest that in the case of lower categories, qualification with benthic diatoms may loose its relevance.

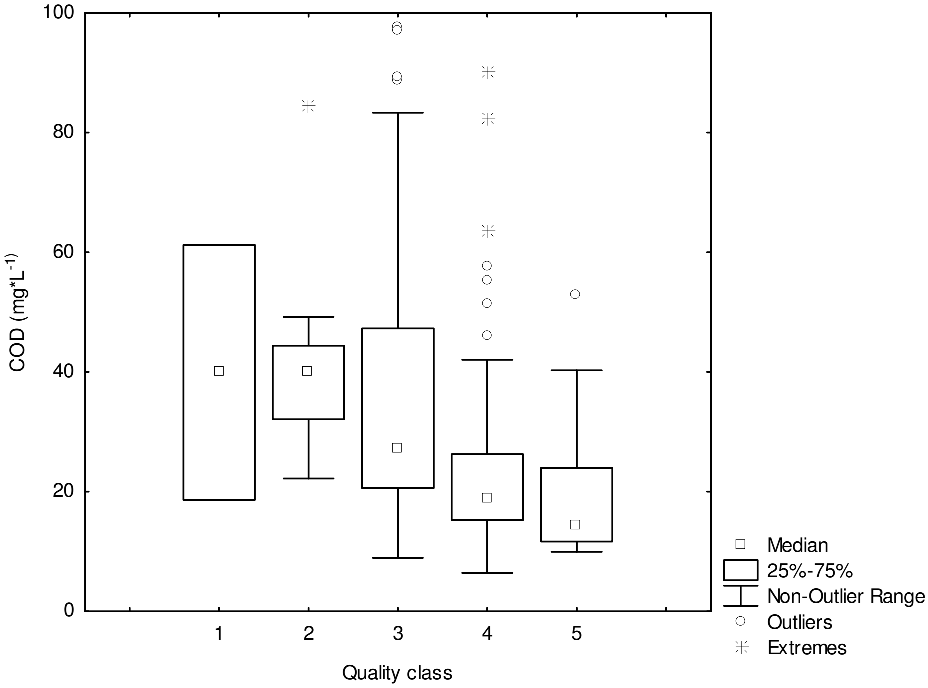


Figure 3.*Values of chemical oxygen demand in each quality classes (1: bad, 5: high).*

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Autoecology of epilithic diatoms in the Duero rivers Basin

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Diatoms are known to be an effective tool for water ecosystem health diagnosis. Two major arguments in favour of using diatoms in water-quality assessment are their cosmopolite distribution and their well-known ecological requirements. This features let, therefore, that diatom indices developed in a geographic region can be used in other parts of the world. However, there is a strong evidence that diatom metrics are less useful when applied in a geographic area other than that where species-environment relationships were originally assessed. This is due to the fact that species have different autoecological requirements in different geographic areas.

In this study, we define the ecological optimum and tolerance ranges for selected environmental variables (pH, conductivity, BOD_5, [NH_4^+-N], [NO_3^--N], [PO_4^{3-}-P]), in three common epilithic diatom species in the Duero Basin (NW Spain): Achnanthidium pyrenaicum (Hustedt) Kobayasi, Navicula tripunctata (O.F. Müller) Bory and Eolimna minima (Grunow) Lange-Bertalot; comparing our results with the data gathered from different geographic regions. Furthermore, we compare the autoecological parameters obtained from the northern and southern subbasins, and from different years, in order to observe if significant small-scale spatio-temporal changes exist.

Our results show that there are variations in species' autoecological parameters between different regions. Furthermore, there are significant changes comparing northern and southern Duero subbasins for some species and physiochemical variables, although all studied taxa exhibited highly significant differences regarding conductivity optima and tolerance ranges comparing both zones. Additionally, different autoecologies have been observed for certain diatoms and environmental factors comparing two different years.

It can be concluded that freshwater diatom autoecologies can vary between different geographic areas. This implies that, in order to improve water-quality bioassessments, autoecology-based diatom metrics should be developed by quantifying species distributions along enviromental gradients, using datasets representative of the areas or river types where the metrics will be applied.

Diatoms as indicators of flooding events: paleoreconstruction of floodplain lakes along river IJssel (The Netherlands)

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Global Change will have a serious influence on the flooding frequency and intensity of lowland rivers in The Netherlands. The increased flooding events will cause major effects on the aquatic communities present along these lowland rivers. Floodplain lakes are one of the first ecosystems that are likely to be touched by an increased flooding frequency since water of a different chemical composition and/or quality will enter these closed environments. The effects on the aquatic organisms such as diatoms, macrophytes and macro-invertebrates are still not entirely understood. The purpose of the present study is to investigate the possible effects of flooding on the diatom composition and ecological water quality of floodplain lakes by reconstructing the flooding events of the past 100-150 years.

Using both piston and gravity coring equipment, a sediment sequence of 120 years was obtained in a small floodplain lake near Huize de Poll. The combination of the diatom analysis, radiometric dating and historical records of past floodings allowed us to reconstruct the effects of these floodings on the diatom composition. Prior to 1960, the floodings increased the nutrient load in the floodplain lake altering the diatom composition from a *Cyclotella*-dominated flora to a *Stephanodiscus*-dominance whereas after 1960, a decrease in the nutrient conditions were observed following the flooding with *Aulacoseira granulata* and *A. ambigua* being the dominant species. A morphometric analysis of the *A. granulata* valves gave us a reliable instrument to indicate the exact flooding event in the core.

This poster presents the results of the diatom analysis with the reconstruction of the nutrient conditions in the Huize de Poll floodplain lake. The results of the morphometric analysis of *A. granulata* are discussed in full detail.

A comparison of the diatom communities of selected peat bog pools with different pHs during autumn at Fenn's and Whixall Mosses in the United Kingdom

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The main subject of this research project was to compare the benthic diatom communities of the selected peat bog pools with the different pHs during autumn at Fenn's and Whixall Mosses National Nature Reserve (NNR). Both Mosses are a lowland raised mires of national importance which are partially damage by cutting over the bog for the commercial reasons. Rehabilitation management works commenced on the NNR in 1991 and aim to return the process of active raised mire formation (Horton 2004).

The main aims of the present study was firstly to produce a list of diatom species occurring in the selected pools in the Fenn's and Whixall Mosses with a special attention paid to diatom species which can be used as a bioindicators, secondly to create a photographic documentation of the identified taxa and thirdly to try to assess the ecological status of the selected bog pools.

The investigation was based on 18 benthic samples collected in 6 selected bog pools for 3 months (September 2008 – November 2008). Analysis was carried out to obtain the qualitative and quantitative diatom composition. The species composition was compared on the particular sampling sites. The Omnidia software was also used to assess the values of pH on the basis of biological analysis. For comparison the values of the pH, conductivity, temperature of water and of air were also measured using pH- and conductivity-meters.

Altogether 52 diatom species were identified on the selected sampling pools. Results show the differences in the diatom-flora between selected sites which concerned mainly the qualitative composition of diatom communities, the dominants and subdominant species which occurred in different communities and also the quantitative composition of diatoms assigned to particular trophic and pH classes. The results from the biological analysis seem to confirm the quality of water from the physic-chemical analysis. However, the results presented in this project are very initial. It is absolutely essential to continue this investigation for the next 9 months to achieved results from whole vegetation season.

There had been any previous work about diatom communities carried out on the Fenn's and Whixall Mosses, and it is hoped that this investigation has highlighted the usefulness of diatoms in the biological analysis of water quality.

Late Glacial and Holocene diatoms from glacial Lake Taul dintre Brazi, Retezat Mts, Romania

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INTRODUCTION

The rich biotic evidence preserved in lake sediments of remote alpine lakes has special value in the reconstruction of past ecosystem reactions to rapid climate changes. Siliceous algae (diatoms and crysophycean statospores) are one of the most often studied biotic proxy, but the evenness of diatom-based studies is low, some lake-districts are studied more in detail and repeatedly, while others remain completely unknown (Claire et al. 2005). One of such poorly investigated lake-rich areas is the Retezat Mountains (South Carpathian Mountains).

The Retezat is the wettest massif in the Romanian Carpathians due to Mediterranean and oceanic influences. As a result, the effects of the last glaciation have been more significant here than elsewhere in the South Carpathians. Numerous glacial lakes appear in the subalpine and alpine belts that were formed following the retreat of the ice, mainly during the Late Glacial. One of these glacial lakes is Lake Taul dintre Brazi (N 45o23'47" E22o54'06" 1740 m a.s.l) from the subalpine belt. It is located below the upper tree limit, in a Norway spruce (*Picea abies*) forest. So far, only a single radiocarbon dated pollen diagram provides information on the Late Glacial and Holocene vegetation history of the subalpine belt (Fărcaş et al. 1999). Diatom assemblages from palaeoecological respect were studied at first time by Péterfy (1974) in Mts Retezat. Recently diatoms of pre-industrial times and the present day were compared in order to show biological and limnological changes, from five lakes of the district (Claire et al. 2005).

MATERIAL AND METHODS

Five meters long sediment core was taken in 2007 with Livingston piston corer from the deepest part of the shallow lake (1 meter average depth). For sub-sampling the plastic tubes containing the sediment were cut into halves and sub-samples were taken at 1-4 cm intervals for multi-proxy analyses, including pollen, macrofossils, cladocera, chironomids, geochemical and siliceous algae. For siliceous algae analyses samples were prepared using standard digestion procedures (Batterbee 1986). Aliquot-evaporated suspensions were embedded in Zrax (refractive index 1.7). At least 300 valves were counted in 52 samples using a light microscope (LEICA DM LB2 with 100 HCX PLAN APO). The percentage ratio of diatoms to chrysophycean cysts follows Smol (1985). For the modelling sediment deposition time, nine plant macrofossil samples were analysed in the AMS Laboratory in Poznan, Poland. CalPal-2007Online program (Danzeglocke et al. 2007) was used to obtain calibrated age ranges (Table 1). Diatom stratigraphies were zoned with optimal splitting by information content as implemented in the program psimpoll 3.00 (Bennett, 1992).

Table 1. *Results of the AMS ^{14}C measurements of core Taul Dintre Brazi. All dates were converted into calendar years BP using the CalPal-2007Online program.*

Laboratory code	Dated material	Method	Depth below water surface (cm)	^{14}C ages BP	Calibrated BP age ranges (1 sigma)	Mid-point of 1 sigma calibrated age range
Poz-26103	needle leaves	AMS	119	725±30	668 – 691	680
Poz-26104	cone scale	AMS	160	1735±30	1604 – 1692	1648
Poz-26106	*Pinus mugo* cone	AMS	238	3045±30	3230 – 3324	3277
Poz-26107	*Pinus* twig	AMS	315	5040±40	5739 – 5873	5806
Poz-26108	needle leaves	AMS	355	6320±40	7196 – 7293	7245
Poz-26110	*Picea abies* seed and 2 *Picea* needle leaves	AMS	450	8240±50	9135 – 9301	9218
Poz-26111	*Picea* needle leaves	AMS	505	8810±50	9753 – 10054	9904
Poz-26112	*Picea abies* cone	AMS	545	9610±50	10,833 – 11,100	10,967
Poz-27305	*Pinus* sp. needle leaves (2)	AMS	578	11590 ± 60	13,353 – 13,586	13,470

RESULTS AND DISCUSSION

More than one hundred taxa were distinguished in the 52 samples. The "fragilaroid" taxa (including *Fragilaria, Pseudostaurosira, Stauroforma, Staurosira*) were abundant in the older, Late Glacial and Early Holocene layers. Beside the common fragilaroid species, *Stauroforma exiguiformis* was dominant in several samples. In the last 10,000 cal yr BP *Aulacoseira* species gradually replaced fragilaroid taxa. At least eight different *Aulacoseira* taxa alternated in the Holocene. *A. alpigera* was dominant, but *A. nygaardii, A. subarctica, A. ambigua, A. nivalis, A. pfaffiana, A.* cf. *lirata* were also abundant. *A. valida* was present having lower but permanent relative frequency throughout the Holocene. Small-celled, fine structured diatoms were abundant in the sedimentary sequence, causing difficulties in the species level identification. The SEM studies provided evidence for the presence of *Achnanthidium, Eolimna, Kobayasiella, Microcostatus, Nupela, Psammothidium* and *Sellaphora* species.

Three zones were differentiated with 2-5 sub-zones (Fig. 1.) on the basis of the generic level diatom analyses. The most characteristic changes were found at *ca*. 10,150 and 5800 cal yr BP. Below 588 cm (14,266 cal yr BP) diatoms were not found.

DAZ TDB-1 (584 - 514 cm; 14,000 – 10,150 cal yr BP)

Small fragilaroid taxa are dominant, with the definite peak of *Sellaphora* species pointing to cold, shallow pond condition. The increasing abundance of different small araphnid species explains the division into sub-zones at 12,350 and 10,800 cal yr BP.

DAZ TDB-2 (514 – 310 cm, 10,150 – 5700 cal yr BP)

The frequency of fragilaroid taxa fluctuates but they are gradually replaced by *Aulacosiera* species in this zone. A first, wetter period can be inferred between 9800 and 9700 cal yr BP (sub-zone 2B) when the increasing relative frequency of the planktonic/tychoplanktonic *Aulacoseira* taxa suggest an increase in water-depth. After these one hundred years long period fragilaroid taxa gain domainance again, suggesting decreasing lake level and/or colder water temperature (sub-zone 2C). The most remarkable changes in the profile can be detected in the fourth sub-zone (TDB-2D), when several diatoms (e.g. *Brachysira brebisonnii* with other *Brachysira* species, *Tabellaria flocculosa, Cymbella gracilis, Eunotia meisteri*) show marked relative frequency peaks. The ratio of chrysophyceaen statospores is high pointing to oligotrophic lake water. The interpretation of the paleoenvironmental changes in this period, between 8900 and 8400 cal yr BP, require further analysis esp. connecting changes with the 8.2 ka event. The fifth sub-zone can be characterised by the gradual decrease of fragilaroid species that probably refers to increasing lake level.

DAZ TDB-3 (310 – 0 cm; 5800 – 0 cal yr BP)

Aulacoseira species dominate in this zone, accompanied by several small-celled achnanthoid diatoms. Increased relative frequency of *Nitzschia* species is also characteristic that can probably be connected with higher nutrient concentration. The border of the two sub-zones is at 3000 cal yr BP.

CONCLUSIONS

The aim of the multi-proxy analyses on the sediment of Taul dintre Brazi is to provide high-resolution environmental reconstruction for periods that show rapid climate change. On the basis of earlier published paleolimnological studies in this region, rapid climate changes are expected around 12,900; 11,500, 8,600-8,200 and 3,300-2,800 cal yr BP. The preliminary, genus-level diatom analyses verified the evidences of these boundaries. Species-level identification is fundamental for fine diatom-based environmental reconstruction (pH, trophy). The higher resolution analyses with species level identification promise high quality data set for the palaeoecological reconstruction of the s southeast European region. Our results about the diatom flora and succession fit well with the data of ~ 17,000 yr old Zănoguța *Sphagnum* bog 1840 m asl in Retezat Mts (Péterfi 1974). The analogous changes can help in the better understanding of climate-driven events in the Retezat Mts.

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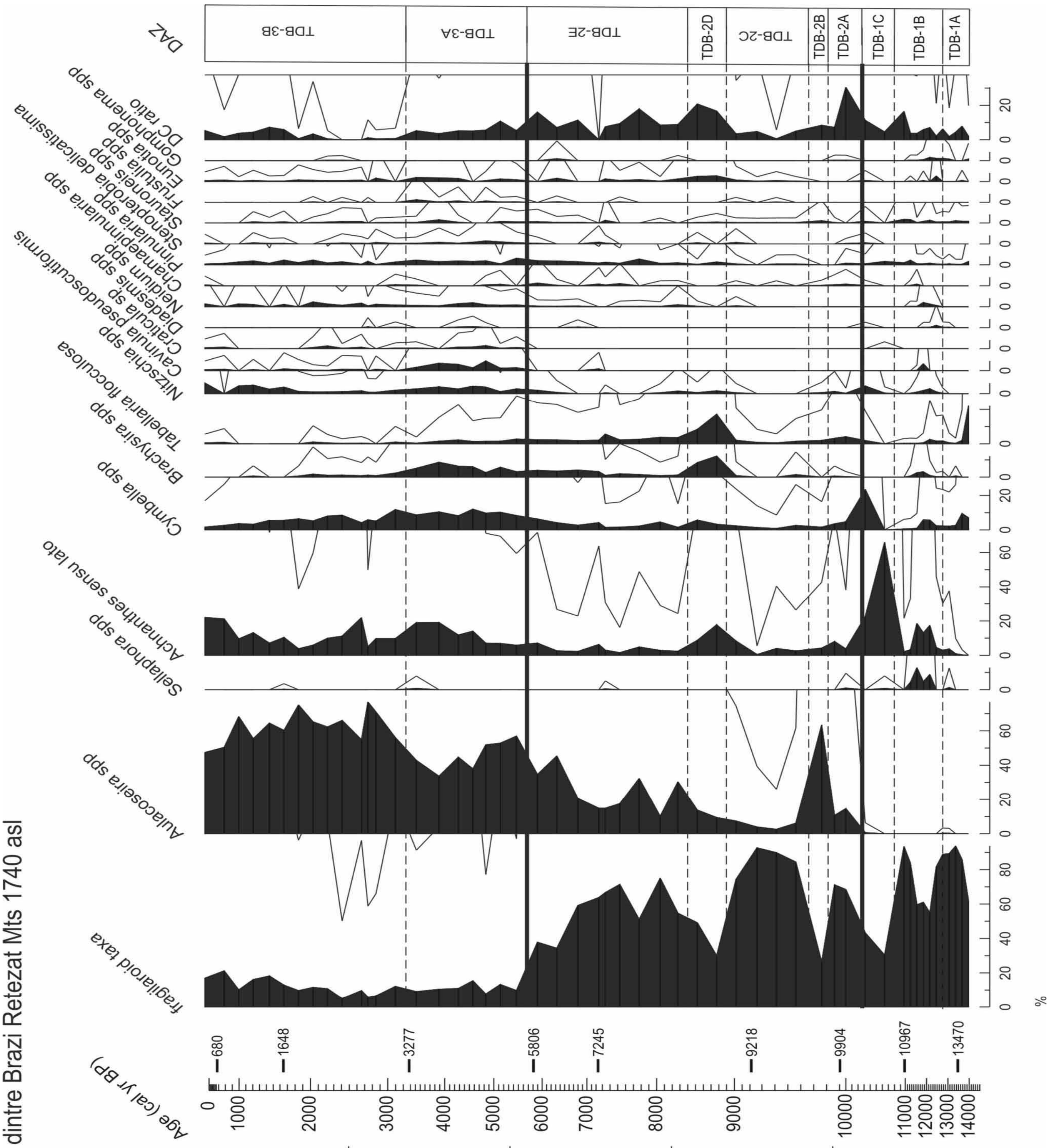

Figure 1. *Relative frequency diagram of selected diatom genus in glacial Lake Taul Dintre Brazi, Retezat Mts. Diatom relative frequencies are expressed as percentage of total diatoms. Lines without filling are exaggerated (x10).*

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Diatom frustule functions and apprpoach to functional morphology of the diatoms

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INTRODUCTION

The diatom frustule is a unique phenomenon in Nature on the genetic reproduction of the highly organized species specific inorganic structures that is concerned over the most vital functions of the protoplast enclosed in it. It still retains numerous physical-chemical features in micro- nano- scale dimension after the elimination of the protoplast, which attracts more and more researchers from the nanotechnology field. Additionally to well known biological functions: 1) mechanical protection of the protoplast, 2) increasing protoplast volume and plasmalemma surface, 3) matters absorption/ excretions, 4) forming function, the review of the modern data on the diatom frustule functions (Bukhtiyarova, in press) has showed numerous earlier unknown ones, in particularly: 5) an effective biological and chemical protection of the protoplast, 6) selective matters concentration, 7) an effective pH buffering, 8) focusing and filtering light energy, 9) rapid change in osmolarity. The task of the taxonomists should be an applying of new data in solving of the numerous taxonomical questions that also may give back useful input to nanotechnologies. It is obvious as well, that the introduction of the new terminology interpreting these data for the diatom frustule description is necessary.

DISCUSSION

The previous studying of the diatoms mostly were concentrated on the morphology of the frustule elements that has got a reflection in proposed terminology for its description (Anonymous, 1975; Ross & al. 1979 and others). Functional approach implies the study of the separate structures in the organism context – their position and functions in the hierarchies of the whole organism. According to modern knowledge any diatom frustule has a principal hierarchical construction with general order: velum – areola – strie – valve – frustule. Functional approach requires a new look at the diatom frustule morphology in order to describe all of its structural units on a regular basis and to define their role in the whole organism. From our point of view, the diatom siliceous frustule can be considered as the one consisting of basic microelements and functional units (= morphs) of different orders that take part in most (all ?) vital diatom single-cell organism functions.

Basic microelement of the diatom siliceous frustule (= db-microelement) is a morphologically detached, homogeneous frustule element, that possesses special physical-chemical features and provides primary base for the frustule hierarchical construction. The evolution of the db-basic microelements is subordinated to functional perfection of the subsequent structures in which they are included. They belong to basic microelemets of the diatom frustule different apertures and cavities in its thickness, regularly repeated and unique silica microelemets.

Morph of the diatom frustule (= df-morph) is a compound structural unit consisting of db-microelements or/and structural units of the lower orders, realizing particular functions for diatom single-cell organism and having its own evolution. We prefer to use the term morph instead of functional structure (unit) since it refers to morphology taking in consideration functional aspect and as one word can be used with different necessary epithets.

The df-morph of the first order (= simple df-morph) consists only of the db-microelements. One of the examples of it in diatom frustule is velum.

The df-morph of subsequent orders (= composed df-morph) includes more than one morph type and can be accompanied by additional db-microelements. It corresponds to the second or further frustule hierarchy steps. Areola and stria are characteristic examples of the df-morphs.

Within final structure – frustule, basic microelements and df-morphs are divided into two groups: morphologically similar, consistently repeated, and unique, single ones. Repeated db-microelements and morphs being concerned over vitally important functions of the diatom unicellular organism, increase their effectiveness by backup and higher organization. In other words, the effectiveness of N repeated db-microelements or df-morphs is not just equal to their total sum effectiveness, it is of great value. Unique structures perform a specialized auxiliary functions.

Because physical-chemical characteristics of any material structure depend on the size of the particles it is compounded from, we suggest the introduction of a size scale in all the definitions of the diatom frustule structures.

Velum is the most common and probably the most important morph in the diatom frustule. Some part of the pore occlusion types were studied in details by D.G. Mann (1980) who classified raphid diatoms into two main groups: the one that has areolae with velum in the form of hymen (= delicate membrane, occupying the whole pore with more or less uniform thickness and perforations) and the other one – in the form of vola (non-porous flaps of silica attached to the pore wall by a broad base and extending across aperture). The latter has more considerable variability in comparison with the former one. According to new information about functions of the different diatom frustule elements velum or pore occlusion are the terms mainly corresponding to this df-morph general morphology but almost totally do not reflect its functions. In our opinion, the term frustule converter can be more precise and clear one as this df-morph not only occludes of the areola aperture but also transform the effects of the environmental factors in the suitable for diatom organism manner and values. The siliceous frustule converter (= df-converter) can be defined as an universal regularly repeated nano-morph of the first order including fine aperture and basic siliceous element (-s), located within areola and carrying out the direct exchange functions between protoplast and environment: matters absorption/excretions, light energy focusing and filtering, biological-chemical protecting and others.

The renewed term of the areola we define as an universal nano-micro-morph of the second/third order that is constructed from penetrating through frustule thickness and 1or 2 df-converters. The areolae are organized in the regularly repeated groups – striae. It is obviously, the type of the df-converter is the main characteristic of the areola. However, the length of its tube, corresponding to the frustule thickness, and its inner surface also deal with their functions.

CONCLUSIONS

1. After light and electron microscopy periods functional morphology corresponds to the third stage in the diatom research that has changed the main accents from WHAT the diatom frustule is to WHY and HOW the diatom frustule was created.

2. Functional morphology requires the revision of the terms and their definitions for the diatom frustule description and is supposed to change basically the Bacillariophyta taxonomy.

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Epiphytic (on the rhodophyte Bangia atropurpurea) and epilithic littoral diatoms of Lake Garda (Italy) studied in the frame of the ACE_SAP Project (2008-2011)

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The ACE_SAP Project (Alpine ecosystems in a changing environment: biodiversity sensitivity and adaptive potential), funded by the Scientific Research Dept. of the Autonomous Province of Trento (Italy), considers a diverse set of organisms (from vascular plants and vertebrates to cyanobacteria) with the aim to gain a thorough understanding of adaptive traits of selected species. Environmental stressors supposed to be sensitive to climate change are chosen. The Limnology and Phycology Section selected the rhodophyte *Bangia atropurpurea*, that grows on rocks in the water-level fluctuation zone of Lake Garda. The goal is to understand its main adaptive traits in relation to high irradiance (UV) exposure and desiccation, from the ecological, bioorganic, morphological, and ecogenomic point of view. The study of the seasonal development of this macroalga, of its distribution in Lake Garda, of its exact location with respect to the water level along multiple depth profiles started in February 2008. Epiphytic diatoms growing on *Bangia atropurpurea* were studied in detail in two localities on the eastern shore of the lake in Trentino. 51 taxa were identified, the most frequent and abundant being *Cocconeis pediculus* and *Diatoma ehrenbergii*. Other common taxa were: *Achnanthidium minutissimum*, *Diatoma mesodon*, *Gomphonema minutum*, *Nitzschia lacuum*, and *Cymbella excisa* var. *angusta*. Interesting spatial and temporal trends were highlighted. In particular, assemblage diversity of epiphytic diatoms was found to be strongly correlated to the development (cover) of the host alga. In parallel to the study of the distribution of *B. atropurpurea* along the shores of the whole lake, epilithic diatoms were sampled from 24 stations (6 localities, distinguishing an impacted and a non-impacted area, each with two replicas). Preliminary results of the epilithon study will be provided.

The taxonomy of *Fragilaria construens* var. *subsalina* and two morphologically related new taxa

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Fragilaria construens var. *subsalina* is a common diatom found in a wide variety of aquatic systems throughout the world. This taxon was described by Hustedt from brackish waters from Oldesloe, Germany, presenting four drawings and in 1987 Simonsen lectotypified this taxon presenting some light microscopy photographs. In the present study we analyze the ultraestructure of several specimens from Hustedt's type material by means of light microscopy (LM) and scanning electron microscopy (SEM) images, showing that this taxon should be better placed in the genus *Pseudostaurosira* as *P. subsalina* and not as a variety of *F. construens*. This combination was yet provided by Morales in 2005 on the basis of LM images from a North American population found in waters with low electrolyte content, though a reexamination of this material using SEM proved to be a new species. We also describe another closely related taxon from Spain found in waters with moderate conductivity, that could also have been frequently confused with *P. subsalina*. Geometric morphometry analysis of the valve shape corroborate the morphological disjunction between these species. This study clarifies the taxonomy, ecology and systematic position of these three related taxa providing a basis to improve water quality assessments based on diatom indices.

Discostella (*Cyclotella*) nana (Hustedt) Chang, a primitive centric diatom species

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SUMMARY

Detailed morphology of *Discostella nana* was studied by using electron microscopy (SEM) on Hustedt´s type material of *Cyclotella nana*. The results clarify any confusion with Stephanodiscus diatoms or Thalassiosira species in the past.

INTRODUCTION

Hustedt (1957) had nominated *Cyclotella nana* as a new species with a simple description, i.e. he showed it only with a blank valve surface (Fig. 1). A relevant characteristic is the presence of < 5 marginal processes (Fig. 1) and thus, it can be differentiated from other species (*C. pseudostelligera* Hustedt 1939 with >5, s. Fig. 3 & none by *Thalassiosira nana* Lohmann 1908, s. Fig. 2). Using a phase contrast microscope, Simonsen (1987, p.439. 157-2, pl. 657/13-21) has shown this diatom with a clearer valve structure yet not clear on the marginal processes. Guillard and Ryther (1962) had used the scanning electron microscopy (SEM) to show the valve structure in more detail. Also using SEM, Hasle and Heimdal (1970) have examined Hustedt´s original material and found a fact that *Cyclotella nana* should be grouped in the genus of *Thalassiosira* as "*T. pseudonana* Hasle et Heindal" due to a complicate striation on the valves. Furthermore, this diatom has shown more than five marginal fultoportulae. Therefore it should not be considered *Cyclotella nana*. In contrast, Simonsen (1987) has tried to conserve the name of *Cyclotella nana* based on a microscopical examination of only one of Hustedt´s prepared slides. Obviously, Hasle (1976) and Heimdal (1970) have misnamed other diatoms as *Cyclotella nana* in Hustedt´s collected samples. Thus, Hustedt´s type material has been examined again in order to resolve the confusion.

MATERIAL AND METHODS

Hustedt´s material was obtained from the "Polar Research Institute" in Bremerhaven, Germany, and was signed "(E10093) Wümme, Grund bei der Kreuzung Ritterhuder Heerstrasse (06.06.1956) H8". It should be identical to the "Liquid-preserved net sample, Wümme, Germany, 6 June 1956 (Hustedt Collection)", previously examined by Hasle and Heimdal (1970) and Hasle (1976). The dried sample was treated with low concentrated HCl and washed three times with distilled water via centrifugation. A portion of the clean valves was prepared on a metal-stub, coated with gold and observed in a SEM (Hitachi-650). Such SEM figures were compared to those in Chang and Steinberg (1989) or in Chang and Chang-Schneider (2008).

RESULTS AND DISCUSSION

The valves < 5 µm diameter and always decorated with 5 marginal fultoportulae (F, with a rimoportula, R, Figs. 4-6) can be identified as *Cyclotella nana* Hustedt. The costal striae are short and all radiated from the valve centre (Fig. 4). Viewing the internal valve face, the central area is blank without any ornamentation (Figs. 5-6) and definitively different from the one with an unclear rosette structure (*C. pseudostelligera*, Fig. 7) or with a stellate centre (*C. stelligera*, Fig. 8). *Cyclotella meneghiniana* is also found in Hustedt´s collected material as a common species (not shown here). But some valves with a long and fine striation (Figs. 9-14) should be *Stephanodiscus* diatoms (with > 5 marginal fultoportulae). They should not be the diatom identified by Hasle & Heimdal (1970, Hasle 1976) as "*Thalassiosira pseudonana* Hasle & Heimdal", since the former has shown a regular striation (Figs. 9-12) and the other an irregular one (s. Hasle 1976, figs. 11-16). Hasle and co-workers have not found any valves of *C. nana* in Hustedt´s material and thus miscategorised these *Stephanodiscus* valves (s. Figs. 9-14) as "*Cyclotella nana*". They have compared the valves with those in the culture of Guillard and Ryther (1962) and subsequently renamed the diatom "Thalassiosira pseudonana" (cf., Paache 1973). With more than five marginal fultoportulae, it should not be considered as "*Cyclotella nana*" (s. Huestedt 1957). Simensen (1987, figs. 20-21) could have also shown this presence on Hustedt´s prepared slide with the Wümme sample. Nevertheless, *Cyclotella nana* can be found in Hustedt´s type material which corrects Hasle´s classification of "*Thalassiosira pseudonana*".

CONCLUSION

Both *Thalassiosira pseudonana* and *Cyclotella nana* could be found in Hustedt´s collected material. Both are well defined diatoms. The latter can be considered as a primitive diatom due to its simple valve strucure. It is widely distributed in Germany (North, s. Hustedt 1957; South, s. Chang & Steinberg 1989 & Chang & Chang-Schneider 2008) and has recently been renamed as *Discostella nana* (Hustedt) Chang (s. Chang & Chang-Schneider 2008) due to the location of the marginal fultoportula between two costae.

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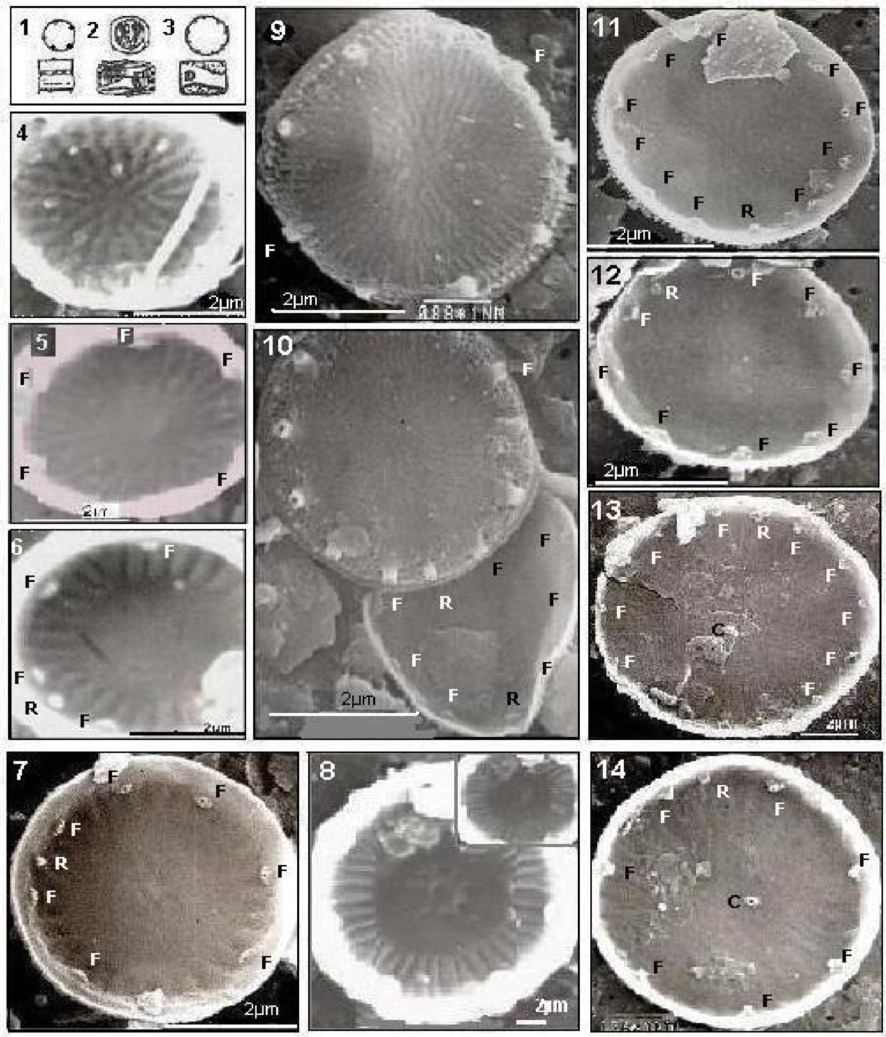

Figure 1. Cyclotella nana *Hustedt 1957, Fig. 2.* Thalassiosira nana *Lohmann 1908, Fig. 3.* Cyclotella pseudostelligera *Hustedt 1939, Figs. 4-6.* Discostella nana *(Hustedt) Chang, Fig. 7.* Discostella pseudostelligera *(Hustedt) Houk & Klee, Fig. 8.* Discostella stelligera *(Cleve & Grunow) Houk & Klee, Figs. 9-14,* Stephanodiscus*? or* Thalassiosira*? species. C: central fultoportula, F; marginal fultoportula, R: rimoportula.*

Diatoms of turfy fish pond margins of the Třeboň basin, Southern Bohemia

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Diatom assemblages of turfy fish pond margins were studied in the area of the Třeboň basin (South Bohemia). The aim of this research was to determine distribution of diatoms and to establish their relation to environmental factors. Similar algological study has not been conducted in this region yet in spite of the fact that this ecotone combines both elements of the region defined by the Ramsar conventions – fish ponds and peat bogs of Třeboň.

Studied material was collected at 7 sampling sites in spring, summer and autumn 2006. Samples were taken by squeezing water out of moss tufts. In addition pH, temperature, conductivity, oxygen saturation and nutrient concentrations were measured.

Diatoms dominated in all samples. Altogether 85 diatom taxa were identified in 21 samples.

Majority of them were acidophilous pennate diatoms. Most common species were Eunotia bilunaris, Eunotia exigua, Kobayasia subtilissima and Ulnaria acus. Taxa diverzity ranged from 3 to 37 diatom taxa per sample.

The taxa richest site had pH with the mean 5.8. On the contrary, the lowest number of taxa was at the site with acid pH (mean 3.5). Following rare species were found: Eunotia exigua var. tridentula, E. meisteri, E. monodon, E. naegeli, E. pectinalis, E. triodon, Neidium bisulcatum and Stenopterobia intermedia.

Diatom assemblages showed only small seasonal variability. A correlation analysis between particular diatom taxa and physical-chemical parameters showed that the diatom species richness was influenced mainly by pH. Other environmental factors affecting species structure were conductivity and concentrations of Ca^{2+}, Mg^{2+}, NO_3^- a K^+.

The turfy fish pond margins are in the area endangered by eutrophication due to intensive fishery management.

Living marine benthic diatoms as indicators of nutrient enrichment

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In the WFD 2000/60/EC the diatom community is one of the considered biological indicators for water quality assessment. It is still unclear whether differentiating live and dead diatoms would enhance the bioassessment accuracy. In this study only viable cells were considered to test what kind of ecological information can be gained from the marine benthic diatom community.

In the Gulf of Trieste (northern Adriatic Sea) three sublittoral sites subjected to different impacts were investigated: St. C1, a marine sanctuary; St. AA1, subjected to river flows; and St. Duct, located nearby an underwater sewage duct.

Sediment cores were collected, diatoms were analysed in the surface sediment and nutrients in the overlying water. K-dominance curves, the univariate diversity, cluster and principal component analyses were computed. The fuzzy set was applied to test the intensity of the links among each nutrient and each taxon.

At St. C1 27 genera were found, 17 at St. AA1 and 18 at St. Duct. Navicula and Nitzschia were the major genera at the three sites. Paralia sulcata was the most abundant species at St. C1 and St. AA1; at St. Duct Navicula directa was dominant. The highest richness and diversity were observed at St. C1. St. Duct was characterised by NH_4^+ and PO_4^{3-} enrichment leading to the highest dominance and the most elevated k-dominance curve. The fuzzy sets revealed a phosphate loving group which included, among others, N. directa, Thalassiosira eccentrica and Nitzschia panduriformis. The genus Navicula appeared to have a wide ecological valence; at St. Duct it reached 69% of the total diatom abundance.

This study suggests that living marine benthic diatoms can be useful indicators of nutrient enrichment, representing a potential tool in the biomonitoring of marine sediments.

The algal flora of Lake Kaitabarago, a small Ugandan crater lake, with special attention to the diatoms

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INTRODUCTION

Lake Kaitabarago (Fig. 1) is a small (1.8 ha) but deep (45 m) maar crater lake in the region of Fort Portal, western Uganda situated at an altitude of 1554 m asl on the shoulder of the Edward-George extension of the East African Rift Valley. The maximum height of the crater rim reaches 46 m, and encloses a crater basin of 9 ha surface area. Average annual rainfall is 1400 mm. The lake's major physical and chemical characteristics are given in Table 1.

Lake Kaitabarago is one of 48 Ugandan freshwater crater lakes studied in the CLANIMAE project. These crater lakes were specifically chosen along a gradient from oligotrophic to eutrophic (natural as well as anthropogenic) with the aim to develop a diatom-based transfer function for reconstruction of the past trophic status (nutrient budget) of East African lakes. The broader objective of the project is to resolve the controversy between research on global patterns of historical land-use, which supposes low population density (~3% of today in 1700 AD) and low anthropogenic impact on the landscape in pre-colonial Africa; and the traditional paradigm from archaeology stating that landscape modification and significant deforestation was important from at least 2500 years ago. This research question will be addressed with paleoecological techniques through reconstruction of lake history using fossil diatoms, chironomids and aquatic macrophyte remains in the sediment record (indicating lake-level and water-quality changes due to natural climate variability), and though reconstruction of historic land use using fossil pollen, fungal spores, and phytoliths (indicating landscape changes due to anthropogenic impact).

MATERIALS AND METHODS

Quantitative phytoplankton analyses of all algal groups from one pelagic and one littoral sample, taken on 6 February 2008, were done following Uthermöhl (1931) with an Olympus CKX41 inverted microscope.

Diatoms were studied in three types of samples: a pelagic and a littoral phytoplankton sample taken with a phytoplankton net (mesh width 10 µm) on 6 February 2008 and a surface-sediment sample containing dead diatoms recently settled on the lake bottom. This sample was collected with a UWITEC gravity corer on 22 January 2007. The three samples were oxidized with peroxide and embedded in Naphrax; and the analyses were executed using an Olympus BX 51 light microscope equipped with differential interference contrast and a color view digital camera. A JEOL 5800 scanning electron microscope was used for the determination of critical taxa.

Table 1. *Physical and chemical characteristics of Lake Kaitabarago after Rumes (2007) and Gelorini, Cocquyt & Lebrun (2008).*

		22-01-2007	06-02-2008
temp. (°C)	surface	24.98	22.87
	bottom	21.56	21.56
pH	surface	8.03	8.2
	bottom	6.04	6.04
Conductivity (µS/cm)	surface	489	502
	bottom	1373	1427
dissolved oxygen	surface	5.23	6.91
	bottom	0.00	0.00
anoxic (< 0.5 mg/L) depth (m)		8.0	7.0
TP (mg/L)	surface	65	-
TN (mg/L)	surface	416	-
Chl a (µg/L)	surface	4.7	-
Secchi depth (cm)		-	172

Figure 2. *Lake Kaitabarago.*

RESULTS

Phytoplankton

The quantitative phytoplankton analyses (Tables 2 & 3) revealed that the Cyanobacteria, represented by 11 taxa, is the most important algal group in the pelagic as well as in the littoral. Although less numerous in cell numbers, the large biovolume of *Peridinium* spp. (Dinophyta), makes this group the second most important, followed by the Chlorophyta (12 taxa). Only seven diatom taxa were observed, of which *Achanthidium minutissimum* and *Nitzschia confinis* (Fig. 2) are the most numerous.

Diatoms

Diatom taxonomic diversity was very low: in 500 valves only 9 taxa were observed in the pelagic, 13 taxa in the littoral and 12 taxa in the surface sediments. In all these samples the dominant taxa were *Nitzschia confinis* and *Achnanthidium minutissimum* (Table 4).

Only some minor differences were found between the three samples; the Pearson's correlation coefficient between the percent abundances of the represented taxa varied between 0.898 and 0.999. The highest correlation exists between the pelagic and surface-sediment samples.

Total diatom species richness is low in Lake Kaitabarago: less than 30 diatom taxa were observed. A small number of taxa were observed separate to the counts: *Cymatopleura solea* var. *clavata*, *Gomphonema clevei, G. gracile, Placoneis gastrum, Rhopalodia gibberula*. Only three species (corresponding to 10 % of the total species richness) have a distribution restricted to tropical Africa: *Nitzschia confinis*, *N. obsoleta* and *N. tropica*.

Table 2. *Percent abundance of phytoplankton groups in Lake Kaitabarago on 6 February 2008, derived from cell counts and biovolume calculations.*

	Pelagic	Littoral
Cyanobacteria	38.6	36.1
Chlorophyta	17.0	9.7
Euglenophyta	0.0	5.3
Dinophyta	23.6	36.2
Chrysophyta	0.0	0.0
Cryptophyta	6.9	8.3
Diatoms	13.9	4.4
Total	100.0	100.0

Table 3. Most *important phytoplankton taxa in the pelagic and littoral of Lake Kaitobarago.*

	Pelagic	Littoral
Cyanobacteria	*Ananaenopsis* cf. *raciborskii*	*Ananaenopsis* cf. *raciborskii*
	Anabaenopsis circularis	*Anabaenopsis circularis*
	Synechococcus elongatus	*Synechococcus elongatus*
Chlorophyta	*Monoraphidium komarkovae*	*Monoraphidium komarkovae*
	Tetraedron minimum	*Tetraedron minimum*
Euglenophyta		*Trachelomonas volvocinopsis*

DISCUSSION

The crater basin of Lake Kaitabarago is very steep, both above and below the waterline. Consequently the littoral zone (substrate within the illuminated surface water) is restricted to a very small area nearshore, notwithstanding the relatively high transparency (Table 1). Therefore also the nearshore phytoplanktonic community has a strongly pelagic character. Conversely, due to the small size of the lake also species that normally live attached to a substrate (e.g. *Cocconeis plancentula*) are recovered in net samples from the central part of the lake.

The very high similarity between the diatom assemblages recovered from surface sediments and in the actual live pelagic plankton of Lake Kaitabarago partly reflects the scarcity of littoral epiphytic habitat, but also indicates that diatom preservation is very good, and that the single living phytoplankton sample collected in February 2008 is representative for the local algal community. Good preservation of the thinly silicified Nitzschia confinis in the surface sediment confirms limited dissolution of diatom valves in the lower water column and the sediments. Only a monitoring of the algal composition in Lake Kaitabarago over an entire year can give information on seasonal variability in the diatom community; however the congruence between the surface-sediment assemblage and the live sample from February may indicate that in Lake Kaitabarago this seasonal variability is relatively low compared to other tropical African lakes.

CONCLUSION

The surface-sediment death assemblage of Lake Kaitobarago, composed of a *Nitzschia confinis-Achnanthidium minutissimum* association, is a perfect reflection of the living pelagic diatom community collected in February 2008 because its littoral zone is poorly developed, diatom preservation is excellent, and seasonal variability in the diatom community is limited. Diatom species richness is low in the plankton, the littoral and in the surface-sediments of the lake. Ten percent of observed taxa, all belonging to the genus *Nitzschia*, have a distribution restricted to tropical Africa.

ACKNOWLEDGEMENTS

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Table 4. *Percent abundance of diatoms in the littoral, pelagic and surface-sediment samples of Lake Kaitabarago (x= valve observed in the sample, but not present in the counts).*

	Littoral	Pelagic	Surface sediments
Achnanthidium minutissimum	32.6	14.9	4.5
Amphora copulta	0.0	0.0	0.2
Amphora pediculus	0.2	0.0	0.0
Cocconeis placentula var.	0.8	0.4	0.6
Cymatopleura solea var. *clavata*	0.0	0.0	x
Cymbella naviculoides	0.0	0.0	0.6
Diadesmis contenta	0.0	2.4	0.0
Encyonema muelleri	0.8	0.2	0.0
Epithemia adnata	0.4	0.0	0.0
Fragilaria cf. *tenera*	1.2	0.6	0.0
Gomphonema affine	0.4	0.0	0.0
Gomphonema clevei	0.0	0.0	x
Gomphonema gracile	0.0	0.0	x
Gomphonema sp.	0.8	0.8	0.0
Navicula cryptotenella	0.0	0.0	0.6
Nitzschia acicularis	0.0	0.0	0.2
Nitzschia confinis	60.4	80.2	89.5
Nitzschia fonticola	0.0	0.0	0.4
Nitzschia epiphyticoides	0.0	0.0	0.2
Nitzschia cf. *frustulum*	0.0	0.2	0.0
Nitzschia lancettula	0.0	0.4	0.0
Nitzschia obsoleta	0.2	0.0	0.0
Nitzschia tropica	1.2	0.0	0.2
Placoneis gastrum	0.0	0.0	x
Rhopalodia gibberula	0.0	0.0	x
Rhopalodia rhopala	0.4	0.0	0.0
Ulnaria acus	0.0	0.0	0.2
Ulnaria ulna	0.6	0.0	2.6

300 years of environmental change reflected in sediments of a deep dike-burst lake in the Netherlands

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A 400-year sediment record from a deep water scour hole near the Meuse River in the Netherlands (Haarsteegse Wiel) was studied for past changes in water quality, flooding regime and landscape change using a combined geochemical and micropaleontological (diatom and palynological analyses) approach. The results are highly significant for determining natural water quality, the impact of (atmospheric) pollution on the (aquatic) flora and the study of the impact and signals related to river floods. The sediment was dated by combining ^{137}Cs activity measurements, biostratigraphical ages and historically documented flooding events indicated by the magnetic susceptibility of the sediment. The first flooding event is indicated in the sediment at AD 1610 when the lake was created by water masses bursting through a dike. The extent of large historical river floods are well described in historical chronicles and present an opportunity to study how a flood signal is represented in the lake catchment and provide an additional age calibration point. The resulting chronology is highly accurate and show that sedimentation rates decrease sharply with the widespread change from wheat cultivation to pasture land from around AD 1875 as a direct result of falling wheat prices and intensified cattle farming.

Water quality changes and absolute phosphorous concentrations are reconstructed using diatom-based transfer functions. Results show that the currently nutrient rich lake water has mostly been in a mesotrophic state pior to AD 1920, with the exception of several sharp eutrophication events. These events generally occur in sediments deposited during river floods. The river flooding also impacts the vegetation composition by importing allochthonous components such as *Nymphaeea candida*, and indirectly by the deposition of nutrients which have a clear impact on vegetation composition and richness.

Distribution and diversity of diatoms in the Tommelen pool complex

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Small size, concomitant ease of dispersion, high population densities and a short generation cycle suggest primacy, if not exclusivity, of environmental filters on spatial constraints in determining species assembly and distribution patterns of diatoms. Whereas there is little doubt that Baas-Becking's classic paradigm 'everything is everywhere, but the environment selects' does not hold on larger geographical scales, it is hardly disputed within the minute spatial framework (< 1 km2) typical of many pond restoration projects or even nature reserves. From this viewpoint, environmental determinism on diatom assemblage composition should be forthright among pools and small ponds, whilst their spatial configuration would not matter in case of hydrological isolation and sufficient age. The small nature reserve 'Tommelen' (Hasselt, Belgium; 12 ha) is densely strewn with a large number of small pools of exactly the same age (April 1944) and within a similar setting of soil conditions (loamy sand) and land use. This offers the opportunity to compare biodiversity features and the relative influence of environmental and spatial variation between different types of biota, from amphibians and higher plants, down to bacteria, as part of the PONDSCAPE project.

Here we focus on the surface sediment assemblages of diatoms in 49 pools of the Tommelen reserve. All the examined pools hold at least some water during the entire year, so short-term recolonization following complete drying should not be a major factor influencing their community structure. Among the measured habitat variables, an alkalinity gradient, partly related to periodic flooding by water from an adjacent brook affecting some of the pools, has the strongest influence on diatom assemblage composition. Important effects also appear to arise from the abundance of macrophyte vegetation and, possibly the relative degree of desiccation. Fairly distinct groups of pools can be recognized along these gradients, allowing us to examine the relative contributions of environmental and spatial influences with increasing hydrological isolation and decreasing environmental heterogeneity. Furthermore, we also consider the partitioning of diversity components and the occurrence of nestedness in this pool complex.

Treasures of the Western Carpathian spring fens

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Springs belong to the most threatened biotopes of Central Europe. Pristine springs preserved in Protected Landscape Areas can serve as models of practically intact freshwater habitats. They host species-rich diatom flora with many rare species included in regional Red Lists. Moreover, recently described taxa can exhibit some degree of „rareness“ due to lacking knowledge about their distribution and autecology This work is bringing such information for each of the four fen types along the gradient of mineral richness distinguished in the Western Carpathians. About one third of the identified taxa are cited in the Red List of freshwater diatoms of Germany under various categories from endangered to near threatened. The most interesting diatoms inhabiting calcareous fens were *Eucocconeis flexella, Caloneis constans, C. sublinearis, Campylodiscus hibernicus, Diploneis minuta, Eunotia arcubus, Frustulia spicula, Muelleria gibbula, Navicula seibigiana, Stauroneis acuta, S. tackei, Surirella helvetica* and *S. spiralis*; at extremely mineral rich fens were observed *Eunotia islandica*, *Gomphonema lagerheimii, Decussata placenta* and *Stauroneis gracillima*. By contrast mineral poor *Sphagnum*-fens were inhabited by *Stenopterobia delicatissima*, *Stenopterobia* cf. *densestriata* and *Tabellaria ventricosa*. Rare taxa from mineral-rich Sphagnum-fens occurred also at other fen types. Some rare taxa exhibiting wide ecological tolerances were present at two or more fen types: *Diploneis petersenii, Eunotia glacialis, E. monodon, E. praerupta, E. soleirolii, E. steineckei, E. tetraodon, Navicula tridentula, Neidium bisulcatum* and *N. hercynicum*.

Set-up of diatom monitoring programs in surface waters in Flanders (Belgium) for the Water Framework Directive

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To meet the requirements of the European Water Framework Directive (WFD), a good ecological status should be reached in all natural surface water bodies by 2015, and a good ecological potential in all artificial or heavily modified surface water bodies. For this purpose, member states establish monitoring programs for evaluating the ecological status or potential of their water bodies, based on those biological quality elements that are specified by the WFD for each surface water category.

According to the WFD, the assessment method used by the member states to evaluate the ecological status or potential should be expressed as an ecological quality ratio (EQR) that can take values between zero and one, with high ecological status represented by values close to one and bad ecological status by values close to zero. The EQR range is divided into five quality classes.

The member states establish three monitoring programs. Surveillance monitoring is carried out at least once every six years for a sufficient number of surface water bodies to provide an assessment of the overall surface water status. Operational monitoring is undertaken at least once every three years to establish the status of those water bodies identified as being at risk of failing to meet their environmental objectives. Investigative monitoring is carried out in case the reason for any exceedance is unknown.

Monitoring of diatoms (one of the relevant biological quality elements for the surface water categories ‘rivers’ and ‘lakes’) consists of routine sampling and sample preparation, followed by identification and counting of the valves and EQR calculation.

This poster provides an overview of the current progress in implementing the diatom monitoring program for the WFD in Flanders (Belgium) by the Flemish Environment Agency (VMM).

In the Flemish region, the first samplings for the WFD were carried out in 2007. Approximately 250 samples were taken in 2007 and approximately 380 in 2008. After sample preparation, 500 valves are identified at species level and counted. Subsequently, the taxonomic lists can be integrated into an electronic database to enable EQR calculation.

A new diatom-based assessment method for Flanders has been developed by the Institute for Nature and Forest Research, called PISIAD (Proportions of Impact-Sensitive and Impact-Associated Diatoms; Hendrickx & Denys, 2005).

To ensure that quality classes based on assessment methods of different member states are comparable, international comparison is necessary. At the European level, intercalibration exercises are organised to ensure that the two highest quality class boundaries are comparable. Results of a first round of intercalibration exercises were already endorsed by the European Commission, including PISIAD class boundaries for most types of Flemish rivers. The remaining types of rivers and all types of lakes need to be tackled in the next intercalibration round. Furthermore, bilateral comparisons with France and with the Belgian region Wallonia are in progress in order to compare results obtained by samplings carried out at the same location.

Littoral diatoms as indicators for water quality in Swedish lakes

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Diatom-based monitoring of running waters is widely used and accepted, but despite of promising results so far no diatom-based monitoring of lakes is implemented in the EU or elsewhere.

We test if benthic diatoms can be used as indicator organisms for lake water quality, applying indices developed for diatom-based monitoring of streams. Diatoms were sampled in 58 Swedish lakes, covering wide geographical, acidity and trophic gradients. Temporal and spatial variations in indicated lake water quality were tested by sampling several times per year or by sampling different sites in some of the lakes. We calculated the following indices (included in the Swedish standard): Indice de Polluo-sensibilité Spécifique (IPS), Trophic Diatom Index (TDI), Pollution Tolerant valves (%PT) and Acidity Index for Diatoms (ACID).

First results show that benthic diatoms reflect the water quality in a lake well, diatom indices indicate about the same range of water chemistry in lakes and in streams, diatoms reflect lake water quality at least as well as phytoplankton and one sampling per year at one lake site is sufficient to reflect lake water quality.

Holocene environmental change on Kamchatka, Eastern Russia – from diatoms in lake sediments

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The presented study on lacustrine diatoms is part of the German-Russian research programme KALMAR (Kurile-Kamchatka and Aleutean Marginal Sea-Island Arc Systems: Geodynamics and Climate Interaction in Space and Time) and deals with the reconstruction of late Quaternary land environments and Holocene climate dynamics on Kamchatka.

In September 2007, lacustrine sediment cores were taken from Two-Yurts Lake that occupies a former proglacial basin situated in the central Kamchatka mountain chain. The postglacial lake sediments consist of diatomaceous oozes with interspersed ash layers, spanning the last 7.5 kyr. So far analysed fossil diatom assemblages from Two-Yurts Lake show a wide range of species and are dominated by *Aulacoseira subarctica* and *Stephanodiscus alpinus*, both of which are planktonic cold-water forms of oligotrophic to mesotrophic fresh-water lakes, as also indicated by low $\partial^{18}O$ values in their shells. Modern lake hydrology and low concentrations of organic matter with low C/N ratios are consistent with these first microfossil signals. Biogenic opal concentrations and variations in total organic carbon point to a maximum of the biological export production during the mid-Holocene (~ 6.8 to 5.0 ka BP). The recognition of mid-Holocene warmth gives evidence of climate affinities to eastern Siberia and Europe.

How far back in time do we have to go for lake-type specific reference conditions? - Paleolimnological examples from lowland lakes and their implications for the EU-WFD.

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We will present the identification of trophic state reference conditions based on paleolimnological multi-proxy analyses as required by the European Water Framework Directive (WFD, EU 2000). Sediment cores from several carbonate-rich lowland lakes (n >10) from northern Germany were analysed, representing different subtypes of German Lake-Type 10 (dimictic) and 11 (polymictic) and covering the past 290 to 5500 years. Anthropogenic impact was assessed using pollen and geochemical proxies. Historic TP levels were inferred using diatom assemblages and optimised diatom data sets identified with the moving window-approach (Hübener et al. 2008). We inferred the historically most recent periods with reference conditions. These occurred for some lakes just prior to the industrial land-use in ~1950, in others prior to the industrial revolution in ~1850 and in some lakes just prior to increased anthropogenic activities following ~1650, i.e. during a period of low population levels through the plague and the Thirty Years' War. But there are also some lakes with already significant and prolonged trophic state changes as a result of settlement activities since late medieval times in northern central Europe (Ohle 1973, Hübener & Dörfler 2004, Bradshaw et al. 2005). In contrast to this very time consuming way to identify reference conditions, some researchers suggest to simplify the evaluation process by setting a fixed point in time (e.g. 1850) prior to which they assume reference conditions. This may be sufficient, as the industrialisation had a very high impact on lakes (Barker et al. 2005, Taylor et al. 2006). However, our data suggest that a fixed point in time does not approprately reflect the trophic development of lakes, as they vary significantly between lakes in this area.

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Imaging diatoms – why, when, and how

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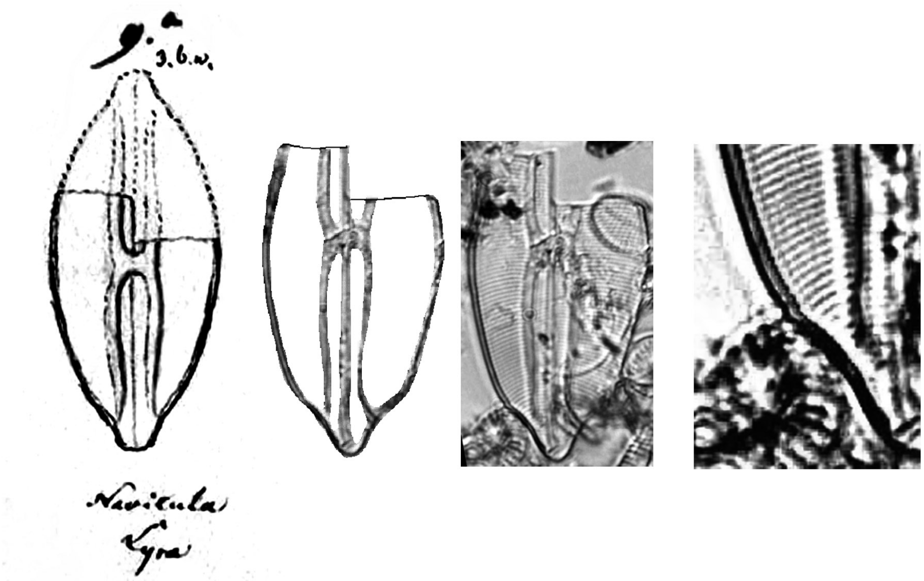
INTRODUCTION

Imaging diatoms is the most important documentation besides typifying, describing and depositing the specimen in an accessible collection for future research. Published figures such as drawings or photographs (by light microscopy, transmission electron microscopy, scanning electron microscopy) are representatives of the state of science when the specimen was investigated. Presenting a figure of diatoms is necessary when: 1. describing a new taxon; 2. calibrating a taxon concept (e.g. identification); 3. evaluating historical specimens with the help of new methods.

RESULTS AND DISCUSSION

Figs 1-4 demonstrate why, when and how imaging in diatom research is a documentation of the state of the art in science. Before the invention of micro photography, drawing (as the basis of copper plate engravings) was the only way to document findings (see also examples in Jahn & Kusber 2006).



1 2 3 4

Figure 1-4. Imaging Lyrella lyra (Ehrenb.) Karaeva. 1. Drawing of C.G. Ehrenberg; note that the broken valve was completed by dotted lines. 2-4. Photograph of the type specimen by modern light microscope. 2. Details, which Ehrenberg could not have seen, have been deleted by image processing (broken edge of the upper part of the valve added). 4. Enlarged detail, contrast increased (see Jahn et al. 2004).

Fig. 1 shows the limits of this technique. In outline and main structures the proportions of the drawing are relatively close to the original (Fig. 2) but striation was not visible due to the optics of Ehrenberg's time. A subjectivity of the drawing can be seen when comparing the rounded ending of Ehrenberg's drawing to the more tapering ending of the valve in the photograph. Using a modern light microscope Figs 3 and 4 show the striation of the valve which was invisible for Ehrenberg. For a more precise documentation, new preparations and/or electron microscope methods are necessary. Figs 5-7 are showing an example where an EM re-interpretation of the original material would be necessary to serve for identification. Identifications of Fig. 6 and 7 are doubtful when comparing them with the figure of the original description (Fig. 5).

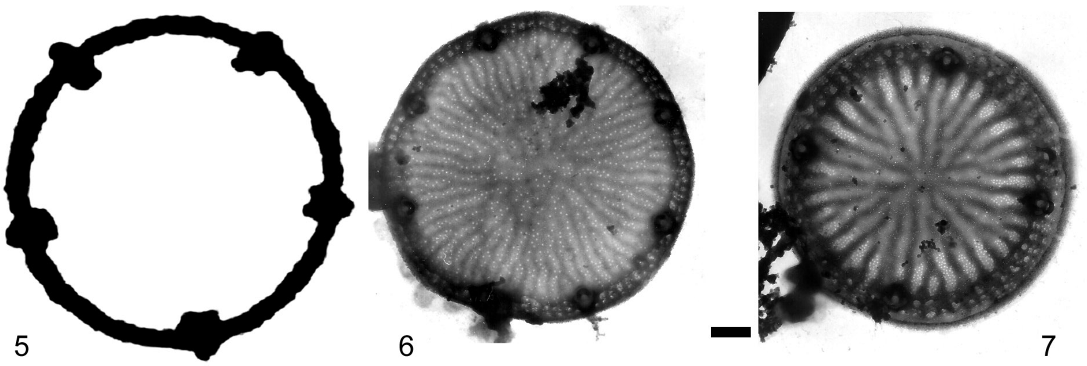


***Figure 5.** Published original drawing of Thalassiosira pseudonana Hasle & Heimdal (as Cyclotella nana Hust.) from Hustedt (1957). **Figure 6-7** Cf. Thalassiosira pseudonana from Lake Nikolassee, Berlin, Germany, summer 1987, TEM, Scale bar = 0.5 µm.*

Images and nomenclature

The importance of images in taxonomy is reflected by their treatment in the Botanical Code of Nomenclature (Greuter et al. 2000, McNeill et al. 2007). Table 1 summarizes the main facts, concerning non-fossil diatoms.

In the past, several diatomists called the typical image of a newly described taxon an "iconotype" giving a single documentation a type-like status. The formal acceptance of this iconotype by the ICBN was withdrawn (Greuter et al. 1999) because of the undefined usage of the term by different authors. Using images of types to calibrate taxon concepts we came to the result, that it should best practice to point from the diagnoses and/or descriptions to single published pictures. The reference to a picture showing the important characters of the diagnosis is certainly helpful (e.g. Lange-Bertalot 2001: 225 for Navicula curtisterna Lange-Bert.).

Images in taxonomy and routine duties

In diatom research there is a wide range from establishing a new species on the basis of one single valve (Fig. 1) to documenting populations or demes without formally naming them. And there are publications of new taxa giving a type locality and diverse paratype localities and images, which can not be traced back to a single location and preparation. However, the best practice is a good documentation and a clear linkage between preparation, location, date, and image.

Citing figures (see also last line in Table 1) may include all figures or there might be reasons for citing only a subset of figures. Navicula viridulacalcis Lange-Bert. was published in Rumrich et al. (2000). The cited plates are pl. 37: figs 5-8 and pl. 38: figs 1-5 for the species, but only pl. 38: fig. 5 shows the European *Navicula viridulacalcis* Lange-Bert. subsp. *viridulacalcis*; the other figures are part of the protologue of the simultaneously described *Navicula viridulacalcis* subsp. *neomundana* Lange-Bert. & U.Rumrich from Chile.

For identification purposes an understanding of the variability of a taxon and its geographical occurrence is necessary. Navicula amphiceropsis Lange-Bert. & U.Rumrich was described in Rumrich et al. (2000) with 12 figures from the type locality (Central Chile, Río Cauquenes, 14 March 1997) seven of them by LM and five by SEM showing structure, ultrastructure and variability. The same detailed reference between figures and locality and date would be helpful in secondary literature, too. *Navicula amphiceropsis* was included in Lange-Bertalot (2001: 83, pl. 34: figs 8-15, pl. 71: fig. 2). These figures are showing nearly the same variability but the caption on p. 304 reads only: "Specimens from Europe, Israel, South America". There is no internal evidence for who is who. Comparing the figures in Lange-Bertalot (2001) with those in Rumrich et al. (2000) and Tsarenko et al. (2000), all but two could be traced back to a locality or region: LM figures pl. 34: figs 8, 11-13 are original material from the type locality in Chile, pl. 34: fig. 9 is from Israel, and pl. 34: figs 10, 14 might be from Europe; the SEM picture pl. 34: fig. 15 is identical with a published picture from the type locality but pl. 71: fig. 2 has no locality data.

Besides taxonomical papers on diatom diversity also in ecological studies such as monitoring in water research, diatom images play an important role. Mann et al. (2008) illustrated different demes of the genus *Sellaphora*, citing the slide, collection, and locality from which each figure was derived. Demes, as illustrated in his work can be identified, but it is difficult to cite them. On the other hand, some recently described species in *Sellaphora* can be cited because they have been named but not easily identified, as discussed in Mann et al. (2008).

Table 1. *Requirements of the ICBN concerning the imaging of nomenclatural types (for more details see Jahn & Kusber 2009).*

Figure	Time scale	Comment
Figure can serve as description	1753-1907	Only if it shows differential characters
Protologue is lacking a figure	1753-1952	Figure not required for valid publication (but necessary for identification)
Lectotype is a figure	1753-	For retro-actions only. Designating true specimens is preferable
Holotype is a figure	1753-2006	Already restricted since 2000 if material is available; forbidden since 2007
Plate and figure of the protologue should be cited when recombining a name as part of the full and direct reference of the basionym or the replaced synonym	1953-	See "Citing figures" below

CONCLUSION

Imaging diatoms is an important and ongoing task; it should be redone if new techniques are providing new information. However, the precise linking of the figures to material, slides, herbaria, localities, collecting events, and dates is just as important.

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The genus *Neidium* in Sweden

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The genus *Neidium* is a fairly small naviculoid genus. The genus is exclusively typical for freshwater habitats and groups mostly species that are characteristic for acidic, oligotrophic waters, often in association with *Frustulia, Eunotia* and *Brachysira*. Although widespread, they never form large populations.

Neidium species are most often characterized by having a linear to lanceolate outline, a flat valve face and one or more enclosed longitudinal canals near the valve face/mantle junction. The proximal raphe endings are usually deflected or hooked in opposite directions.

During a survey of the benthic diatom floras of Swedish rivers, a large number of Neidium species has been found, such as *N. alpinum, N. bisulcatum, N. densestriatum, N. hitchcockii, N. longiceps* and *N. septentrionalis*. Detailed light and scanning electron microscopical analyses has revealed the presence of several unknown, probably at present undescribed species, closely related to well-known species such as *Neidium ampliatum* and *N. dubium*. This poster gives an overview of all *Neidium* species found in Swedish rivers and focuses on some of the unidentified species. Whether they represent new species is still unclear.

Cymbelloid diatoms from aerial habitats in the Gokyo Valley, Everest (Sagarmatha) National Park, Nepal

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In October 2008, an ambitious three-years project began aiming to investigate the impacts of pollution and climate change on the biodiversity of aquatic habitats in the upper Gokyo Valley, located in the Everest National Park, Nepal. One of the principal components of this project is the analysis of the diatom flora in the Gokyo lakes, streams and associated wetland habitats. During the analysis of samples taken from aerial habitats such as wet soils, terrestrial bryophytes and rock faces a well-developed diatom flora was observed. Dominating diatom groups include *Eunotia, Pinnularia, Fragilaria* s.l. (including *Staurosira* and related genera), *Achnanthes* s.l. and especially *Cymbella* s.l. Analysis of the latter group revealed the presence of more than 20 taxa belonging to *Encyonema*, *Encyonopsis, Cymbella* s.s., *Cymbopleura* and a so far undescribed genus. Based on light microscopical and electron microscopical investigations, it is clear that several taxa cannot be assigned to already described taxa.

This poster gives an overview of the cymbelloid species diversity with a special focus on the unidentified taxa. Whether the latter represent new species is still unclear.

Diatoms as biomonitors in Sweden

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Sweden has implemented the diatom method for assessment of the water quality in streams as required by the European Water Framework Directive during 2006. The use of the method is still increasing due to the good availability of diatom communities to reflect the mean water quality of a stream, as water authorities are right now mostly interested in monitoring the stressors eutrophication and acidification. Recently, water authorities have started to revise stations being monitored with the aim to permanent many of them, giving the possibility to follow the development of diatom communities during time. One wish is to adapt the diatom method so that it can be used independently of global warming. Current work concerns the refinement of all biological indicators in Sweden, comparison of those indicators and guides for managers on how to use them. Still, much is to be done, and one focus in Sweden right now is on the definition of a 'reference status': What is the 'typical' diatom community in a 'natural' stream – and what is 'natural'?

The review on rare species from the Caspian Sea. I.

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INTRODUCTION

The Caspian Sea is the largest closed basin on the Earth, separated from the World Ocean in the early Pliocene. Its salinity in the north part comes to 8.0 ‰ – 9.0 ‰, but around river estuaries sharply reduces to 0.01‰; and in the central and south parts graduates to 12.00 ‰ – 12. 85 ‰. The water is enriched with sulphates and carbonates, poor in Na+ and Cl^- ions when compared with ocean water (Karayeva, 1972). According to the modern data diatom composition of the sea counts is 301species, among them are numerous rare and poorly investigated ones (Karayeva, Dzhafarova, 2007).

MATERIALS AND METHODS

Samples collected from the Caspian Sea littoral within the Azerbaijan coast for the past 30 years were used. Samples were cleaned by sulphuric acid and potassium dichromate, followed by washing with distilled water. TEM observations were made using microscope JEM 100B JEOL and SEM – JSM35 JEOL.

RESULTS AND DISCUSSION

The data on rare species from the Caspian Sea has been presented in several papers by N. Karayeva (1976, 1978) and N. Karayeva with coauthors (1975, 1987, 1991). The limited space allows discussion here of only 11 species. The uniform description of species, unfortunately, is not possible because of lack of the necessary information.

Abbreviations: CS: – species distribution in the Caspian Sea. SC – south, MC – middle, NC – north parts of the Caspian Sea.

Pteroncola marina Holmes & Croll, 1982: 267-268, tab.1, 1-9, tab.2, 10-15. **Figs 1, 2**

Karayeva et al.,1991, p. 66-67, fig. 1.

Frustule rectangular from girdle view, thin-walled, height 14-21µm. Valves linear slightly narrowing to rounded ends, with high mantle, 9-28 µm in length, 2.2-3.3 µm in width. Striae poroid, parallel, slightly oblique, 58-64 in 10 µm, between prominent external virgae. Areolae poroid. Two rimoportulae, one at the each valve end, are diagonal-symmetrically orientated along the striae. Pore fields at the each valve end. Girdle band consists of open valvacopulae and 2-3 pleurae, the last ones – with one row of well distinguish areolae.

CS: Apsheron semi-island, epiphyton on heat exchanging equipment of refinery, at 38˚C. SC, abundant in epiphyton of the different substrates.

Striatella delicatula (Kützing) Grunow in V. Heurk 1880-85, tab. 54: 5, 6. **Fig 3**

Karayeva 1976, p. 14, fig. 1-3.

Valves linear to elliptical, sometimes with protracted ends, 5-22 µm in length; 2.5-4 µm in width, with pore fields at the each valve end. Striae poroid, parallel, 30-32 in 10 µm. Areolae poroid.

CS: east shore of MC, SC, often in epiphyton on artificial substrates. Species is distributed in all seas of Europe however often is missed because of fine structure.

Cymbellonitzschia diluviana Hustedt, 1950, 395, figs 41: 56-60 **Fig. 5**

Karayeva et al., 1991, p. 67, fig. 6. John, 1983, tab. 68: 6, 7.

Valves dorsoventral, semi-lanceolate, with elongate ends 12-20 µm in length, 1.6-2 µm in width. Striae poroid, parallel, 21-24 in 10 µm. Areolae poroid. Channel raphe is eccentric, on the keel of the ventral valve side, with 9-10 fibulae in 10 µm.

CS: NC, free living in sandy sediments in strongly desalinated waters.

Astartiella punctifera (Hustedt) Witkowski, Lange-Bertalot in Moser et al. 1998: 360 **Fig. 6, 7**

Basioniym: *Achnanthes punctifera* Hustedt 1955: 18, figs 5: 26–28.

Karayeva et al., 1991: 67, fig. 2.

Frustule heterovalvate, of 3 levels (raphe, stigma, postmacroareolae, presence/absence), with delicate structure. Valves lanceolate to elliptic-lanceolate with protracted ends, 12-25 µm in length, 8-11 µm in width. Striae slightly radiate; poroid, 28-32 in 10 µm on rapheless valve; combined, 21-24 in 10 µm, some intercalary short-out at the central part on raphe valve. Areolae poroid, postmacroareolae along raphe valve margin. Sternum narrow liniear on both valves, with single stigma at the central nodule of the raphe valve.

CS: SC, MC, rare, in epiphyton of the different substrates.

Haslea subagnita (Proshkina-Lavrenko) Karayeva comb. nov. **Fig. 8**

Basionim: *Navicula subagnita* Proshkina-Lavrenko, 1963. Diatomovye vodorosly bentosa Chernogo vorya [Diatoms of the Black Sea benthos], 1–243. Izdatelstvo AN SSSR, Moscow-Leningrad (in Rus.): 150, tabl. 14, fig. 15.

Synonym: *Haslea subagnita* (Proshkina-Lavrenko) Makarova et Karayeva nom. invalid

Karayeva, Gadzhieva, 1975: 124-125, Figs 1, 1; 3, 1. Guslyakov et al. 1992: 46, figs 57: 4-6.

Valves linear-lanceolate, with sharp ends, 30-42 µm in length, 4.4-6.6 µm in width. Striae poroid, slightly radiate in central part of valve to strongly radiate at its ends; 14-16 in 10 µm. Sternum narrow linear, without central area. Raphe filiform. Areolae poroid.

CS: MC, SC, rare, in epiphyton of different substrates.

Note: Citation of the taxon as *Haslea subagnita* (Proshkina-Lavrenko) Makarova et Karayeva is incorrect as this combination was not made before.

Navicula ordinaria Hustedt 1950: 352, tab. 37, figs. 27, 28 **Figs 4**

Simonsen, 1987, 480, tab. 688: 1-5. Karayeva et al.,1991, p. 68, fig. 4.

Valves linear to lanceolate with protracted ends, 18-25 µm in length, 7-10 µm in width. Striae poroid, radiate, convergent at the valve ends; 33-35, to 45 at the valve ends in 10 µm. Sternum narrow linear, central area small, round. Raphe filiform. Areolae poroid.

CS: west shore of NC, in epiphyton of different substrates.

Navicula hedinii Hustedt, 1922:132, tab.9, fig.36 **Fig. 11, 12**

Synonym: *N. intricata* Karayeva, 1963: 47, fig. 2.

Valves lanceolate with broadly (about half of valve width) protracted ends, 30-35 µm in length, 9-10 µm in width. Striae poroid, radiate and intercalary shorter ones, 30-32 in 10 µm at the middle part of valve; convergent, 36-38 in 10 µm at the valve ends. Sternum narrow linear without central area. Raphe filiform. Areolae poroid.

CS: west shore of NC, in epiphyton of different substrates.

Fallacia florinae (Möller) Karayeva comb. nov. **Fig. 13**

Basionym: *Navicula florinae* Möller M., 1950, The diatoms of Praestö Fiord. (Investigations of the Geography and Natural History of the Praestø Fiord, Zealand). Folia Geogr. Danica, 3(7), 187–237: 204, fig. 9.

Valves oval, 9-16 µm in length, 5-7 µm in width. Strie poroid, radial, 15-17 in 10 µm. Sternum broadly lanceolate. Raphe filiform. Areolae poroid.

CS: epipelic, on silt bottom.

Navicula phyllepta Kützing 1844: 94, tab.30, fig. 56 **Fig. 14**

Synonym: *N. lanceolata* var. *phyllepta* (Kützing) Cleve

Valves lanceolate with protracted beak-shaped ends, 9-22 µm in length, 8-11µm in width. Striae poroid, slightly radial, almost parallel, convergent at the valve ends, 20-23 in 10 µm. Raphe filiform. Areolae poroid.

CS: east shore of SC, MC, epipelic, abundant on silt bottom.

Proschkinia bulnheimii var. *caspica* (Karayeva) Karayeva comb. nov. **Fig. 9, 10**

Basionym: *Navicula bulnheimii* var. *caspica* Karayeva in Karayeva, Gadzhieva, 1975, Novye dannye k izucheniu diatomobyh vodorosley Kaspiyskogo morya, Novosti sistematiki nizshyh rasteniy, T. 12, 123-129. Nauka, Leningrad: 125, fig. 1: 2.

Valves convex, linear-lanceolate with protracted beak-shaped ends, 30-50 µm in length, 5-6 µm in width. Striae poroid, parallel in the middle part of valve, convergent from the narrowing part to the ends, 26-27 in 10 µm, to 30 at the valve ends. The vimines are strongly thickned outside and create along apical axis unbroken parallel ribs. Sternum narrow linear, central area slightly expanded at the raphe nodule and laterally along two striae on half of valve width. Sometimes a stigma present at the middle stria. Raphe channel-filiform. Areolae poroid. Girdle band consists of numerous bands, 20 in 10 µm, smooth copulae without areolae.

Cells make up thin mucilaginous tube colonies.

P. bulnheimii var. *caspica* differs from type variety by larger size, more convergent striae at the valve ends, shape of the central area.

CS, type locality: west shore of Kara-Bogaz-Gol gulf, Turkmenistan, in epiphyton of different substrates, at water salinity 20.4 ‰.

Proschkinia complanatoides (Hustedt) Karayeva 1978b: 1149, figs 1: 3, 4 **Fig. 15-20**

Basionym: *Navicula complanatoides* Hustedt 1962: 340, fig. 1451.

Synonym: *Proschkinia complanatoides* (Hustedt) D.G.Mann in F.E.Round et al., 1990.

Valves lanceolate-sigmoid with protracted beak-shaped ends, 25-40 µm in length, 3.5-5.5 µm in width. Striae poroid, parallel, 21-24 in 10 µm. Raphe channel-filiform with complicated central nodule: outside flap over the central pores and inside crest-like structure. Areolae poroid.

CS: in east shore of SC, MC, epipelic, abundant on silt bottom.

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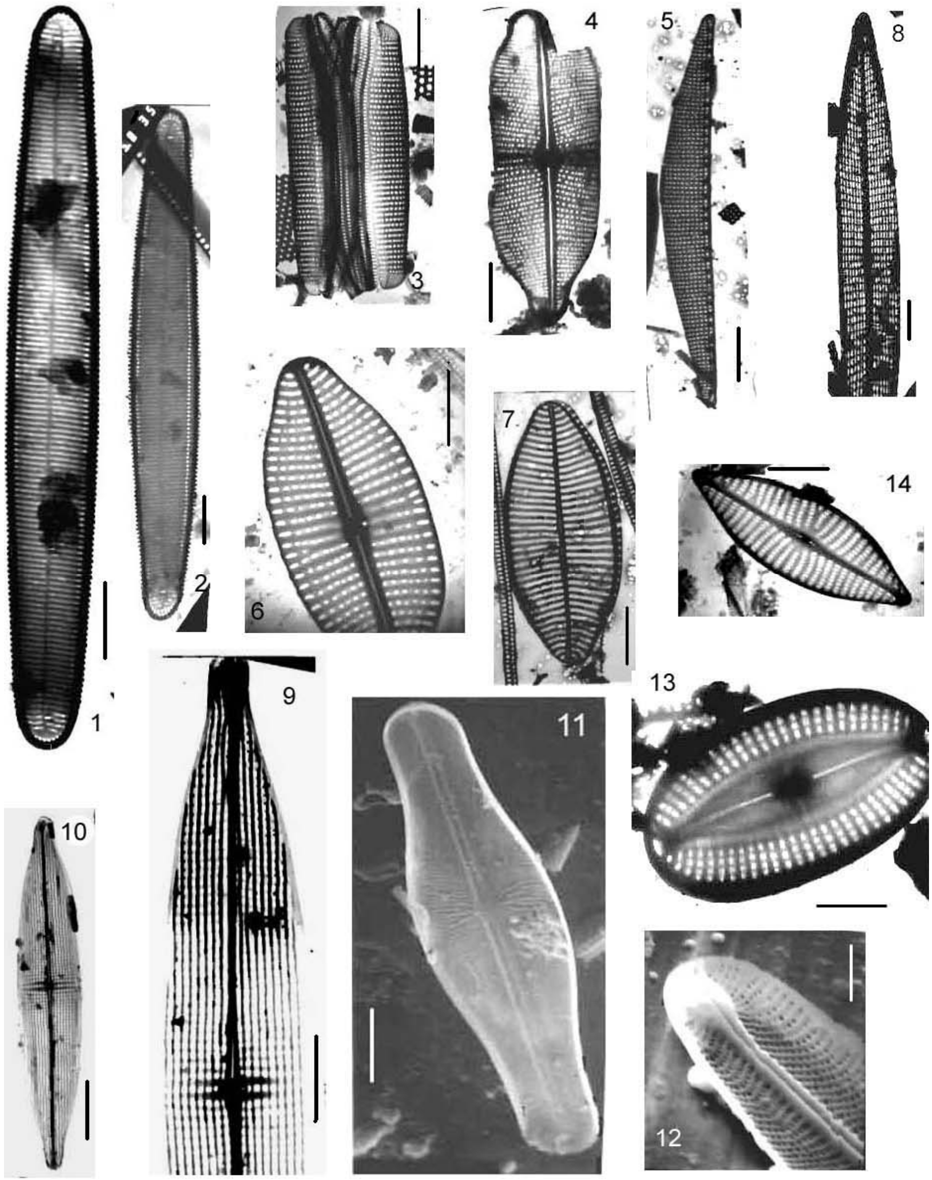
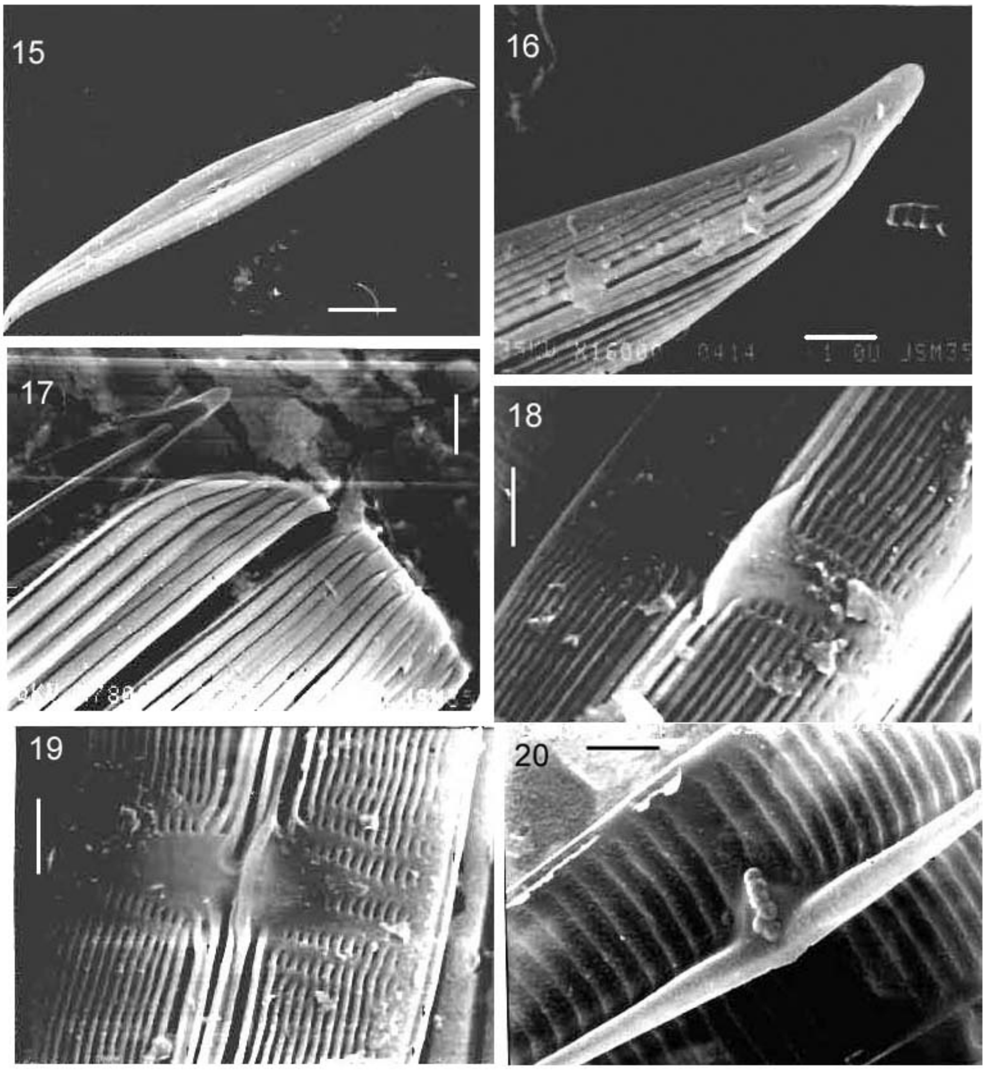
Figures 1, 2. Pteroncola marina *Holmes et Croll, the valve.* ***Figure 3.*** Striatella delicatula *(Kützing) Grunow, girdle view.* ***Figure 4.*** Navicula ordinaria *Hustedt, the valve.* ***Figure 5.*** Cymbellonitzschia diluviana *Hustedt, the valve.* ***Figures 6, 7.*** Astartiella punctifera *(Hustedt) Witkowski et Lange-Bertalot, 6 – raphe valve, 7 – rapheless valve.* ***Figure 8.*** Haslea subagnita *(Proshkina-Lavrenko) Karayeva, the valve.* ***Figures 9, 10.*** Proschkinia bulnheimii *var.* caspica *(Karayeva) Karayeva, 9 –enlarged fragment of the valve, 10 – the valve.* ***Figures 11, 12.*** Navicula hedinii *Hustedt, 11 – the valve inside, 12 – the valve end inside.* ***Figure 13.*** Fallacia florina *(Hustedt) Karayeva, the valve.* ***Figure 14.*** Navicula phyllepta *Kützing, the valve.* ***Figs 15-20.*** Proschkinia complanatoides *(Hustedt) Karayeva, 15 – the valve outside, 16 – the valve end from outside, 17 – girdle view outside at the valve end, 18 – central area of the valve outside with a flap, 19 – central nodule and central area of the valve outside, 20 – central area of the valve inside with a crest-like structure.* ***Figures 1-10, 13, 14. –*** *TEM;* ***Figures 11-12, 15-20.*** *– SEM. Scale bars:* ***Figures 1, 2, 16, 18-20. –*** *1 µm; figs 3, 4, 5, 6, 7, 8, 13, 14, 17 – 2 µm; figs 15 – 5 µm.*

Karayeva and Bukhtiyarova, ***Figures 1-14.***



Karayeva and Bukhtiyarova, ***Figs 15-20.***



Beyond surveillence monitoring: diatom-based indices and the Water Framework Directive

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The goal of the Water Framework Directive is to restore water bodies to good ecological status by 2015. Considerable effort has been spent developing methods to assess ecological status using diatoms and these methods will play a valuable role in identifying water bodies that are presently failing to achieve good ecological status. Such water bodies will be the subject of "programmes of measures" which will address water quality problems within the water body. Diatom-based methods will be useful for identifying inputs within water bodies which are having a significant effect on ecological status. This talk will describe a framework developed in the UK for the Urban Wastewater Treatment Directive that may be useful under such circumstances. Important features of this framework are an appreciation of within-site variation and of concepts of statistical power. Case studies will be used to explain how simple experimental designs, combined with ecological interpretation, can provide valuable information on which to base decisions.

Seasonal dynamics of diatom assemblages as revealed by varved sediments

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Palaeolimnological studies offer valuable insights into the development of aquatic ecosystems and evidence past natural or human-induced changes in lakes. Diatoms preserve well in lake sediments and have been broadly used to infer past changes in water quality related, for instance, to nutrient enrichment. This study is the first to explore diatom assemblages at seasonal time-resolution in a lake with annual (varved) sediments. Annually laminated sediments provide a precise chronology and allow environmental reconstructions at annual and seasonal resolution. We present results of a seasonal sediment resolution study from A.D. 1894 to 2000 of diatom deposition in the sediments of Sacrower See, northeastern Germany. The varved sediments of Sacrower See are macroscopically divided into couplets of light and dark layers. The dark layers consist of fine organic matter deposited during late summer, autumn, and winter, whereas the light layers are composed of planktonic diatoms and calcite crystals precipitated during spring and early summer. The ultra-high resolution study of diatom assemblages in Sacrower See has demonstrated that diatoms deposited in spring-summer and autumn-winter reflect very similar assemblage shifts, especially on decadal time-scales. Rates-of-change analyses revealed that seasonal variability in diatom assemblages are higher than annual changes. Summer diatom rates of changes over the period A.D. 1894-1960 are on average higher than the winter rates of change, whereas between the 1960s and the 1970s the winter rates of change become higher than the summer ones. The results imply that meteorological changes indirectly affected diatom assemblages via the mixing behavior of the lake. Redundancy Analyses showed that seasonal temperatures and wind strength are significant explanatory variables for the diatom assemblages in the annual and seasonal layers. A comparison of the diatom rates of change with the amplitude of inter-annual climate change shows a statistically significant correlation for the spring-summer layers in the period of A.D. 1963-2000. Our results show that the sensitivity of diatom assemblages to meteorological changes has clearly varied over the past century, with a stronger effect on diatoms registered during the past ca. 40 years. The reconstructed total phosphorus concentrations based on the diatom assemblages (DI-TP) of the annual layers fluctuate around 65 μg TP l^{-1} with no clear trend. However, the DI-TP concentrations in the dark layers tend to be slightly higher in the period A.D. 1894-1940. In contrast, after the 1940s DI-TP from dark and light layers shifted with the light layers showing higher values. This shift show slight changes in the seasonal TP concentrations with higher phosphorus concentrations in the spring-summer season after the 1940s. We suggest that ultra-highly resolved diatom records are tracing meteorological changes in a more sensitive way than annual records and have therefore a potential for climate reconstructions based on seasonal palaeorecords.

The diatom flora of lakes on James Ross Island (Antarctica)

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James Ross Island (64°10'S, 57°45'W) is a large (2450 km²) island situated in the north-western part of the Weddell Sea, close to the northern tip of the Antarctic Peninsula. Several years ago, a detailed study was started on the taxonomy and ecology of the non-marine diatoms from the northern part of the island. In a first part, the diatoms from seepage areas and streams have been investigated, leading to the publication of 4 new species (Esposito et al. 2008, Kopalová et al. in press).

During the Antarctic summers of 2007-2008 a large number of samples have been collected from the numerous lakes that are present on the ice-free areas. The physico-chemical characteristics of these lakes show a large variability in pH, specific conductance and nutrients. This variability determines the diatom composition of the different lakes, as is shown by the multivariate analysis.

The diatom analysis of these lake samples resulted in the observation of a well-developed diatom flora consisting of 105 non-marine diatom species, almost double the number of species found in the seepage areas. There is a clear difference between the two habitats. The principal species in the lakes are *Nitzschia* aff. *perminuta*, *N. homburgiensis*, *N. paleacea* and *Diadesmis* sp.1 dominating different types of lakes.

After detailed morphological research, several species, within the list of observed species of James Ross Island, proved to be new for science. Some of these species are represented on the poster such as *Craticula antarctica* Van de Vijver & Sabbe sp. nov., *Luticola gigacohnii* Van de Vijver & Kopalová sp. nov. and *Luticola adelae* Van de Vijver & Kopalová sp. nov.

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Diatomededelingen 33, 2009

Species composition and peculiarities of the centric diatom flora from the waterbodies and watercourses of Kamchatka

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On the basis of the study of samples from the Kamchatka Lake Dalneye, small watercourses (Perevalniy, Ralli, Samatkin Kluch, Sorniy, Cholodniy, Troinoi) the species composition in these biotopes is studied. The diatom flora of the studied ecosystems is mainly formed by rare oligosaprobic northern species. The difference between small watercourses and Lake Dalneye and other lakes is shown. *Stephanodiscus minutulus* and *S. invisitatus* are very abundant species in the Kamchatka springs. Changes in the diatom flora of Lake Dalneye from 1946 to 2003 are analyzed. The analysis of species occurrence frequency and seasonal abundance has been also made. A very abundant species in Lake Dalneye is *S. minutulus*. This taxon with *Aulacoseira subarctica* and *Stephanodiscus alpinus* forms a group of species prevalent in other lakes of Kamchatka.

Databasing diatoms: Experiences with 3 generations of data input tools

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INTRODUCTION

This paper takes a look at "how data gets into the database", examining how AlgaTerra data has been entered and edited over the lifespan of the project, and briefly introducing three generations of data input tools. The first and second generation are sophisticated tools still in use, while the third - the EDIT Desktop Taxonomic Editor - is currently under development, with an initial version available for download since November 2008 and the AlgaTerra project actively involved in testing.

RESULTS AND DISCUSSION

1st Generation: MS Access frontend for MS SQL Server database

At the beginning of the AlgaTerra project, data was collected from a number of project partners (Jahn et al. 2004) and imported into a database based on a model developed for the project. Since 2003, entering data into the model has been possible via an Access frontend on top of an MS SQL Server database (Berendsohn et al. 2003, Kusber et al. 2003) (see Table 1). Since then, almost all names, name relations, references, nomenclatural authors, and all types have been databased in this way (Figure 1).

Table 1. *How data was entered into the AlgaTerra database (Jahn & Kusber 2003-).*

	Data import	Access data entry	Web data entry
Scientific name	12767	12937	3
Name concept	27818	2639	1544
Nomenclatural type	3155	3800	0

2nd Generation: Taxonomic Web Editor

The Taxonomic Web Editor - a web-based input tool developed at the BGBM Berlin (Güntsch et al. 2003), for the input and editing of biological name and concept-related information stored in databases implementing the Berlin Taxonomic Information Model (Berendsohn et al. 2003; Geoffroy & Berendsohn 2008) - has been used for data entry by the AlgaTerra project since 2005. The main benefit for the AlgaTerra project is the ability to edit name and concept relations and the classification of accepted names and concepts (Table 1, Figure 2). A type module was developed on a pilot basis for the Berlin Model environment (Kusber et al. 2003) but not included in the taxonomic editor.

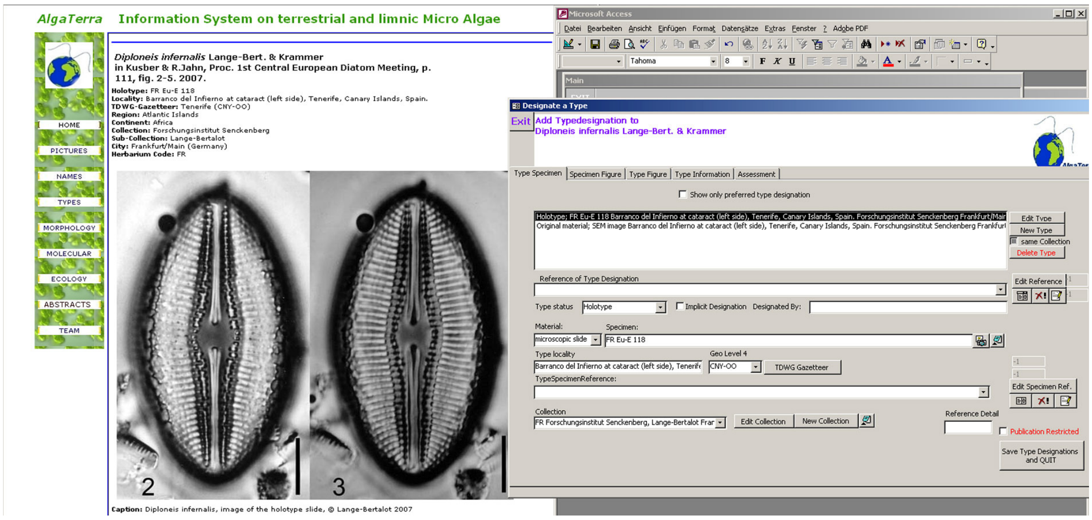

Figure 1. AlgaTerra Information System. Left side: Display of the nomenclatural type of Diploneis infernalis Lange-Bert. & Kammer. Right side: Data input tool using Access as the frontend of an MS SQL Server database.

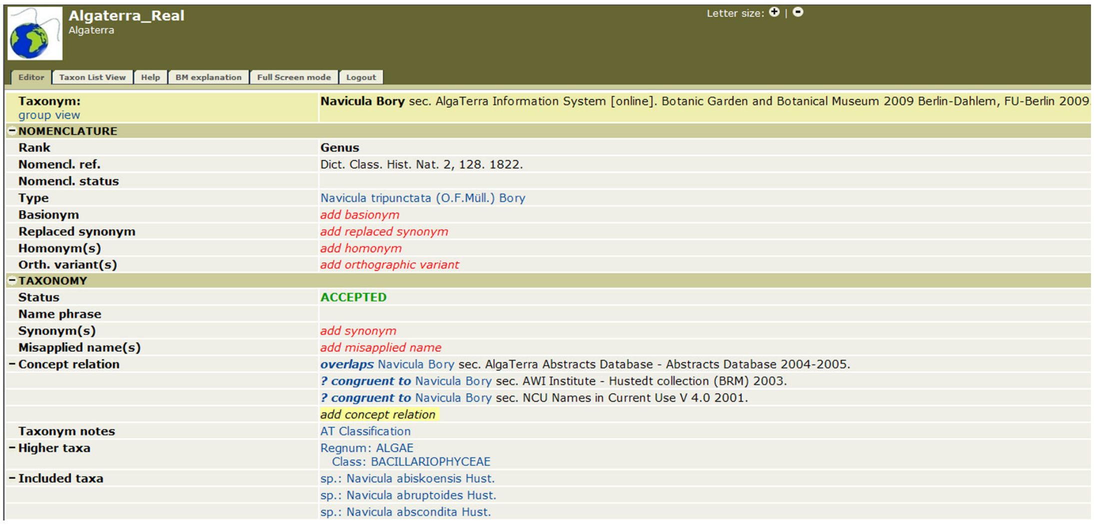

Figure 2. Taxonomic Web Editor, an Internet data input tool, set up on different Berlin Model databases. Screen shot shows the AlgaTerra taxonomic treatment of the genus Navicula Bory.

3rd Generation: EDIT Desktop Taxonomic Editor (prototype)

The EDIT (European Distributed Institute of Taxonomy) Desktop Taxonomic Editor is used to input and edit data stored in the Common Data Model (CDM). The CDM is at the heart of the EDIT Platform for Cybertaxonomy, which builds on lessons learned from the Berlin Model and related projects to integrate the needs of taxonomists across geographic and disciplinary boundaries and to ease the taxonomic workflow. Information from the GBIF network and other digital resources will be available via the EDIT portal (Kelbert 2008).

The Taxonomic Editor can be used for anything from fine-tuning an imported checklist to compiling a complete dataset from scratch. A guiding principle of the Editor is that a well-designed model alone will not win acceptance within the taxonomic community, and that it is crucial that taxonomists are provided with editing tools that are intuitive to learn and easy to use, and which align as closely as possible to their customary workflow. Development is guided by use cases developed within the EDIT project, i.e. creating a monograph, or editing a database which uses concept relations extensively, and the application's user interface leverages the BGBM's experience in constantly improving the Berlin Model Web Editor to meet the needs of taxonomists who use it daily. The EDIT Desktop Taxonomic Editor represents a concerted push away from forms-based editing in favour of a word processor-like input window with auto completion, syntax hints, and on-the-fly parsing (see Figure 3, right column); the hope is that this approach will be instantly recognizable and attractive to taxonomists used to working in Microsoft Word.

The Editor is a desktop application sitting on top of a web infrastructure; it offers the ability to download either a complete copy or a slice of the data in a centralized data store; it can then use the synchronizing components of the CDM programming library to save any local changes to the central store and to resolve any resulting conflicts. Furthermore, a desktop application allows the user to work entirely offline.

The initial release of the Editor focuses on scientific names and name relations, and has been tested with AlgaTerra data. Copying of data into the CDM and subsequent editing has proven fast and easy; on-the-fly parsing of names and references is working satisfactorily. Next steps include the development of a module for the editing of nomenclatural type information.

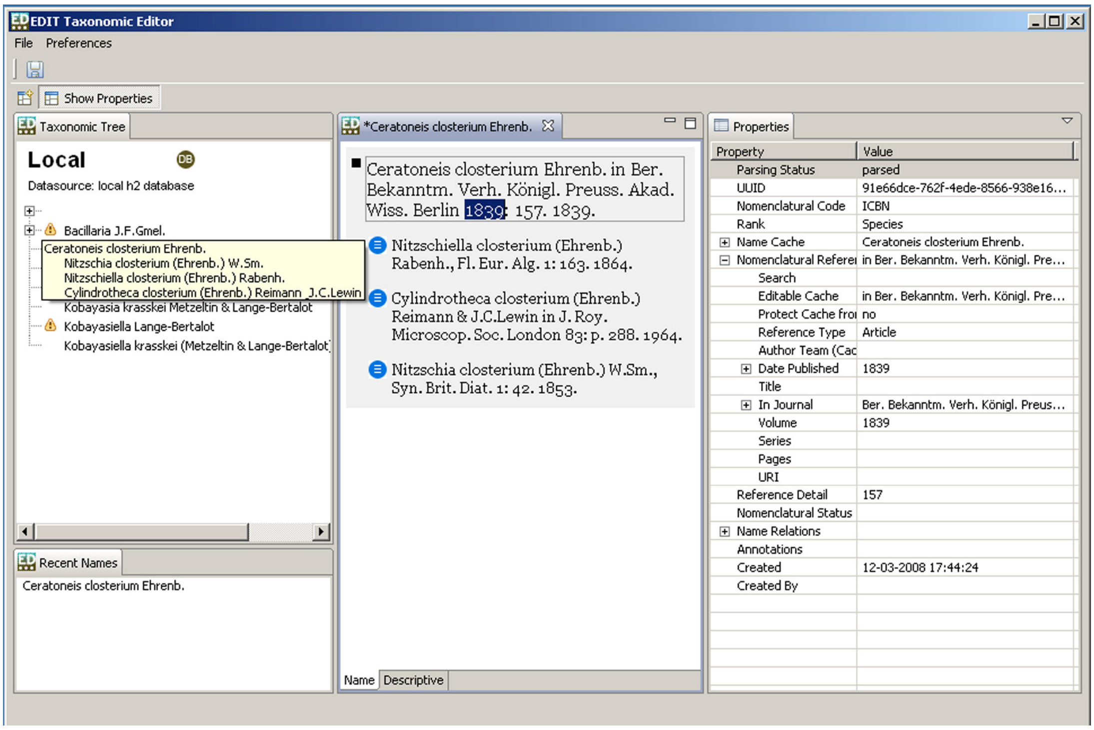

Figure 3. *EDIT Desktop Taxonomic Editor, showing data entry of Ceratoneis closterium Ehrenb. and its name relations.*

ACKNOWLEDGEMENTS

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New and interesting species of the genus *Navicula* in northern and western Europe

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During several biomonitoring studies in European river and lakes (Sweden, Belgium, Germany), nine unknown or only poorly known *Navicula* species have been found. The morphological analysis using both light and scanning electron microscopy, has shown that four of them should be described as new species: *Navicula antverpiensis* Van de Vijver & Lange-Bertalot sp. nov. is a new species found in a small lowland river near Antwerp (Belgium), showing some similarites with *N. cariocincta* Lange-Bertalot. Both species can be separated based on differences in valve dimensions and valve outline.

N. wendlingii Lange-Bertalot, Hofmann & Van de Vijver sp. nov. was described from the river Rhine and is close to *N. veneta* Kützing but can easily be distinguished by the lower number of lineolae and the larger valve dimensions.

N. lacuum Lange-Bertalot, Hofmann, Werum & Van de Vijver sp. nov. was found in some German lakes and closely resembles *N. seibigiana* Lange-Bertalot.

Navicula suecicarum Van de Vijver, Jarlman & Lange-Bertalot is a Swedish species, related to *N. viridulacalcis*.

The taxonomy of five other, already established, taxa is investigated: *Navicula neomundana* (Lange-Bertalot) Van de Vijver, Jarlman & Lange-Bertalot stat. nov., *Navicula simulata* Manguin syn. *Navicula symmetrica* Patrick, *Navicula schroeteri* Meister s. str. and *N. escambia* (Patrick) Metzeltin & Lange-Bertalot. The ecological preferences and distribution for each species are briefly discussed.

Diatoms in the Mongolian *Sphagnum* ecosystem: their significance in formation of regional flora and comparison with the same ecosystem of Eurasia

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Diatoms from Sphagnum bog Nur situated in Mongolia are studied. *Sphagnum* bog Nur (49°38'; 107°48') is the biggest in Mongolia. This bog is situated in the mountain taiga forest (1348-1351 m a.s.l) in the northern part of Khentei highlands. The total description of higher plants of this bog was given by Yunatov (1950) and Lavrenko (1956). Earlier the flora of alga from sphagnum bog of Nur was not studied. A total of 242 diatom taxa, belonging to 48 genera have been identified from samples that were taken from different acidic habitats of this bog. The most diverse genera are *Pinnularia* (46 taxa, 19%), *Eunotia* (35 taxa, 14.5%), *Stauroneis* (14 taxa, 5.8%), *Gomphonema* (12 taxa, 5%), *Aulacoseira* (11 taxa, 4.6%), *Encyonema* (9 taxa, 3.7%), *Fragilaria, Neidium, Psammothidiu*m (seven in each, properly 2.9%), *Luticola, Cymbopleura* (six in each taxa, properly 2.5%). The comprehensive analysis using LM and SEM methods resulted in the description of many new diatom taxa. Additionally 12 new taxonomic combinations are suggested. Comparison with other Eurasian sphagnum bogs is given. Ecological preferences of species are shown. Geographical analysis of the flora with the conclusion that a lot of found species prefer northern and mountain oligotrophic ecosystem is made.

Studies on planktonic diatoms – methodological aspects (case study from the Vistula River mouth)

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INTRODUCTION

Diatoms are often the most important group of phytoplankton, both in terms of biomass and species composition. Moreover, many taxa within this group are sensitive indicators of changes in water quality, which means that they should have an important role to play in monitoring programmes. Thus phytoplankton is one of elements recommended in rivers monitoring by WFD.

This study examines the species composition of planktonic diatom assemblages in the Vistula river mouth in space and time and considers some aspects of methodology which should be taken into consideration in order to achieve reliable and repeatable results using this group of organisms for routine investigations.

MATERIAL AND METHODS

Phytoplankton net samples were collected once a season between 2005 and 2007 from three separate arms of the Vistula River mouth, northern Poland. All samples were preserved with Lugol's solution and stored in a cool dark room.

Simultaneously, water quality parameters were measured in situ and samples for chemical water analysis were taken.

The laboratory treatment of diatom samples was carried out according to Battarbee (1986). Subsequently, material was examined with light and scanning electron microscopes.

RESULTS AND DISCUSSION

Chaetoceros Ehrenberg cells were identified and enumerated from Lugol's preserved samples as most *Chaetoceros* species are distinguished/classified on the basis of features which disappear during laboratory treatment (e.g. colony structure, number and shape of chloroplasts, Fig. 1).

The finely silicified valves, of such taxa as: *Cerataulina* Peragallo, *Dactyliosolen* Castracane, *Rhizosolenia* Brightwell, dissolve when treated with oxidizing reagents. *Dactyliosolen fragilissimus* (Bergon) Hasle – a species that is rarely identified in Polish waters, reached high abundances in the Vistula river mouth, although it was not recorded from permanent slides (Fig. 2).

Another advantage of the observation of preserved material was information on the number of living cells in the assemblage and thus its general condition, as well as the ratio of allochthonous and autochthonous taxa.

Phytoplankton samples should be examined and laboratory treated as soon as possible after collecting, as delicate valves of some finely silicified taxa dissolve when kept longer after preservation with Lugol's solution. We observed that the number of *Skeletonema marionoi* cells was about 80 % lower after six months of storage in comparison with results obtained immediately after sampling. Frustules of *Dactyliosolen fragilissimus* were subject to almost complete dissolution after long periods of storage.

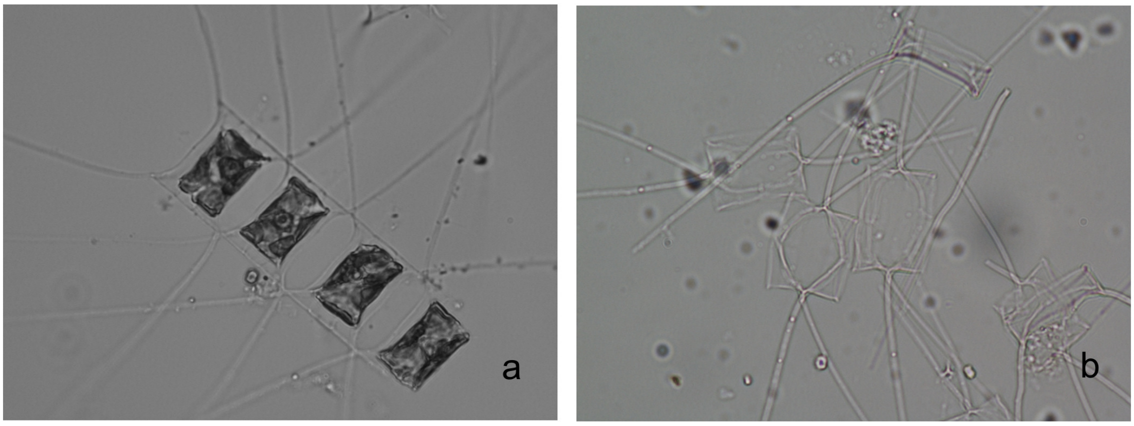

Figure 1. Chaetoceros brevis *Schütt in water preparation (a) and permanent slide (b).*

Figure 2. Dactyliosolen fragilissimus *(Bergon) Hasle in water preparation.*

Light microscopy techniques were insufficient to properly identify some diatom species, especially small-celled centric taxa, which should be included in analyses as they often indicate the increase of trophic status. The identification of *Skeletonema marinoi*, which seems to be ubiquitous in the Gulf of Gdansk but is frequently incorrectly defined as another species from the same genus – *Skeletonema costatum* (Greville) Cleve, was only possible using electron microscopy. Therefore, the necessity of SEM analysis which is time consuming and requires expensive equipment, can be an argument against using phytoplankton in wider monitoring applications.

During the microscopic examination the total number of 220 taxa was identified. 41 species belonged to Coscinodyscophyceae, 35 to Fragilariophyceae and 144 to Bacillariophyceae. In the studied samples, only 29 species made up over 5 % of total abundance in a single sample. Five species (*Aulacoseira islandica* (O. Müller) Simonsen, *Chaetoceros brevis* Schütt, *Cyclotella meneghiniana* Kützing, *Navicula perminuta* Grunow and *Skeletonema marinoi* Sarno & Zingone) constituted >50% of the total abundance on at least one occasion. However, the most numerous group was formed by rare (1-5% of the total abundance) (56 taxa), and very rare (<1% of the total abundance) diatoms (135 taxa). Both taxonomic composition and structure of studied assemblages were highly diverse depending on the time and place of sampling. Salinity was the variable with the greatest effect on the diatom assemblage composition, followed by temperature.

Planktonic algae quickly respond changes in the environment thus samples should be collected frequently enough to avoid drawing any conclusions from specific, short-lived phenomena such as short-term blooms caused by parameters as among others e.g. temperature or light. However, if sufficient data are obtained, phytoplankton can serve as a source of important information on the state and functioning of river ecosystems.

The studied assemblages were dominated by euplanktonic diatoms, suggesting that the environment of the Vistula River mouth supports forming typical planktonic assemblages which are potentially of great value in monitoring. However the interpretation of results regarding trophic and saprobic conditions on the basis of planktonic assemblages in question was difficult and unreliable because of the lack of data on the ecological requirements of some algae, particularly brackish and brackish-marine taxa. In our studies diatoms of unknown ecological preferences made up to 90 % of total abundance.

CONCLUSIONS

In case of application of planktonic diatoms for routine monitoring, aspects that are considered to be of minor significance in studies on benthic diatoms (e.g. frequency of sampling, time of storage, examination of preserved and laboratory treated samples or insufficient information on autecology) can have a significant effect on final results. Therefore, the use of methods developed for microphytobenthic communities without prior revision should be avoided.

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Interesting brackish taxa from the Antwerp harbour docks

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The Antwerp harbour is one of the largest in the world. Contrary to most international harbours, the Antwerp harbour is located at more than 100 km from the North Sea in the estuary of the river Schelde. This results in a mixture of fresh, brackish and marine water flowing through the different docks, influencing the diatom flora present in these docks.

In 2008, an extensive analysis was carried out investigating the diatom flora of the harbour docks in the framework of a large environmental study. The results of this study indicate the presence of a well-developed diatom flora typical for most of the European estuaries, composed of both freshwater species such as *Diatoma vulgare*, *Navicula lanceolata* or *Asterionella formosa* and brackish-marine species such as *Catacombas obtusa*, *Berkeleya rutilans* and *Thalassiosira angulata*. The dominating diatom genera include *Nitzschia*, *Navicula* and *Thalassiosira*.

During the survey, several unknown or so far unidentified taxa were found. In most cases, identification up to the genus level was possible although one species remains up till now entirely unidentified and could possibly be attributed to the (newly erected) genera *Olifantiella* Riaux-Gobin & Compère or *Labellicula* Van de Vijver & Lange-Bertalot.

This poster presents some of these unidentified taxa and comments on their morphology and possible taxonomic position.

Benthic diatom communities in mountain streams: response to anthropogenic pollution

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Response of epilithic diatom communities to anthropogenic pollution was studied in streams of the Giant Mountains and the Bohemian Forest (Czech Republic). 16 streams running through areas affected by recreational activities were selected (vicinity of mountain cottages, small touristically exploited villages) and 132 samples were collected both in unaffected stream parts and at sites below sewage outflows during years 2004–2006.

Total number of 153 diatom taxa has been identified. Significant differences in water chemistry between sites above and below sources of pollution were found. Consequently, the performed analyses (DCA, cluster analysis) based on species data generated two main groups of samples: sites polluted by sewage outflows and non- or only slightly affected sites. Specific community types with particular dominant taxa were found in different ecological conditions; oligo- to mesotraphentic taxa (e.g. *Achnanthidium minutissimum*, *Diatoma mesodon*, *Eunotia exigua*, *E. minor, Fragilaria capucina, Karayevia oblongella, Pinnularia subcapitata, Psammothidium subatomoides*) were replaced by eutraphentic taxa (e.g. *Cocconeis placentula* var. *lineata, Eolimna minima, Mayamaea atomus* var. *permitis, Planothidium lanceolatum, Reimeria sinuata*) below sources of pollution. Five environmental parameters had a significant influence on diatom species composition - pH, water temperature, discharge, nitrate nitrogen concentration and organic nitrogen concentration. There was no significant influence of anthropogenic pollution on diatom diversity.

Overall, we conclude that the changes in diatom species composition indicate well the environmental stress, such as sewage pollution, in mountain streams.

Influence of storm "Kyrill" induced deforestation on the silicon supply of the Sorpe Dam

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SUMMARY

The storm "Kyrill" in 2007 fell a huge amount of timber in North Rhine-Westphalia, Germany and produced areas with uncovered soil. It is assumed that bare soil leads to an increased leaching of minerals, which could influence the Si concentration in the receiving waters. We were able to proove this by finding a slight positive correlation between the relative area of Kyrill clearances and the Si content of the draining streams on several forest covered areas on the western shore of the Sorpe dam. In catchment areas with 44 % Kyrill clearances the Si content of the draining streams increased about 1.1 mg/L (SiO_2), that is about 0.25 mg/L (SiO_2) for each 10 % of deforestation. This additional silicon load could possibly have a positive effect on the diatom development in the dam.

INTRODUCTION

In the night of January 18th, 2007, a storm with maximum velocities of more than 225 km/h drew over Europe. The associated depression and the storm were named "Kyrill". More than 37×10^6 m^3 of timber fell in Germany alone (Bundesregierung 2007); almost 50 % of that figure only in North Rhine-Westphalia: 18×10^6 m^3 on an area of 31102 ha (areas smaller than 0.25 ha are excluded in this calculation) (Asche et al. 2007). A decrease in trees is followed by a decrease in evapotranspiration, which has as consequence an increased surface and subsurface flow (Elliot et al. 1999), resulting in an increased leaching of minerals. Removing vegetation and forest coverage causes erosion and a run off of nutrients which can lead to a loss of up to 0.6 kg of soil m^{-2} yr^{-1} (Douglass/Goodwin 1980). This observation raises the question wheather or not clearances in the forest due to Kyrill could remarkebly increase the elution of silicon and influence the population growth of diatomaceous algae in the Sorpe dam.

INVESTIGATED AREA

The Sorpe reservoir forms part of the dams which supply the Ruhr industrial region with water. The reservoir lies in the mountains of the Sauerland (North Rhine-Westphalia, Germany) in a catchment area of about 100 km^2, of which 66.7 % are forested. It consists, similar to the other dams of the Ruhr region, of a pre- and a main basin (Fig. 1). The pre-basin receives effluents rich in nutrients from two streams, running mainly through agriculturally used area. The nutrient status of the pre-basin is highly eutrophicated. The main basin receives the waters of the pre-basin and the nutrient poor waters of contributing small streams arranged around the main basin. Its nutrient status is oligo- to mesotrophic (LAWA 1990). The total volume is 70.8×10^6 m^3 with a theoretical filling time of 1.53 years. In 2007 the trophic rating increased from 1.5 to 1.8 according to LAWA 2001 (Ruhrverband 2008). The majority of the flora of both basins are diatoms. In the pre-basin *Asterionella formosa* and *Synedra acus* dominate, whereas in the main basin *Asterionella formosa*, *Melosira* (*Aulacoseira*) *varians* and *Fragilaria crotonensis* are the most common diatoms. The majority of the forests on the slopes of the Sorpe valley are composed of *Picea abies*, complemented with a small fraction of *Fagus sylvatica*. The diameter of the trees is about 30 cm.

METHODS

To obtain an overview of the damages Kyrill made to the landscape, the forestry department of the North Rhine-Westphalian government mapped the forests by means of aerial infrared photographs (LDS 2007). These maps were the prerequisite to determine where water of the draining streams should be sampled to examine silicon content and conductivity (κ). Ten sampling points (Fig. 1) were choosen according to accessibility and differences in the fraction of Kyrill clearances in respect to the total catchment areas of the draining streams. The Kyrill fractions ranged from 4.4 to 41.6 %. (An example is shown in Fig. 2). Each station was sampled three times in total, on Jan. 14th, Jan. 21st and March, 3rd, 2008, three days with precedented rainy periods. A WTW conductivity meter (Cond 315i, with automatical correction to 20 °C) and the Macherey-Nagel visocolor silicon test for water analysis (914224), together with Macherey-Nagel photometer PF-10, were used. Results were plotted against relative Kyrill area and regression curves were obtained using the spreadsheet module of the OpenOffice.org software package (version 2.4). Significance was calculated by correlation analysis.

***Table 1**. Si concentration and conductivity of streams in some Kyrill areas on the west shore of Sorpe Dam (*: Increased conductivity due to de-icing salt).*

No.	Area (total) (m^2)	Kyrill area (m^2)	Area Kyrill (%)	14 Jan 2008 c(SiO_2) (mg/L)	14 Jan 2008 Cond. (µS/cm)	21 Jan 2008 c(SiO_2) (mg/L)	21 Jan 2008 Cond. (µS/cm)	3 March 2008 c(SiO_2) (mg/L)	3 March 2008 Cond. (µS/cm)
1	166648	14115	8.4	5.8	602*	6.2	264	7.6	263
2	382441	58866	15.4	9.0	129.2	8.6	116.5	8.6	116.6
3	563935	95009	16.8	8.4	114.5	7.8	106.4	8.0	105.1
4	329962	44211	13.4	7.6	90.5	8.0	87.5	8.0	86.9
5	154268	27785	18.0	8.0	153.6	7.2	136.6	7.4	136.2
6	170145	70536	41.6	8.4	97.2	9.2	94.0	9.4	93.2
7	277433	65142	23.5	8.0	104.9	8.2	103.2	8.6	105.4
8	1298190	394752	30.4	9.0	133.5	9.0	134.4	9.0	136.9
9	226583	10080	4.4	9.0	105.9	8.8	104.4	9.2	103.9
10	746526	92014	12.3	9.0	104.3	8.6	100.6	8.0	98.6

RESULTS

The ten streams draining the catchment areas were examined as close to the dam as possible, depending on accessibility. The results are found in Table 1.

With the data of the three visits of the sampling sites pooled, regression analysis shows a correspondence between silicon content of the streams and the relative area of Kyrill clearances (Fig. 3). An increase of the vegetation free area to 40 % lead to an increase of the silicon content of a flux of env. 1.0 mg/L (SiO_2). (The correlation coeffcient is about $r = 0.38$, which states significance at $\alpha = 0.05$). Assumed an average loss of 20 % forestry area due to Kyrill in the total catchment area (100 km^2) of the Sorpe dam, this would match an increase of 0.5 mg/L SiO_2 in the contributing waters. With an annual influx of 52×10^6 m^3 this makes 26000 kg yr^{-1} of SiO_2, what equals to an additional silicon load of 11400 kg yr^{-1}. It is possible, that this additional load leads to additional diatom biomass. But since it will not take long until the clearances are vegetation covered again, the momentarily state is only transitionally.

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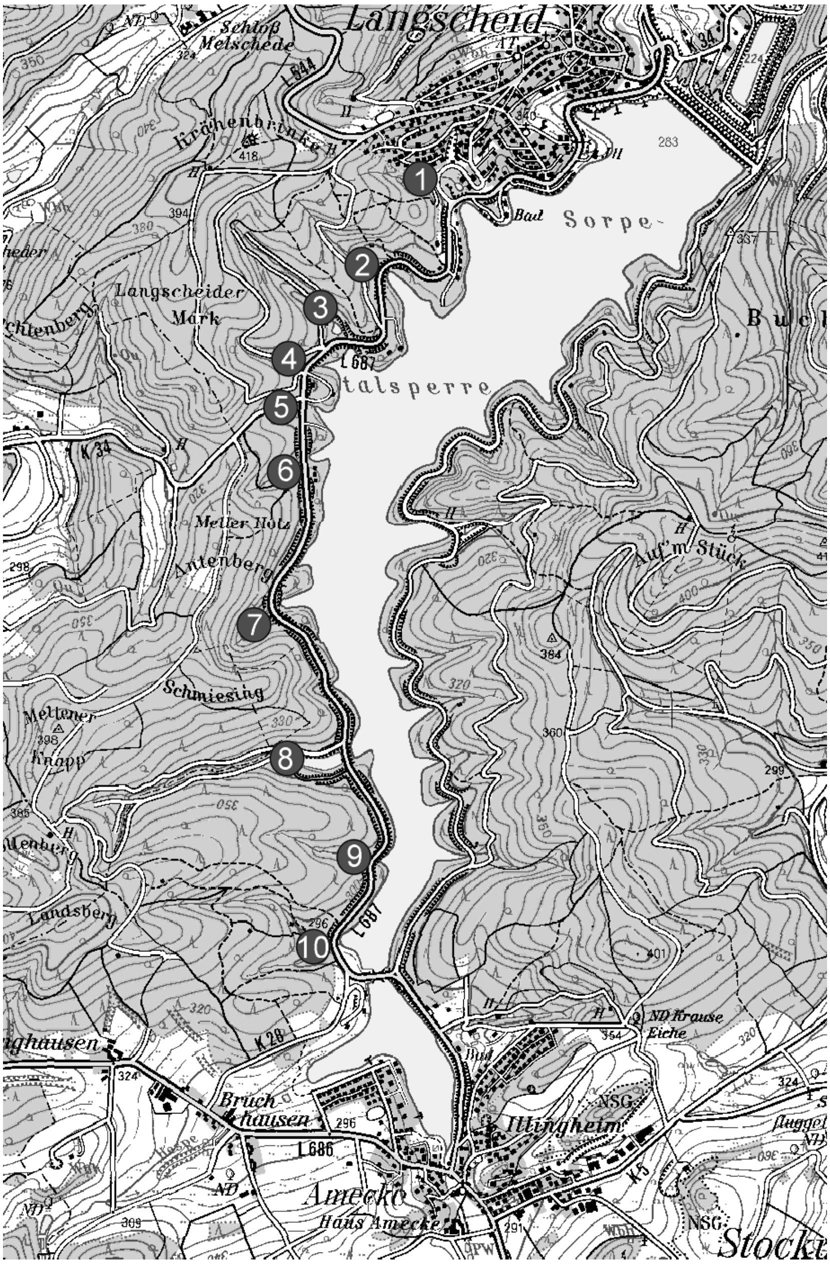

Figure 1. Sorpe Dam (from German Topographical Map 4613 (1:50000, Landesvermessungsamt Nordrhein-Westfalen 1990) with sampling sites.

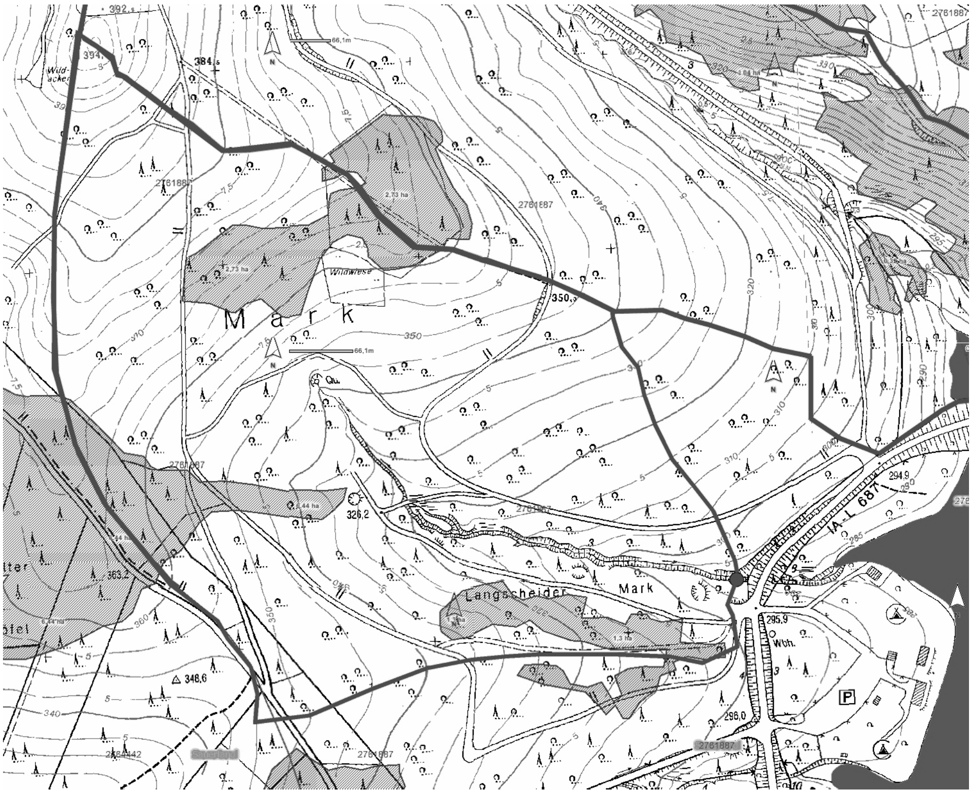

Figure 2. *Map of catchment area "Marker Bach" (32.9 ha, surrounded by thick line) with Kyrill clearances (4.4 ha, shaded), showing sampling point no. 4, indicated by dot (made using data from LDS 2007).*

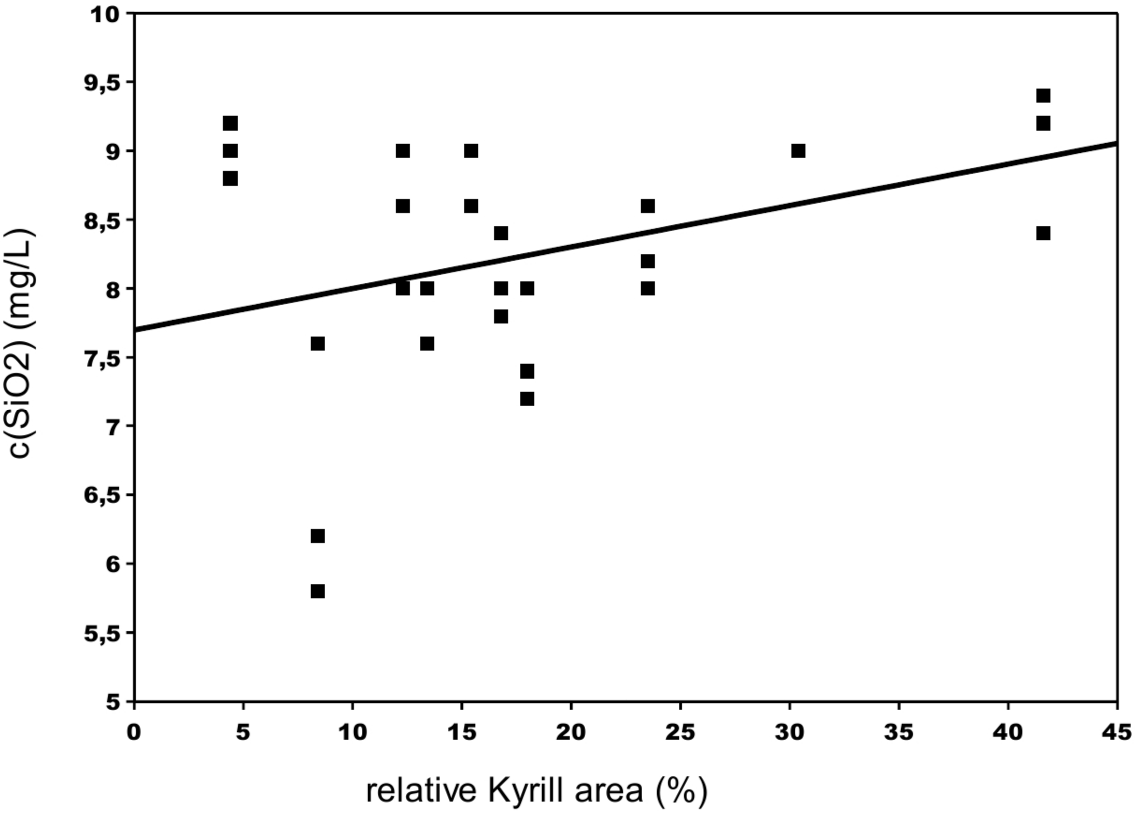

Figure 3. *Silicon content of draining streams in relation to kyrill area within the resp. catchment area, with linear regression.*

Diatom flora of the Gangetic drainage in the ancient Vindhya and the recent Himalaya: Biogeographic perspective in the Indian subcontinent

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INTRODUCTION

Many diatom species are known to have world-wide distributions; others appear limited to certain climatic zones or geographical regions, or are endemic to particular water bodies. The importance of geographical factors in explaining patterns in diatom flora has been underestimated (Kociolek and Spaulding 2000). Most of the factors found to be important for distribution of benthic river diatoms like water chemistry (pH, ionic strength and nutrient concentrations), substrate, current velocity, light and grazing (Patrick and Reimer, 1966; Round, 1981) depend strongly on climate, geology, topography, land-use and other landscape characteristics, and hence are similar within ecological regions defined by these characteristics (Stevenson 1997). In the Indian subcontinent, the ancient Central Highlands (Pre Cambrian) and the recent Himalaya are geological entities connected by the Gangetic drainage (GD). This drainage is isolated from the Indus and Brahamaputra.[1] Thus GD is restricted to the west and central Himalaya only and connects with the Central Highlands. However, these two regions vary in climate and biota by virtue of their geographic location and geomorphology. The diatom flora from these two regions was compared to throw some light on the biogeography of diatoms in the subcontinent. Fragmented studies exist on the distribution of flora from the Peninsular India and the Himalaya (Dickie 1882, Carter 1926, Gandhi 1998, Nautiyal & Nautiyal 1999 a-b, Nautiyal et al 2004 a-b, Jüttner and Cox 2001, Cantonati et al 2001).

STUDY AREA

The part of GD considered in the study includes the rivers of west Himalaya, the Yamuna and Ganga and the north flowing Vindhya rivers (Ken, Paisuni and Tons) which join the Yamuna and the Ganga in the Gangetic Plains between the Tropic of Cancer and the Indo-Gangetic Plains and drain the Bundelkhand plateau. The selected Himalaya streams/rivers Dharasu Gad (ca. 40 km upstream of Tehri Dam), Nagni Gad (ca. 50 km downstream of Devprayag), Supin (a parent tributary of the Tons), Yamuna, Bhagirathi and Alaknanda lie north of the Indo-Gangetic Plains and flow in southerly direction through a cross-section of mountains to enter the Plains. The Bhagirathi and Alaknanda join to form the Ganga R at Devprayag in lesser Himalaya.

[1]The Gangetic drainage is Himalayan while the Indus and Brahmaputra drainages have trans-Himalayan origin.

MATERIAL AND METHODS

Epilithic diatoms were sampled at 11 stations on 3 rivers in the Vindhyan region and 9 stations on 3 rivers and 2 streams in the Himalaya during November to May 2004-2005. Diatom samples were obtained by scraping hard substrate and preserved in 4% formalin. Samples were treated with Hydrochloric acid- peroxide, washed repeatedly and mounted in Naphrax. Identifications were made according to standard literature.

RESULTS AND DISCUSSION

The Gangetic drainage connects the Himalaya and Vindhya highlands in the Indian subcontinent. They are separated by the Gangetic Plains. The flora of these two highlands was compared to throw some light on the biogeography of diatoms in the Indian subcontinent. The Vindhya rivers have low slope (<1 m km^{-1}), fixed rocky substrate in the upper stretches and clay-silt near the mouth zone. The Himalayan rivers largely have movable stony substrate and high slope (>1 m km^{-1}). The current velocity regimes range from >90 cm s^{-1} in the Himalaya rivers and 5-70 cm s^{-1} in its streams compared with <20 cm s^{-1} in the Vindhya. The water temperatures can reach 30^{o}C in both cases, however the lower limit was 15^{o}C in the Vindhya and 1^{o}C in the Himalaya. The pH and DO concentration varied slightly. The conductivity is generally low in the Himalaya (exceptions Mandakini basin 50-970 µ mhos cm^{-1}) and moderate in the Vindhya.

The flora belonged to three sub orders, one centric-Coscinodiscineae with two families (Thalassiosiraceae and Meloseriaceae), two pennate-Araphidineae (Fragilariaceae) and Raphidineae (Eunotiaceae, Achnanthaceae, Naviculaceae, Epithemiaceae, Bacillariaceae, Surirellaceae) with one and six families respectively. Four centric taxa were present in the flora of the Gangetic drainage. Naviculaceae accounted for the highest number of genera and taxa, followed by Fragilariaceae, Achnanthaceae and Bacillariaceae (Table 1). However, the Vindhya was comparably richer in *Navicula* sensu stricto, *Nitzschia* and *Cymbella* sensu stricto while the Himalaya in *Achnanthidium*. Six and ten genera occurred only in the Himalaya and the Vindhya, respectively (Table 1). The Gangetic drainage comprised 363 taxa of 55 genera (288 taxa, 71 varieties, 4 forms), of which 117 taxa (32.5%) are common to both regions. The similarity index (0.489) was at the threshold of significance. Lack of significant similarity (0.41) observed for the fish fauna of the Vindhya and Himalaya (Nautiyal 2005).

The present day low similarity can be attributed to 'Gangetic Plains' which form a physical barrier for passively dispersing unicellular diatoms. The 'Plains' are wide extending 6^o N latitude (Vindhya 23^{o}30' to 26^o N, 78^{o}30' to 82^{o}30' E; West Himalaya 29^{o}31' to 31^{o}20' N, 77^{o}33' to 80^{o}6'E). Higher thermal regimes (ambient and aquatic) in the Gangetic plains act as efficient barriers to the exchange flora. The effectiveness of the barrier gets enhanced due to great width of the 'Plains'. Himalayan elements cannot easily proliferate for long distances in the hot Gangetic Plains and vis-a-vis. Besides, the river bed consists of soft sediments in the 'Plains' where only planktonic or epiphytic forms can flourish and the epilithic forms will cease to persist due to lack of hard substrate, typical to highland streams/rivers. Thus, despite the Gangetic drainage connection similarity of diatom is low among these highlands. As the 'Plains' were formed consequent to Himalayan upheaval, the historical factors also become important. Since the Vindhya is historically a part of the ancient (Pre Cambrian) Peninsula and the Himalaya is recent, this difference should be reflected in the diatom flora also.

However, comparison of the recent Himalaya and ancient Vindhya shows substantial similarity at genera level (65.5 %) than at species level (32.5%).[2] This evidently suggests that exchanges have occurred between these two highlands in the past followed by a period of isolation, owing to which there is more similarity than dissimilarity. A certain level of similarity can be expected even between distant regions because taxa are adapted to specific environmental conditions, and because diatoms can be widely dispersed, they are likely to exist where those conditions occur (Charles et al. 2006).

The difference in the flora of the Himalaya and Vindhya is partially due to climate and geography and partly due to barrier in the form of 'Plains'. The presence of palearctic elements (*Melosira*, *Ceratonies* etc. each with one or two spp.) in the Himalaya only, shows the effect of geography while differences in the species of genera occurring in both regions shows the speciation that occurred after the 'Plains' became a barrier.

The development of Himalayan flora must have happened in two major phases. In the first phase the newly formed stream habitats in the sub-Himalaya must have been colonized from the north flowing rivers of the Indian Peninsula. The mechanism of colonization however, is not easy to explain. The species found only in the Himalaya may be the result of speciation within each genus, most of which were ancient by virtue of Peninsular ancestry. The fact that 176 taxa compared to 72 taxa were found only in the Vindhya and Himalaya, respectively suggests less time frame for speciation in the recent Himalaya than the ancient Vindhya. In the second phase i. e. during the glaciations many of the Himalayan elements reached Peninsular India and some peninsular elements may have perished. Similarly, in the third phase i.e. 'post glaciations' some of the Himalayan forms retreated or perished from the Vindhya, as also opined by Mani (1974). This supports the theory proposed by Charles et al. (2006) that factors related to historical events, disturbance, chance introductions and dispersal ability govern distributions and are more important than environmental conditions.

CONCLUSIONS

Historically, 1) the upheaval of Himalaya created new lotic habitats which were colonized primarily by the Peninsular flora, and possibly the Indus and Brahmaputra elements; 2) the glaciations facilitated movement of the Himalayan flora to the Peninsula and depleted the Peninsular elements, 3) during post glaciations[3] the retreat of ice-cover led to further depletion of the Peninsular elements, and thus similarity in the present flora of these highlands.

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[2]It is important to determine if high local species numbers are related more to enrichment of numbers of families or to enrichment in numbers of spices per family (as the number of species increases, there is a gradual, distinct increase in the numbers of families, but not an overall pattern of increased species per family). This could mean, overall, that increased species richness in local stream fish assemblages results at least in part from greater number of families per locality, as well as proliferation of species within the families that are present. If this is the case, then high local species richness would related both to evolutionary events in the "deep past" (i.e., when families were emerging) and to those in the more recent past (when extant species evolved). An increased number of families should mean greater morphological diversity in an assemblage, relative to the morphological diversity that would exist if there were a large number of species within only one or a few families (Matthews 1998).

[3]Climate became hot and taxa unable to withstand desiccation may have perished and those which modified or adapted to sub tropical climate became new taxa, varieties and forms.

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Table 1. *Diatom flora: Comparison of the Himalayan and Vindhyan region. Vindhya is rich in Cymbella, Navicula both sensu stricto and lato and Nitzschia (S/G = Species/Genera).*

GENERA	V	H
THALASSIOSIRACEAE		
Aulacoseira	1	
Cyclotella	2	1
Total S/G	3/2	1/1
MELOSIRACEAE		
Melosira		1
Total S/G	-	1/1
FRAGILARIACEAE		
Ceratoneis		3
Diatoma	4	4
Fragilaria	2	4
Staurosira	2	3
Synedra	19	10
Tabellaria	1	
Total S/G	28/5	24/5
EUNOTIACEAE		
Eunotia	6	1
Total S/G	6/1	1/1
ACHNANTHACEAE		
Achnanthes	1	1
Achnanthidium	14	22
Planothidium	5	6
Cocconeis	6	4
Total S/G	26/4	33/4
NAVICULACEAE		
Amphipleura	1	1
Amphora	12	5
Anomoeoneis	1	
Brachysira	2	1
Caloneis	6	4
Cymbella	31	23
Cymbopleura	14	3
Encyonema	5	3
Encyonopsis		3
Reimeria		2
Diploneis	6	4
Frustulia	1	1
Gyrosigma	3	1
Gomphonema	15	10
Mastogloia	1	
Navicula	32	24
Navicula sensu lato	5	3
Adlafia	2	2
Aneumastus	2	
Craticula	5	
Diadesmis	2	
Fallacia	2	1
Geissleria	1	1
Hippodonta	2	2
Luticola	8	1
Placoneis	2	1
Sellaphora	7	1
Neidium	4	
Pinnularia	7	2
Rhoicosphenia		1
Scoliopleura	1	
Stauroneis	2	1
Total S/G	183/30	101/25
EPITHEMIACEAE		
Epithemia	1	
Rhopalodia	2	
Total S/G	3/2	-
BACILLARIACEAE		
Bacillaria	1	
Denticula	1	1
Hantzschia	1	2
Nitzschia	32	19
Total S/G	35/4	22/3
SURIRELLACEAE		
Cymatopleura		1
Surirella	9	5
Total S/G	9/1	5/2
GRAND TOTALL S/G	293/49	189/42

Reinvestigation of the fossil diatom flora from Jastrabá deposits, Ehrenberg Collection - preliminary results

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Fossil material of the Jastrabá deposits (today Slovak Republic) from the Ehrenberg Collection, was re-investigated. The material contains a number of species which Ehrenberg (1854) described as new from this diatom thanatocoenoses: *Fragilara rhombus, Gallionella scala, Eunotia jastrabensis, E. cistula*. Up to now these species were not lectotypified. Some of them were identified and synonymized by Pantocsek (1892), Řeháková (1980), and in other freshwater deposits within the realm of Central Paratethyan basin. This report provides a preliminary description of the Jastrabá diatomite deposits, their origin and precise age, as well as first taxonomical remarks on these diatom taxa.

We used the material from the Ehrenberg Collection in BHUPM, which consists of:

- Ehrenberg's original samples – raw materials # 2847-1; # 2847-2, Jastrabá Kieselgur;
- Ehrenberg's original mica tray 4401
- Ehrenberg's original drawings – Zeichenblatt # 2423;

Raw samples were treated and examined with scanning electron microscope (SEM) Philips 515 at BGBM Freie Universität Berlin.

The evolution of the tertiary basins in the Western Carpathians was closely connected with the evolution of the Carpathian orogenic. A number of volcanous have formed in the area of Central Slovakia during the Neogene volcanic activity. This volcanic activity coincides with a tectonic desintegration of the area on partial blocks with different vertical displacement. Two lithostratigraphic units are recognized in Zwolenská kotlina depression, situated in the south-eastern part of Kremnické vrchy mountain range, and namely: 1. Sielnica Formation (100-200 m thickness), composed of extrusive dome, rare lava flows, pyroclastic flow deposits, and epiclastic volcanic rocks (Middle-Upper Sarmatian/~12 Ma); 2. Turova Formation (50-100 m thickness), composed of necks, lava flows, pyroclastic flowed deposits, reworked pyroclastic rocks, and epiclastic volcanic rocks of pyroxene andesites (Upper Sarmatian-Lower Pannonian (?)/~11.6 Ma). In the proximal zone reworked pyroclastics, epiclastic volcanic breccias and sandstones occur, grading eastwards into conglomerates and relatively finer sandstones, lignite and diatomite, indicating a transition into volcano sedimentary beds. The Jastrabá diatomite deposits originated within this sedimentation cycle.

The dominant and subdominant diatoms in the studied thanatocoenoses are benthic forms. The most diverse are species belonging to the genera *Fragilaria* Lyngbye sensu lato, *Cymbella* C.Agardh. sensu lato and *Rhopalodia* O.Müll. Of all encountered taxa in Ehrenberg's Zeichenblatt # 2423, *Gallionella scala*, *G. distans*, and *Fragilaria rhombus*, have been selected for their stratigraphic importance and evolutionary interest.

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Assessment of ecological status of Polish running waters by diatom phytobenthos – the present approach

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INTRODUCTION

Poland as other member states of EU is obliged to implement the Water Framework Directive (Directive 2000/60EC) and till 2015 to achieve at least good ecological status of significant natural surface water bodies or good ecological potential of artificial or heavy modified water bodies. Phytobenthos is one of biological quality elements used to define ecological status of surface waters (WFD, Annex V). Diatoms are regarded as proxies for phytobenthos in rivers and lakes, and therefore diatom-based methods are widely used to assess water quality and ecological status of running waters (Kelly et al. 2008a). In the end of 2006, a multimetric diatom index IO (Indeks Okrzemkowy) (Picińska-Fałtynowicz 2009) was prepared as one of methods consistent with the WFD requirements to be implemented into the three year monitoring programme of Polish rivers over the period 2007-2009. Presented results are part of the work ordered by the Polish Environment Protection Agency (GIOŚ) and funded by the National Fund of the Environment Protection and Water Management (NFOŚGW).

MATERIAL AND METHODS

Benthic diatom samples were collected in spring (late March-April) and autumn (late September-early November) 2007 at 270 monitoring sites. In streams and rivers with rocky bed, epilithon was scraped and preserved following CEN standard (2003). In rivers with soft sediments where no cobbles were available, biofilm from submerged wood pieces (epixylon) or an upper layer of sediments (epipelon) were sampled. Simultaneously, river water was taken for physical and chemical analyses. Prior to cleaning procedure in a laboratory, 'water slides' prepared from each raw sample were examined to evaluate the quality of a collected material, i.e. abundance and quality of diatom cells and amount of admixture of organic and/or mineral particles. Homogenized sub-samples were digested in hydrogen peroxide. Cleaned diatom frustules were mounted in permanent slides using Naphrax®.

300-500 valves were counted per sample using 1000 x magnification (CEN standard, 2004). Diatoms were identified to the lowest possible level – usually species or variety following guidebooks and monographs of Krammer & Lange-Bertalot.

A multimetric diatom index IO based on German method (Schaumburg et al. 2005) is an average of three normalised modules: the trophic Z_{TI}, the saprobic Z_{SI} (TI – Trophieindex, Rott et al. 1999; SI – Saprobienindex, Rott et al. 1997, after Schaumburg et al. 2005) and the reference species GR (Schaumburg et al. 2005). The two first modules reflect the main impact factors currently affecting Polish running waters, i.e. nutrient enrichment and organic pollution. The third constituent reflects changes in species composition in comparison to a reference community. Three main groups of reference species have been determined: for siliceous waters, for calcareous waters and for both siliceous and calcareous waters. In addition, reference taxa specific for nine diatom-types of rivers (I–IX, Table 2) have been selected according to Schaumburg et al. (2005) (Picińska-Fałtynowicz 2009). The TI and SI indices are calculated by a weighted formula of Zelinka & Marvan (1961) basing on relative abundance of indicator taxa and their indicative and weight values (Rott et al. 1997, Rott et al. 1999). The module GR is a sum of relative abundances of reference species multiplied by their weight values (1 or 0.75, Schaumburg et al. 2005). The module GR varies between 1 and 0 but TI and SI indices have different ranges (0.3–3.9 and 1.0–3.8 respectively). Therefore, they have been transformed into normalised Z_{TI} and Z_{SI} which vary within the same range as the GR module and 1 indicates best quality while 0 – worst quality. The IO values vary also from 1 (best ecological status) to 0 (worst ecological status). Preliminary boundaries between high, good, moderate, poor and bad classes have been proposed for 5 groups of Polish streams and rivers clustered on the basis of an altitude and size of a catchment area (Table 1).

Apart from 270 samples from monitoring sites, 53 samples from mountain and mid-altitude siliceous streams collected in 2004-2006 were included into the data set analyzed.

Table 1. *Preliminary boundaries between ecological status classes according to the diatom index IO for particular groups of Polish river types: mountain streams: of Tatry Mts. (1 – siliceous, 2 – calcareous); of Sudety Mts. (3); mid-altitude streams: siliceous gravely (4) or sandy (5), calcareous sandy (6) or gravely (7) or flysh (12); mid-altitude rivers: small siliceous (8) or calcareous (9) or flysh (14), medium western (10) or eastern (15); lowland streams: loess or clayey (16), sandy (17), gravely (18) or organic (23); lowland rivers: sandy-clayey (19), gravely (20), in a peat valley (24), connecting lakes (25) or affected by Baltic waters.*

Ecological status	**River types**				
	1, 2, 3	**4, 5, 6, 7, 8, 9, 10, 12,14, 15**	**16**	**19, 20, 24, 25**	**17, 18, 22, 23,**
High	> 0.75	>0.70	>0.70	>0.65	>0.60
Good	0.55	0.50	0.50	0.45	0.40
Moderate	0.35	0.30	0.30	0.25	0.20
Poor	0.15	0.15	0.10	0.10	0.10
Bad	<0.15	<0.15	<0.10	<0.10	<0.10

RESULTS

The most numerous types sampled in 2007 were medium-sized lowland sandy-clayey river (type 19) and lowland sandy stream (type 17), while several types were represented by single or few sites only (Table 2). According to the IO index values, in more than a half of the water bodies (54.8%) ecological status was assessed as moderate, in 22.6% as good, in 16.1% as high and in 6.5% as poor (Table 2).

In water bodies of high or good ecological status, diatom communities were composed mainly of reference taxa, e.g. in Sudety Mts. streams (type 3) *Diatoma mesodon, Achnanthidium minutissimum, Fragilaria capucina* var. *rumpens, Eunotia exigua, Fragilariforma virescens, Gomphonema gracile, Psammothidium helveticum* and *Tabellaria flocculosa* prevailed. In seven reference mid-altitude siliceous gravely streams (type 4) *Diatoma mesodon* was usually the dominant species. In Tatry Mts. calcareous stream (type 2), epilithon was also of reference character and composed of *Achnanthidium biasolettianum, Diatoma ehenbergii, Gomphonema olivaceum, G. olivaceoides, G. pumilum, Achnanthidium minutissimum, A. minutissimum* var. *gracillimum* and var. *scoticum*, *Hannaea arcu*s and *Fragilaria capucina* var. *austriaca*. Those species were also the most abundant in mid-altitude calcareous streams and rivers (types 12, 14 and 15) of high ecological status. In lowland streams and rivers (types 16, 19, 20, 24 and 25) diatom communities indicating high or good ecological status consisted of *Achnanthidium minutissimum* and type-specific reference taxa, e.g. Amphora pediculus, *Pseudostaurosira brevistriata, Gomphonema olivaceum, G. pumilum, Navicula cryptotenella. N. reichardtiana, N. tripunctata, Nitzschia dissipata, N. fonticola, Rhoicosphenia abbreviata, Staurosira costruens* incl. var. *binodis* and var. *venter* and *Staurosirella pinnata*. In running waters of moderate status in regardless of their abiotic types, diatomphytobenthos was composed of indicators of high trophic level that frequently developed in masses, e.g. *Melosira varians*, *Navicula gregaria, N. lanceolata* and *Nitzschia palea* and accompanied by other eutraphentic species. In waters of poor ecological status, apart from mentioned above eutraphentic taxa, indicators of organic pollution played significant quantitative role, e.g. *Eolimnia subminuscula, Navicula veneta, Nitzschia capitellata* or *Sellaphora seminulum*.

Table 2. *Ecological status of Polish running waters assessed by the diatom index IO. River types as in Table 1; in brackets – number of samples analyzed.*

Diatom type of rivers	**River type**	**Ecological status**			
		High	**Good**	**Moderate**	**Poor**
I	**2** [1]	0.78	–	–	–
	3 [20]	0.94 - 0.76	0.74 – 0.64	–	–
II	**4** [34]	0.90 – 0.72	0.68 – 0.64	0.48 – 0.31	–
III	**5** [2]	0.83	–	0.45	–
IV	**6** [6]	–	0.63	0.41 – 0.32	0.24 – 0.21
V	**8** [5]	–	0.50	0.41 – 0.36	0.19
	10 [2]	–	–	0.40; 0.36	–
VI	**7** [1]	–	–	0.28	–
	9 [5]	–	–	0.48 – 0.37	0.28
	12 [15]	0.85 – 0.71	0.67 – 0.53	0.34 – 0.31	0.25 – 0.23
	14 [11]	0.75 – 0.73	0.69 – 0.52	–	0.25 – 0.24
	15 [4]	0.82 – 0.78	0.66	0.46	–
VII	**16** [20]	–	0.61 – 0.54	0.48 – 0.31	0.29 – 0.18
	19 [41]	0.85	0.64 – 0.53	0.45 – 0.31	0.24
	20 [9]	0.68 – 0.67	0.56 – 0.51	0.42 – 0.30	–
	24 [8]	0.65	0.60 – 0.49	0.42 – 0.31	–
	25 [8]	0.75 – 0.65	0.52	0.38 – 0.32	–
VIII	**19** [23]	–	0.63 – 0.50	0.44 – 0.26	–
	20 [14]	–	0.56 – 0.50	0.42 – 0.28	–
	24 **[**5]	–	0.48 – 0.47	0.37 – 0.32	–
	25 [2]	–	–	0.38 – 0.32	–
IX	**17** [57]	0,69 – 0.60	0.59 – 0.40	0.39 – 0.22	0.18
	18 [10]	–	0.54 – 0.41	0.36 – 0.29	–
	22 [5]	–	–	0.38 – 0.27	–
	23 [15]	–	0.49 – 0.40	0.38 – 0.30	–

DISCUSSION AND CONCLUSIONS

Diatom communities of mountain streams and mid-altitude streams and rivers with determined high ecological status consisted of species indicating low trophic levels (oligo- to oligo-mesotrophy) and none or slight organic pollution (oligo- to –ß-mesosaprobity) (Rott et al. 1997, 1999). They are regarded as reference taxa and reported from other European regions as diatoms characteristic for unpolluted and oligotrophic mountain waters (Rimet et al. 2007). In waters of good ecological status, reference taxa were still abundant but diatoms preferring higher or high trophic conditions appeared, sometimes with quite significant abundances. In waters of moderate status diatom communities were composed of indicators of eu-politrophy or hypertrophy but usually not of strong organic pollution. Nevertheless, they reflected considerable deviation from reference communities. In streams and rivers of poor ecological status that deviation was much stronger – taxa preferring high trophic state and/or strong organic pollution dominated while reference diatoms were absent or represented by few taxa only never reaching considerable relative abundances. Many of these taxa have been classified by Kelly et al. (2008b) as indicators of moderate and/or poor ecological status of British rivers.

The presented method has been implemented as a new tool into the ongoing monitoring programme of Polish running waters (2007-2009). On the basis of the whole data set covering c.a. 1000 samples and matched chemical characteristics of water, following tasks on validation, correction and revision of the IO index will be done: 1. Revising indicator taxa lists (for TI and SI); 2. Revising river diatom types I-IX; 3. Revising reference taxa lists, especially type-specific ones (for I-IX river diatom types); 4. Selecting sufficient number of reference sites and defining reference communities, psrticularly for lowland types; 4. Defining real boundaries between high/good, and good/moderate status classes.

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Interesting diatoms from lotic headwaters in the central Eastern Alps

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Whereas diatoms from lentic environments (lakes in the Central and Southern Alps) are well studied especially with respect to airborne acidification and climate change (e.g. Psenner et al. 1988, Mosello et al. 2002), diatoms from springs and headwater streams above the timberline are much less well studied (Rott et al. 2005). We investigated benthic diatoms and water chemistry to detect eventual effects of long-distance pollution supplemented by a few data from a potentially indicative group of insects (chironomids). From a total of 110 streams and springs in Italy (Southern Central Alps) and 15 in Austria (Central Alps) we were able to selected 20 situations with acid pH and low conductivity (< 50 5S cm-1). The most prominent sites with the lowest conductivity values which might be sensitive to effects of airborne acidification will be mapped. In addition we studied the glacier streams of a few rock glaciers which in fact were largely variable in buffering capacity and diatom compositions (from soft to hard waters).

In spite of the small dataset the overall taxa richness of diatoms was high (overall 150 species) and included especially a high number of rare oligotraphentic species, as was to be expected for high mountain headwaters. The relative dominance within diatom mount counts showed a high percentage of *Eunotia*-species (*E. exigua, E. intermedia; E. subarcuatoides*) in 4 of 21 samples including several acidophilous and/ or acidibiontic taxa, as well as of the acidophilous Achnanthes species of the species complex *A. acidoclinata* and *A. marginulata* (Cantonati in press).

Species structure and biogeography of the marine diatom *Pseudo-nitzschia pungens*

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We investigated regional and global variation in molecular markers, sexual compatibility and morphological characteristics in populations of the marine pennate diatom *Pseudo-nitzschia pungens*. Three distinct genetic clades would be distinguished on the basis of sequence variation of rDNA ITS and rbcL, corresponding to the morphological entities var. *pungens*, var. *cingulata* and var. *aveirensis*. Inter-clade hybridization was shown in laboratory experiments and in the field for vars pungens and cingulata. A population genetic survey using 6 microsatellite markers of the most widespread clade pungens demonstrated significant geographical differentiation between the populations at a global scale with geographical isolation being significantly correlated with population genetic differentiation, while at a regional scale significant gene flow appears to occur resulting in uniform, unstructured populations.

Initial and non-initial cells in *Meridion circulare* (Greville) C.A. Agardt complex: variation in size and shape

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Meridion circulare is a common freshwater araphid diatom. According to the original description by C.A. Agardt in 1831 and the later data, *M. circulare* is characterized by flat valve face, curving abruptly into mantles that diminish in height from head to base with cuneate valves, 10-82 µm long and 4-8 µm broad.

The aim of this study is to show variations in valve shape and size within a large complex of M. circulare collected around St.-Petersburg (north-west of Russia) in May 2008.

All our samples containing *M. circulare* were collected from the typical habitats for this species: cold water springs or snow melted running waters. We found that the cells of *M. circulare* were extremely variable in valve shape and size. Whole *M. circulare* complex that were observed could be easily divided in three groups: 1. The cells straight non–cuneate, obovate shape in valve view, extremely short and wide, 8.0-8.5 µm long and 5.4-5.8 µm broad; 2. The cells straight mostly cuneate in valve view shape, 22.6-44.9 µm long and 5.3-5.8 µm broad; 3. The cells curved or at least not straight, usually lying in girdle view, with extremely long apical axis, 75.2-95.5 µm long and 4.6-7.4 µm broad.

We suppose that the cells in the last group are initial or early post-initial because of their giant size and abnormal valve outline, valves face are smoothly rounded lacking any distinct valve shoulder and apical pore fields are indistinguishable. The cells in two first groups are non-initial because of their flat straight valve face and well-developed pore fields. This material is required for further study to determine the structure of auxospore, initial cells and stages of valve formation because of the lack information about sexual reproduction process within *M. circulare*.

Diatomededelingen 33, 2009

The application of diatom indices in the Felent Creek (Porsuk-Kütahya)

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INTRODUCTION

Water is one of the most essential factors for civilization, and also among the most important items in the new world order due to its unrenewable feature. In this concern, developed countries have been continually monitoring and classifying their current sources. For this reason, a number of EU countries have developed a national water quality system, considering characteristic structure of their own rivers and have used this type of indices for revealing the current stituation of water quality level of their waters.

The water quality monitoring, based on diatom indices, is a new topic for Turkey especially after 2000s; and this topic is getting more and more important with each day. There are several studies on water quality monitoring based on diatom indices inTurkey. The first ones based on Saprobity Index. For example:, Bodrum Creek (Muğla) (Barlas et. al. 2001), Akçapınar Stream ve Kadınazmağı (Muğla) (Barlas et. al. 2002), Aksu Creek (Isparta) (Kalyoncu, 2002), Isparta Stream (Kalyoncu, 2006). Firstly, Karasu River was investigated different diatom indices (TDI, SI, GI ve DAIpo) by Gürbüz and Kıvrak (2002) and then, Upper Porsuk River (Kütahya) was investigated according to TDI, SI, EPI-D ve DES by Solak et. al. (2007b,c,d) and the results of this study was presented in different national symposiums. OMNIDIA Software Program was used firstly in Akçay (Muğla) by Solak et. al. (2007a) and .Düden Waterfall by (Solak et. al. (2007e). The aim of the study is to use diatom indices, used European and other Countries; to see how these indices will in evaluating the water quality of Felent Stream; and to help determine the best index for Turkish rivers.

MATERIAL AND METHODS

The sampling was carried out at five stations along the Felent Stream between June 2006 and May 2007 monthly. Some limited analyses (DO, temperature, pH and conductivity) were measured in the field. Slides were studied LM microscope with x1000 magnification, and species were identified according to Krammer and Lange-Bertalot (1986-1991). At least 300 valves were counted on each slides. Diatom indices were calculated by OMNIDIA. Then the correlation were investigated between water analyses and diatom indices values.

RESULTS AND DISCUSSION

In this study, 117 diatom species, belonging to 41 genera were found during the study. The composition of the assemblages changed from one sampling station to another (Table 1).

Achnanthidium minutissimum, Cymbella affinis ect. which are sensitive-organic pollution taxa were found in high densities at the unpolluted stations, while Gomphonema parvulum, Nitzschia palea and Nitzschia palea, Nitzschia capitellata, Navicula cryptocephala which are pollution tolerant taxa were dominant at the F4 and F5, polluted by sewage discharges in this study.

According to our foundings, IPS, IDG, TDI, TID, IBD, CEE, SLA ve DI-CH indices worked over 80% of our species, so these indices seems to be the best. IDAP, WAT, CEE and IPS indices were high correlated with physico-chemical parameters (Table 2). The highest correlation was IPS and EPI-D ($r = 0.993$, $p < 0.01$, $n = 11$) while the lowest correlation was IDP and LOBO ($r = -0.001$, $n = 11$). Also there was a few significant correlation between LOBO and other indices.

As a result, the pollution in the Felent Stream increased throught the course according to the indices values. Also, the water quality monitoring, based on diatom indices, is a new topic for Turkey; and this topic is getting more and more important with each day. For this reason, by doing more and more studies using the indices, we think that we can restructure the current monitoring procedure with respect to the aquatic organisms like diatom.

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Table 1. *Different diatom communities represented by the most abundant taxa found at the studied stations on the Felent Stream.*

F1	*Cymbella affinis, Achnanthidium minutissimum*, and *Nitzschia fonticola*
F2	*Nitzschia palea, Stauroneis smithii, Nitzschia acicularis, Nitzschia commutata and Amphora pediculus*
F3	*Gomphonema olivaceum, Achnanthidium exiguum* and *Nitzschia gracilis*
F4	*Nitzschia linearis, Luticola mutica*, and *Nitzschia acicularis*
F5	*Planothidium lanceolatum, Nitzschia palea, Nitzschia capitellata, Navicula angusta, Gomphonema parvulum* and *Fragilaria ulna* var. *acus*

__Table 2.__ Canonical correlation coefficients between the calculated diatom indices and some physico-chemical variables of Felent Stream. $^* p < 0.05$; $^{**} p < 0.01$; *-- not significant (n = 11).*

	EC	TDS	ÇO	Sıc	pH
IBD	-0.577*	-0.715**	0.740**	--	--
TID	-0.607*	-0.518*	--	-0.477*	--
IPS	-0.619*	-0.707**	0.713**	--	0.481*
SLA	--	--	--	--	--
IDG	-0.749**	-0.670**	--	-0.640**	--
CEE	-0.512*	-0.702**	0.888**	--	0.714**
DI-CH	--	-0.660**	0.951**	--	0.911**
TDI	-0.487*	-0.505*	--	--	--

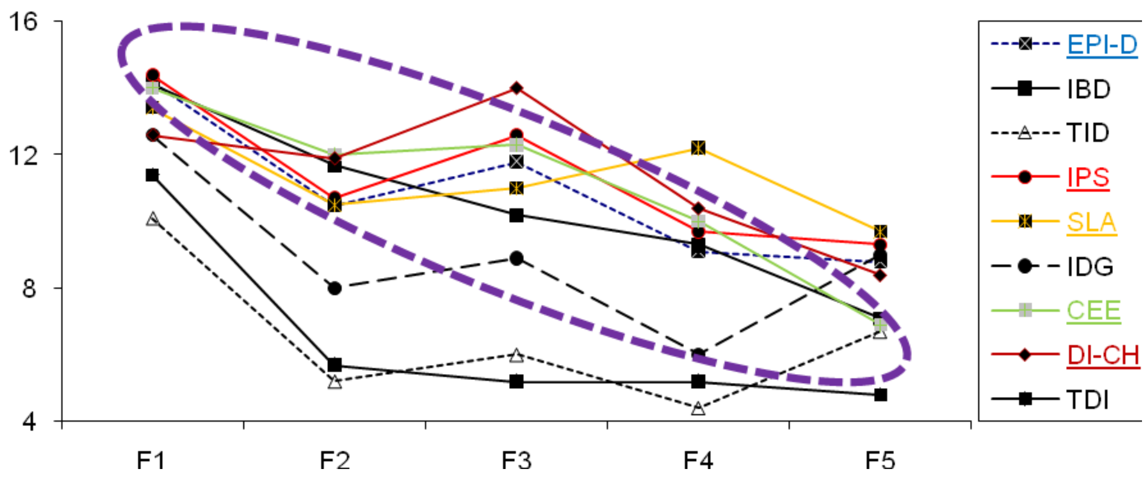

Figure 1. *Changes in different diatom indices at sampling sites along Felent Stream.*

Shifts in macrophyte composition in response to elevated CO2 in softwater lakes

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During the past decades macrophyte communities have changed in many softwater lakes. Specialist isoetids like *Isoëtes echinospora* and *Lobelia dortmanna* are replaced by faster growing elodeid species such as *Callitriche hamulata* and *Myriophyllum alterniflorum.* Since many pristine softwater lakes contain very low CO_2 concentrations of <30 µmol L^{-1}, macrophyte production is often carbon limited in these systems. Therefore the observed shift in the macrophyte communities might be related to rising aquatic CO_2 availability.

Three sediment cores from a South Norwegian softwater lake are analyzed for plant macro-, and micro-remains to reconstruct past macrophyte community dynamics. The results show locally a distinct shift from *Isoetes* spp. to *C. hamulata* dominance during the last decades, while diatom inferred aquatic TP and pH did not change. This rules eutrophication and acidification out as a cause for the invasion of *C. hamulata* . Rising CO_2 availability might, together with nutrient enrichment of the sediment be responsible for the changes in the macrophyte community. To further elucidate the role of CO_2, the growth response of two elodeid species (*M. alterniflorum* and *C. hamulata*) were experimentally determined at CO_2 levels ranging from 20 (ambient) to 230 µmol L^{-1}. *C. hamulata* was also grown on two types of sediment with different nutrient content. Irrespective of sediment type growth of both species was minimal to negative at ambient CO_2 levels and became positive with rising CO_2 availability, approaching maximal growth at CO_2 levels around 100 µmol L^{-1}. Substantial growth of both species only occurred when the plants were grown on mesotrophic sediments. When *M. alterniflorum* was planted together with the isoetids *Littorella uniflora* growth of *M. alterniflorum* was reduced drastically.

The experiments show that the two tested elodeids will not be able to grow in pristine softwater lakes, but can invade these systems when CO_2 availability rises and the nutrient status of the sediment is sufficiently high.

On extinct, freshwater taxa in the genus *Thalassiosira* with observations on Thalassiosira species from Pliocene deposit in Oregon, U.S.A.

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ABSTRACT

During investigations of a freshwater Pliocene deposit from Trout Creek, Oregon (U.S.A.) specimens belonging to thalassiosiroid diatoms were encountered and examined. The specimens belong to the non-plicated group within the genus *Thalassiosira*, possessing continuous cribra. Characters observed were: the single rimoportula replacing mantle fultoportula(e); and a triplet ring of mantle fultoportulae. In this paper we compare the Trout Creek specimens with other freshwater, extinct species of *Thalassiosira*.

INTRODUCTION

The large genus *Thalassiosira* is mainly composed of marine species (Round et al. 1990). Hasle & Lange (1989) listed twelve species of *Thalassiosira* occurring in brackish- and freshwater. The total number of both extinct and extant species of freshwater species in *Thalassiosira* is ever increasing, and, at the moment, is estimated to be around twenty. Interestingly, Serieryssol et al. (1998) noticed that it is little known about the fossil distribution of freshwater *Thalassiosira*. They gave three main reasons: 1) the specimens are too small and therefore easy overlooked; 2) compose only small part of diatom assemblages; or 3) have been ignored as their taxonomic assessment is problematic.

This paper presents morphological observations on specimens belonging to *Thalassiosira* sp. from a freshwater Pliocene deposit from Oregon, U.S.A. and are compared to other freshwater, fossil species in *Thalassiosira*.

MATERIAL AND METHODS

The Trout Creek, Oregon sample is part of the Brigger Collection in the Botany Department of the Natural History Museum, London (BM) donated by the California Academy of Sciences, San Francisco, U.S.A. (CAS). The specimens were mounted on strips of mica for scanning electron microscope SEM examination. A Philips XL30 Field Emission microscope was used (BM).

OBSERVATIONS AND DISCUSSION

The specimens observed have the following characteristics:
1) valves circular, with a diameter of 22-29 µm;
2) loculate areolae with (semi-)continuous cribra;
3) a non-plicated valve face;
4) a single rimoportula located on the valve mantle, replacing a fultoportula;
5) no valve face fultoportulae; and
6) marginal fultoportulae with four satellite pores forming three uniform rings.

Our specimens are similar to those in *Thalassiosira* sensu lato. That is, similar to other freshwater, fossil species in the genus *Thalassiosira* sp. that possess: (i) continuous cribra (such as *T. inlandica* Hayashi, *T. kilarski* Kaczmarska and *T. nevadica* Khur. & VLan.); (ii) a non-plicated valve face (such as *T. bradburyi* Khur. & Kociol., *T. cuitzeonensis* Isr., Ser. & Gasse, *T. dispar* (Perg. & Hérib.) Ser., *T. inlandica* and *T. nevadica*); (iii) rimoportula(e) on the mantle (such as *T. bradburyi, T. inlandica, T. iraidae* Khur. & Kociol., *T. kilarski, T. nevadica, T. patagonica* Maidana and *T. yunnaniana* Khur. & Kociol.); (iv) no valve face fultoportulae (such as *T. inlandica* and *T. nevadica*); and (v) mantle fultoportulae with four satellite pores (such as *T. bradburyi, T. kilarski, T. iraidae* and *T. yunnaniana*) (summarised in Table 1). However, none of the species mentioned above have a triplet ring of mantle fultoportulae, as in the Trout Creek specimens. The extinct species *T. nevadica* shares the greatest similarity to the Trout Creek specimens as it has a non-plicated valve, continuous cribra and a single rimoportula replacing a mantle fultoportula.

Table 1. *Comparison of morphological character in some fossil, freshwater species of the genus Thalassiosira. Key: [1)]this paper; [2)]Khursevich & VanLandingham (1993); [3)]Lupikina & Khursevich (1992); [4)]Hayashi et al. (2007); [5)]Kociolek & Khursevich (2001); [6)]Serieyssol, Israde and Gasse (1998); [7)]Maidana (1999). *Extant species; **additional observation are required to confirm data. Abbreviations: mf = mantle fultoportulae; sat. por. = satellite pores.*

Species	Cribra	Valve relief	No. and location of rimoportula(e)	Valve face fultoportulae	Mantle fultoportulae
Thalassiosira sp.[1)]	(semi-) continuous	non-plicated	1; mantle (replace mf)	absent	3 rings 4 sat. por.
T. nevadica Khur. & VLan.[2)]	continuous	non-plicated	1; mantle (replace mf)	absent	1 ring; 2,4** sat. por.
T. kamczaticka Lup. & Khur.[3)]	continuous **	plicated	**	**	**
T. inlandica Hayashi[4)]	continuous	non-plicated	multiple; mantle	absent	1 ring; 3 sat. por.
T. kilarski Kaczmarska[5)]	continuous	plicated	1; mantle	one-two; 4 sat. por.	1 ring; 4 sat. por.
T. yunnaniana Khur. & Kociol.[5)]	individual	plicated	1; mantle (between mf)	one; 3or4 sat. por.	1 ring; 4 sat. por.
T. bradburyi Khur. & Kociol.[5)]	individual	non-plicated	1; mantle	one; 3or4 sat. por.	1 ring; 4 sat. por.
T. iraidae Khur. & Kociol.[5)]	individual	plicated	1; mantle (between mf)	one-two; 4or5 sat. por.	1 ring; 4 sat. por.
T. dispar (Perg. & Hérib.) Ser.[6)]	individual	non-plicated	1; valve face/ mantle border	one; 2or3 sat. por.	1 ring; 3 sat. por.
T. cuitzeonensis Isr., Ser. & Gas.[6)]	individual	non-plicated	1; valve face near mantle margin	a few; 3(2) sat. por.	1 ring; 3 sat. por.
T. patagonica Maidana[7)*]	flat**	plicated	1; mantle (between mf)	one; 2 sat. por.	1 ring; 2 sat. por.

Table 1 presents a comparison of the primary morphological characters among freshwater, fossil *Thalassiosira*. Variability in the following ultrastructural characters is noted:

1) areolae possessing either continuous or individual cribra;
2) valve either plicated or non-plicated;
3) rimoportula(e) either single or multiple;
4) rimoportula(e) positioned either on the valve mantle or the valve face;
5) valve face fultoportulae either a low number or absent;
6) mantle fultoportulae either forming a single ring (the usual form) or else with multiple rings;
7) the number of satellite pores of fultoportulae may vary, even in the same species.

Thus, both extant and extinct species in genus *Thalassiosira* are morphologically variable. The molecular data so far suggests that *Thalassiosira* is paraphyletic (e.g. Kaczmarska et al. 2006; Alverson et al. 2007).

A better understanding of the relationships with the species of the genus *Thalassiosira* will occur with greater knowledge of their morphology, as well their molecular data, the latter source naturally restricted to the living species alone. Currently we (K.S. & D.W.) have been working on a manuscript providing more information on species related to *Thalassiosira* sp., aiming to solve some of the problems in this group.

ACKNOWLEDGEMENTS

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Application of epilithic diatoms in water quality assessment of the rivers Vit and Osum, Bulgaria

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INTRODUCTION

Benthic diatoms are considered to be key organisms in water quality assessment and in the monitoring of flowing waters in the investigations concerning the EU Water Framework Directive (e.g., EU Council Directive proposal 9710/98). In smaller rivers, the phytobenthic community is often the only useful community for this purpose due to a lack of phytoplankton and due to a scarcity in macrophyte vegetation. Many diatom indices have been developed to illustrate general water quality and adopted to the routine river monitoring in several European countries.

Investigations of stream benthic diatoms in Bulgaria are scarce and mainly focused on river catchments in the mountainous areas located in the southern and western parts of the country. In addition, there is an urgent need to include benthic algae in the Bulgarian national monitoring system of its rivers. In this study, two rivers located within the Danube River basin, the rivers Vit and Osum, have been sampled for epilithic diatoms from their springs to the Danube. The aim of the investigation is to examine the response of the epilithic diatom communities to environmental changes in the watersheds of both rivers. SLA, GDI and IPS diatom indices were calculated by Omnidia software in order to assess water quality of both rivers. The selected indices applied different indicator sets of taxa and the GDI index is included in routine biomonitoring system of basin directorates in Bulgaria. This work marks the first time in Bulgaria that different diatom indices were tested with the aim to evaluate their usefulness for describing the ecological status of two Bulgarian rivers.

MATERIAL AND METHODS

The studied rivers Vit and Osum originate from the Balkan Range at altitudes above 1800 m and the rivers flow for 189 km and 314 km respectively to the mouth of the river Danube. Both rivers pass rural mountain areas with different types of forest into densely populated areas in their lower stretches as they flow across the Danube Plain. This results in a heavy influx of nutrients from agricultural and populated areas. Both rivers are characterized by strong gradients in physical habitat conditions: percent forest cover in the catchment area, substratum type, as well as agriculture and urban impact. Sampling sites were selected to best represent the changes in ecological status of both rivers. A total of 28 epilithic diatom samples were collected from 15 sites of the river Vit and 13 sites of the river Osum in May 2006. Sample collection and material preparation followed classical methods (see Stancheva et al., 2007). Five hundred diatom valves were counted in each sample.

Diatom assemblages and their relation to environmental variables were examined using direct analysis. Canonical correspondence analysis (CCA) was performed without data transformation. Rare taxa, defined as < 1% relative abundance with < 3 sample occurrences, were excluded from the analysis. The multivariate statistics were conducted using the computer program Canoco 4.5 (ter Braak & Smilauer, 1998). Diatom indices were calculated using Omnidia 4. 2 software (Lenicointe et al., 1993). The following indices were applied: SLA - Index of Sladeček (Sladeček, 1986), GDI – Generic Diatom Index (Coste & Ayphassoro, 1991), IPS – Index of Pollution Sensitivity (Coste in

CEMAGREF, 1982). Each index uses more than 80% of recorded diatom species and therefore gives reliable results of water quality alternations. The correlation between the diatom indices and the conductivity of the water was calculated. Chemical parameters of the water were measured in the field by portable Hanna Instruments (Table 1). The investigations were carried out as part of Sofia University scientific project No. 46/2006.

Table 1. *Summary of selected physical habitat and water quality variables.*

Variables	River Vit			River Osum		
	Median	Minimum	Maximum	Median	Minimum	Maximum
Temperature (°C)	12.20	7.10	21.00	17.70	8.50	19.70
pH	8.22	7.70	8.90	8.40	8.00	8.80
Conductivity (mS cm^{-1})	490	64	870	460	205	897
Nitrate nitrogen (mg L^{-1})	1.95	1.00	3.10	1.40	0.90	4.20
Calcium hardness (mg L^{-1})	1.24	0.14	2.12	1.20	0.12	1.68
Elevation (m a.s.l.)	245	18	878	200	49	703

RESULTS AND DISCUSSION

A total of 114 diatom taxa (103 species and 11 varieties) from 36 genera were identified in the epilithon of the studied rivers. Total species richness at individual sites ranged from 10 (site V7) to 43 (site V15) for the river Vit and from 10 (site O2) to 47 (site O13) for the river Osum (see also Stancheva et al., 2007). Canonical correspondence analysis showed that the first two ordination axes accounted for 61.2% of variation in diatom species composition among sites (Figure 1). Collectively, six selected environmental variables explained 71.2% of the variation in diatom species distribution captured by the first two axes. The first CCA axis may represent a rural-to- urban/agricultural land-use gradient. This axis was negatively correlated with elevation (r = - 0.66) and positively correlated with conductivity (r = 0.90), water temperature (r = 0.70) and concentration of nitrate nitrogen (r = 0.60) (Table 2). The second axis correlated negatively with water hardness (r = - 0.52).

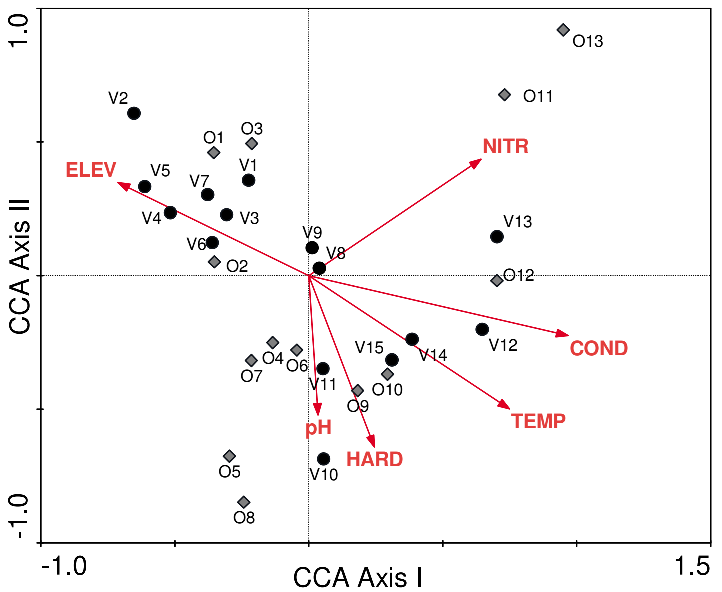

Figure 1. *Canonical correspondence analysis ordination diagram showing the relation between diatom communities at each site and environmental variables. Note: V – river Vit sites; O – river Osum sites. Environmental variables abbreviations noted in Table 2.*

The rural sites were placed on the left side of the first axis based on species composition and their relation to measured environmental variables. This group includes the seven uppermost sites of the river Vit (V1 to V7) and five sites of the river Osum (O1 to O5). Those sites were located above 245 m a.s.l. in forest areas with some marks of human impact due to the urban areas near the cities Trojan and Teteven. The bottom substratum was predominantly hard, dominated by rocks and cobbles, and conductivity was low (less than 334 for the river Vit and 350 for the river Osum). Some of the rural sites were characterized by distributions of several red freshwater algae (Rhodophyta): *Lemanea fluviatilis* (Linnaeus) C. Agardh, *Audounella hermanii* (Roth) Duby and *Hildenbrandia rivularis* (Liebmann) J. Agardh, as well as the brown algae (Phaeophyta) *Heribaudiella fluviatilis* (Areschoug) Svedelius (V2, V5 and O3). The diatom assemblages of the upper part of the studied rivers were dominated by following taxa (showed with their maximal individual relative abundance): *Achnanthidium pyrenaicum* (Hustedt) H. Kobayasi (94%), *A. minutissimum* (Kützing) Czarnecki (19.2%), *Encyonema minutum* (Hilse) D.G. Mann (19.2%), *E. silesiacum* (Bleisch) D.G. Mann (16%), *Gomphonema olivaceum* (Hornemann) Kützing (8%), *G. pumilum* (Grunov) Reichardt & Lange-Bertalot (28%), *Reimeria sinuata* (Gregory) Kociolek & Stoermer (6.2%), *Amphora pediculus* (Kützing) Grunow ex A. Schmidt (16.8%) and *Cocconeis pediculus* Ehrenberg (5.9%). The epilithic diatom based water quality classification of the program Omnidia was absolutely in line with this site characterization: according to SLA, GDI and IPS indices, water quality in all those sites were high to good (Figure 2).

Table 2. *Correlation coefficient between environmental variables and the first two CCA axes.*

	CCA axis	
Variables	I	II
Temperature (TEMP)	0.7016	-0.4099
pH (pH)	0.0330	-0.4282
Conductivity (COND)	0.9063	-0.1843
Nitrate nitrogen (NITR)	0.6023	0.3590
Calcium hardness (HARD)	0.2296	-0.5271
Elevation (ELEV)	-0.6663	0.2872

The sites from the middlemost part of the river Vit (V8 to V11) and the river Osum (O6 to O8) were placed near to the center of the first CCA axis which indicated transitional characteristics of their diatom communities and environmental variables. In accordance, water quality of those sites were classified as good to moderate by SLA index, constantly good by GDI, and high by IPS, excepting site O8 which was rated only of good water quality according to IPS. The challenging intermediate nature of the diatom communities used illustrated the differing levels of sensitivity of selected diatom indices very well.

The lowland urban sites were placed on the right side of the first CCA axis, including the last four sites of both rivers (V12 to V15 and O9 to O13). Lowland sites were located in the Danube Plain below 100 m a.s.l. in deforested areas with intense agricultural and urban impact coming from the largest cities Pleven, Lovech, Levski. In addition, water quality of that river area is impacted by the water of three reservoirs constructed in both catchment areas. The bottom substratum was dominated by small-grained sand and fine particles, and the conductivity was over 635 mS cm^{-1} for the river Osum and 710 mS cm^{-1} for the river Vit. The diatom assemblages found in the lower part of the studied rivers were presented by following taxa (showed with their maximal individual relative abundance): *Navicula cryptotenella* Lange-Bertalot (9.6%), *N. lanceolata* (C. Agardh) Ehrenberg (21%), *Eolimna subminuscula* (Manguin) Gerd Moser, Lange-Bertalot & Metzeltin (20.6%), *Mayamaea atomus* (Kützing) Lange-Bertalot (25.3%), *M. atomus* var. *permitis* (Husted) Lange-Bertalot (12%), *Nitzschia capitellata* Husted (22.7%), *N. dissipata* (Kützing) Grunow (9.3%), *N. palea* (Kützing) W.M. Smith (31.6%), *N. incospicua* Grunow (11.4%), *Surirella brebissonii* Krammer et Lange-Bertalot (8.1%), *Amphora pediculus* (24%), *Cocconeis placentula* Ehrenberg (10.4%), *C.*

placentula var. *lineata* (Ehrenberg) Van Heurck (9.3%), *C. placentula* var. *euglipta* (Ehrenberg) Cleve (7%). The diatom indices showed moderate and even poor water quality for those degraded sites. The highest values, evaluated as having good quality, only occurred when using the IPS index and only with one site from each river.

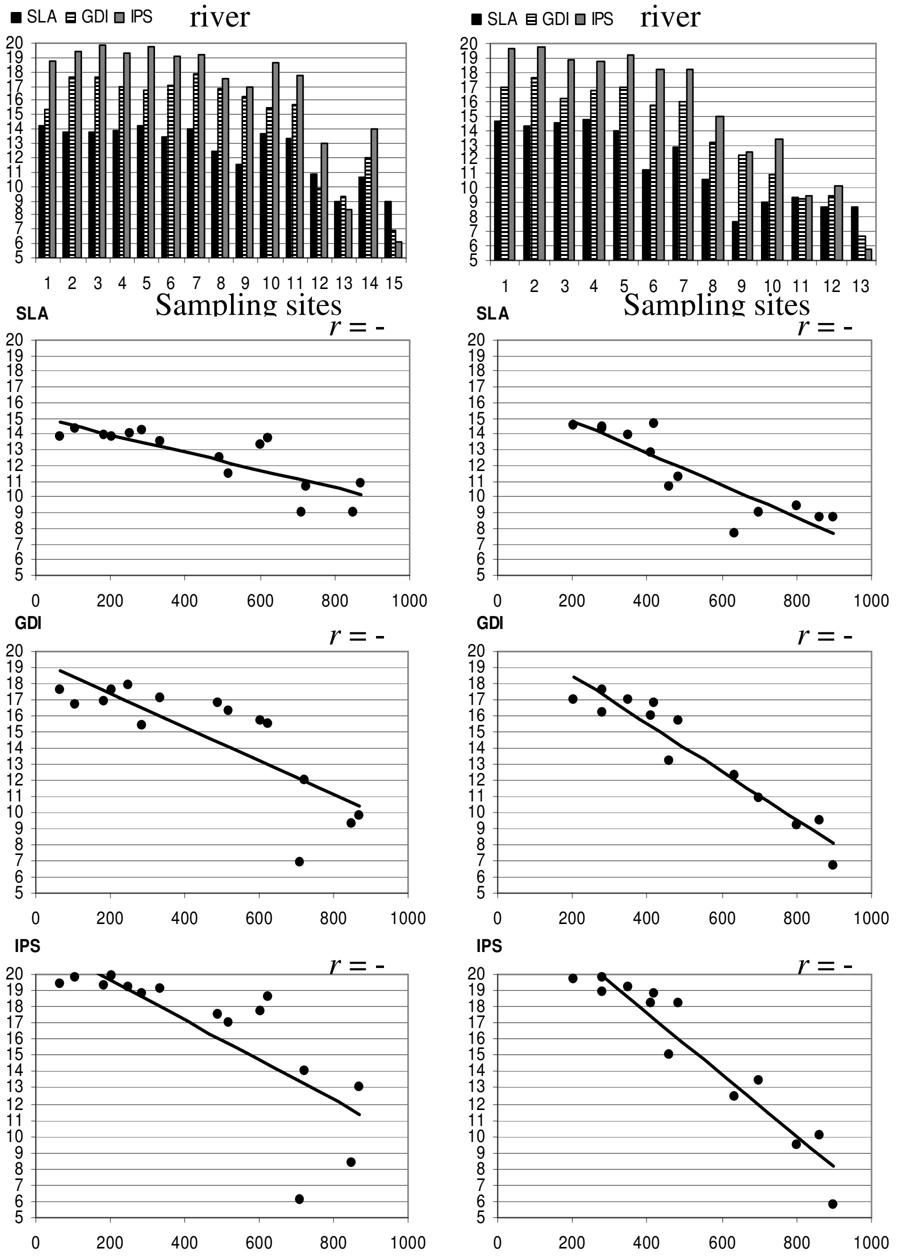

Figure 2. *Diatom indices SLA, GDI and IPS at each sampling site along the rivers Vit and Osum and correlation of the indices with the conductivity of the water. Note: Arrows indicate water quality: White (17-20 DI) - High; Light Gray (13-17 DI) – Good; Dark Gray (9-13 DI) Moderate; Black (5-9 DI) - Poor.*

Since all of these three indices function based on a theoretical correlation between the available inorganic nutrient pool (and partly organic pollution for SLA) and diatom species composition, we subjected correlation of diatom indices and water conductivity reflecting the presence of inorganic dissolved solids which can also come from agriculture or urban runoff. Conductivity of the water showed high negative correlation with the three indices for the river Vit ($r = -0.77$ to -0.89; $n = 15$; $p < 0.01$) and for the river Osum ($r = -0.89$ to -0.96; $n = 13$; $p < 0.01$), which means that a higher conductivity was coupled with lower index values thus with worse water quality (Figure 2). The diatom indices values decreased markedly downstream with increasing strength of human impact. Many studies demonstrated that conductivity is one of the key explanatory variables for lotic periphyton communities in agriculturally dominated regions which reflected changes in land use and increased surface runoff (Munn et al., 2002). Thus, the high negative correlation between water conductivity and diatom indices found in this study validated usefulness of indices in water quality assessment and showed the corresponding responses of the biota and water chemistry to the changing water state of both Bulgarian rivers under human influence.

CONCLUSIONS

This study demonstrates that epilithic diatom based indices for water quality classification of the rivers can be used successfully to assess quality of running waters in Bulgaria. SLA, GDI and IPS indices evaluated water quality of the rivers Vit and Osum as decreasing gradually from high and good in rural upper reaches to moderate and poor in their human impacted reaches in Danube Plain. The high negative correlation between water conductivity and diatom indices found in this study validated usefulness of applied indices in water quality assessment of both Bulgarian rivers.

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Morphological study of a rare diatom species occurring in Lake Balaton (Hungary)

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A new *Cymbopleura* species was studied and described based on morphology and fine structure. Cells occur solitary. Smaller valve with elliptical-lanceolate outline. Poles apiculate. Length 22-36 µm, breadth 7-9 µm (n=32). Maximum length/breadth ratio 4.2. Axial area narrow, in the median line of the valve. Central area small, only fewer than 1/5 the valve breadth and round sometimes a bit asymmetrical. Raphe not linear, slightly bended to the dorsal side. Proximal raphe ends expanded in small central pores and sometimes ventrally tipped. The terminal raphe ending in a hook and dorsally deflected. The interior raphe end is tipped. Striae slightly curved around the central area and radiate throughout. Striae uniseriate containing puncta only in the SEM visible. Stria 13-17/10 µm, puncta 40/10 µm. It was found in the littoral region of Lake Balaton (Hungary). It is not an abundant but characteristic diatom species of the lake, which was not restricted only to recent samples but occur also in fossile materials.

Following the proposals of the Water Framework Directive there is an urgent need to investigate the phytopbenthos of Lake Balaton with special emphasis on diatoms to assess its ecological status. Due to these studies and the exceptional high diversity of the lake, appearance of more and more species which are new to the Hungarian diatom flora or the science are expectable.

Benthic diatom communities in the biological assessment of water quality in the middle section of the Pilica River (Central Poland)

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Samples were taken from 2005-2007, from seven sampling sites on the Pilica River. The main aim of this researche was to point out the dominant and subdominant diatom species and to effectuate on this base the biological estimation of the water quality in the Pilica River. For biological estimation an OMNIDIA 4.1 computer program was used. This program contains taxonomic and ecologic data base with 13 620 diatoms taxa. The water quality was estimated on the base of values of diatom indices: SPI - Specific Pollution sensitivity Index (CEMAGREF 1982) and GDI - Generic Diatom Index (Coste, Ayphassorho 1991), while the trophic status was estimated by using the TDI - Trophic Diatom Index (Kelly, Whitton 1995).

Values of indices determining saprobic water pollution (SPI, GDI) indicated water quality class I and IV for the Pilica River. The trophic status determined on the basis of the TDI index included the Pilica River to the oligo-mesotrophic-to-eutrophic zone.

A total of 379 taxa were identified in the samples. In the Pilica River, diatoms of the sensitive and tolerant to organic pollution groups dominated, such as: *Achnanthidium minutissimum* (Kützing) Czarnecki, *Aulacoseira granulata* (Ehrenberg) Simonsen, *Cocconeis neodiminuta* Krammer, *Cocconeis placentula* Ehrenberg, *Cocconeis placuntula* var. *lineata* (Ehrenberg) Grunow, *Cyclotella radiosa* (Grunow) Lemmermann, *Fragilaria crotonensis* Kitton, *Geissleria decussis* (Øestrup) Lange-Bertalot et Metzeltin, *Melosira varians* Agardh, *Navicula reichardtiana* Lange-Bertalot, *Planothidium frequentissimum* (Lange-Bertalot) Lange-Bertalot, *Pseudostaurosira brevistriata* (Grunow) Williams & Round, *Rhoicosphenia abbreviata* (Agardh) Lange-Bertalot, *Staurosira pinnata* Ehrenberg.

A morphological study of the giant *Licmophora* species from the Greek Mediterranean coast

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The morphology of three giant species of the marine araphid genus *Licmophora*, *L. flabellata* (Carmichael) Agardt, *L. remulus* Grunow and *L.* cf. *grandis* (Kützing) Grunow, was studied using scanning electron microscopy. Material for this study was collected in August 2007 from a littoral rock pool at the south part of Mediterranean coast, Greek Island Samos.

L. cf. *grandis* in our material had a long branched mucilage stalks with one or two cells at apex. The cells of *L. flabellate* and *L. remulus* were found among the numerous mucilage stalks created by L. cf. grandis. All three species had huge valves length ranged between 180 and 310 µm. The valve shape and fine structure, notable that of the quantity, position and orientation of rimoportulae, areolae, multisciccura and girdle construction, for each of the three species and the morphological differences between these species are discussed. These three Licmophora species probably belong to two different sub-groups within this genus because of their differences in fine valve structure: *L.* cf. *grandis* + *L. remulus* and *L. flabellata*.

Photosynthetic activity of epilithic diatoms on natural and modified stream sections of the Torna stream (Hungary)

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In this study, primary production of epilithic communities dominated by diatoms collected from natural and modified stream sections of the Torna stream (Hungary) was estimated with photosynthetic measurements.

In the experiments, semi-natural limestone substrates were exposed in two natural and two modified sections of the stream for 3 weeks. The photosynthesis of the benthic algae sampled in April, August and October 2008 was studied at nine different irradiance levels in the range of 0-1400 µmol $m^{-2}s^{-1}$ and the photosynthetic parameters (P_{max}, I_k) were defined according to the models by Webb et al. (1974) and Platt et al. (1980).

The maximum photosynthetic rate highly correlated with the chlorophyll-a content, which primarily depends on the irradiance reaching the stream bed. The maximum photosynthetic rate (P_{max}) was always higher in samples from the modified sections without riparian vegetation (7-51 mg C m^{-2} h^{-1}) than those from the natural section with close riparian vegetation (<10 mg C m^{-2} h^{-1}). The highest P_{max} was measured in the samples collected in April (45-51 mg C m^{-2} h^{-1}), the lowest in October (<7 mg C m^{-2} h^{-1}). No photoinhibition was observed in the samples collected from modified sections in August, at the other sites photoinhibition was noticed.

The dominant diatom species in the samples from the natural sections were *Navicula tripunctata, Amphora veneta* and *Achnanthidium* sp., in the samples from the modified sections were *Navicula lanceolata, Gomphonema olivaceum, Fragilaria capucina* var. *vaucheriae*, *Cocconeis placentula* and *Achnanthidium minutissimum.*

In conclusion, the differences in the primary production of the natural and modified stream sections reflect well the differences in light availability.

The role of diatoms in the implementation of the European Water Framework Directive

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The most important aim of the Directive 2000/60/EC is to establish a framework for the protection of surface waters and groundwater which prevents further deterioration and protects and enhances the status of aquatic ecosystems. The member states have to implement all necessary measures to achieve ‘good ecological status’ at the latest in 2015.

Although the diatoms are not mentioned in the official text of the directive (WFD) they are used in many countries to monitor the autonomous and human induced changes of water quality. Diatoms are used as a proxy for ‘phytobenthos’, one of constituents of the biological quality elements ‘Macrophytes and phytobenthos’, which should be monitored in both lakes and rivers (running waters).

We have passed now half of the 15-years period and will look back about the use of diatoms as a metric for ecological water quality in several EU-countries and the efforts that have been made to harmonize and intercalibrate the metrics. Which metrics are used in which countries, and how are borders made between vague normative definitions as ‘ no, or only very minor, evidence for distortion’ and ‘low levels of distortion’? How was the intercalibration performed and which lessons did we learn from it? Which kind of work has still to be done in future to optimize the role of diatoms as an instrument in the implementation of the WFD? Which contributions can be made by modern biological technologies?

The non-marine diatom flora from Swedish rivers

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In 1955, Cleve-Euler published her famous work 'Die Diatomeen von Schweden und Finnland', until now one of the standard identification works for non-marine diatoms in the Nordic countries. Almost 50 years later, an informal, ambitious project was started in order to refresh the taxonomic knowledge of the Nordic freshwater diatoms inhabiting the numerous streams in Sweden, based on diatom counts gathered in the past 10 years. This project should result in the publication of a volume of Iconographia Diatomologica.

The geographical position and orientation of Sweden, extending from above the polar circle to the maritime borders with Denmark and Germany, results in a large variability of river types, both physically and chemically, ranging from small acid brooks to large circumneutral meso- to eutrophic rivers. The diatom flora in the rivers in Sweden is highly diverse. Important genera include Eunotia (>50 species), Navicula, Pinnularia, and Gomphonema. During the taxonomic analyses, a large number of new species have been observed (Van de Vijver & Lange-Bertalot 2008,Van de Vijver & Lange-Bertalot 2009, in press).

The present communication briefly introduces the Swedish rivers and the diatom flora, and illustrates some of the new species. The outline of the new Iconographia Diatomologica volume is presented. The objectives of this new volume are on one hand taxonomic accuracy and on the other hand user-friendliness. An example of the genus Frustulia will be discussed. Every species will be accompanied by ecological information.

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Diatoms and microscopy: a contrasting combination?

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INTRODUCTION

The fine glassy details of diatoms are admired already for hundreds of years, ever since the invention of the microscope. During Victorean times, manipulation of the single valves was considered an art and a pastime, and slides with different species of diatoms were used to thoroughly evaluate the latest microscope objectives for performance.

RESULTS AND DISCUSSION

Resolution and contrast in brightfield microscopy

According to Abbe's diffraction theory, the resolution of a lens is determined by the the lens opening (aperture), and the wavelength of the light used. In practicality this means that for a traditional light microscope the limit of resolution is reached at ca. 0.2 µm. In order to be able to reach that level of resolution, the following assumptions are taken for granted: a black and white start situation and no contrast loss within the optical system.

Figure 1. *Resulting image from a line pattern, as seen through a microscope objective. Image contrast decreases to zero when line spacing reaches the theoretical limit of resolution.*

A diatom valve is glassy and colorless, and forms therefore the classical example of the contrast issues faced by a microscopist. The refraction index of the silicified valve of the diatom is pretty much similar to water and glass, and because of that it is barely visible in the tradional microscopical mountants (figure 2). Therefore, special diatom mountants have been developed which differ in refraction index as much as possible with the specimen. Nevertheless, Abbe's diffraction limit still holds as an elusive ideal that only can be approached.

The contrast of a specimen in brightfield microscopy is also regulated by the condenser. Ideally, the condenser iris is open to the point that the condenser forms a cone of light similar to that of the objective. Under these conditions, resolution is maximalised (figure 3). Unfortunately, the gain in resolution with a fully open iris is not perceived visually, due to the very low contrast levels. Therefore, the general advice has always been to slightly close the condenser iris to around ¾ of the aperture of the objective, which increases contrast considerably without (visual) reduction of image quality.

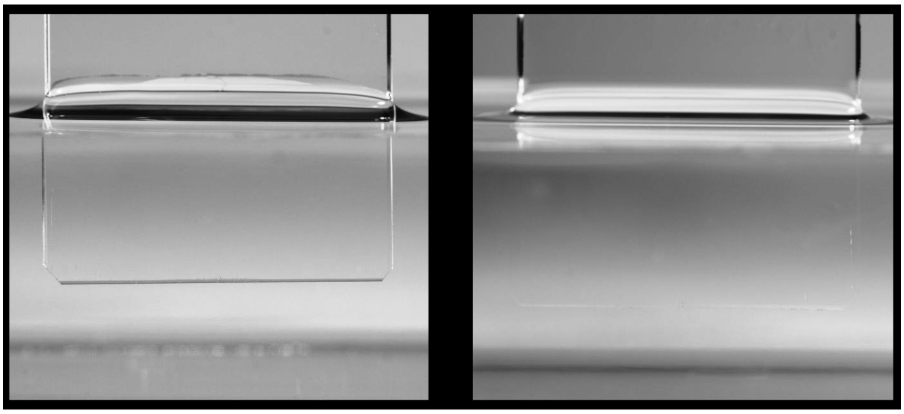

Figure 2. *Contrast of a colourless and transparent structure depends on the difference in refractive index with its surrounding medium. Left: water, right: immersion oil with the same refractive index as the microscope slide.*

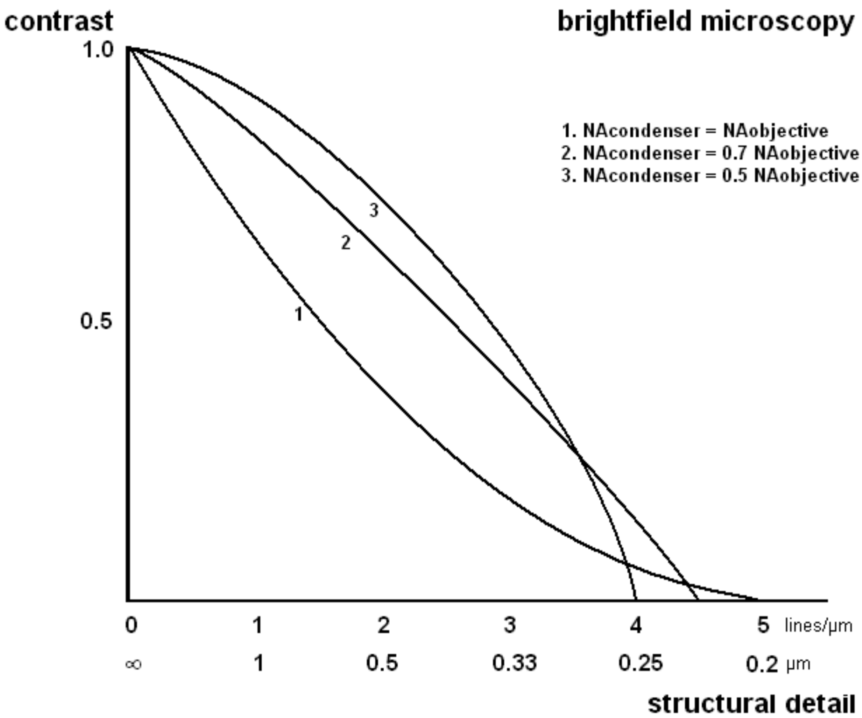

Figure 3. *The effect of the condenser aperture on resolution and contrast. Calculated for an objective with an NA of 1.3. Adapted from Pluta.*

Optical contrast enhancement mechanisms

When light waves penetrate an optically more dense material like glass, it will get a shift in time compared to a light wave that travels through the surrounding medium. This so-called phase shift has no influence on the wavelength (color) or the amplitude (intenstity), therefore it cannot be detected by eye. However, optical tricks have been deviced to change this invisible shift in phase into a visible change in contrast.

Phase contrast

Phase contrast is a relatively modern and cheap way of increasing contrast. It is very sensitive and shows the lightest of silicified diatom valves in high contrast. It has however the disadvantage that large jumps in refraction index are overly intensified. The resulting halo conceals specimen details in that regio.

Phase contrast makes use of an annular opening in the condenser and a corresponding phase ring in the objective. Due to overall image quality considerations, the size of the phase annulus in the condenser is limited to only half that of the aperture of the objective. As the annulus size is directly related to resolution, the reduced condenser aperture limits usability to the point that the structure of a diatom like *Frustulia saxonica* cannot be resolved with a typical 100x lens in phase contrast, even though the structure can still be detected in ordinary brightfield microscopy.

Phase contrast sets that make use of a larger sized condenser annulus have been in production in the past (e.g. Leitz Heine Pv, Zeiss Jena Phv, Reichert 'Anoptral'). These sets perform especially well for diatom analysis. However, as far as we are aware, these systems are not in production anymore.

The phase ring in the objectives covers a small part of the objective lens. This results in a slight reduction in performance in brightfield, compared to normal brightfield lenses. Even though this reduction in image quality is visually hardly noticable, a digital camera will pick up this difference quite easily. Phase contrast objectives can therefore not be regarded suitable for high performance brightfield imaging.

Differential Interference Contrast

Differential Interference Contrast according to Nomarski (DIC) is generally regarded 'better' then phase contrast. It gives stunning 3D-like images without the halo that surrounds subjects in phase contrast. It is also able to give higher resolution then most phase contrast sets, even though overall contrast generally is lower. A major advantage of DIC is that interference contrast is only generated within the sharp layer in focus, without disturbing influence of unsharp layers above and below the focal plane. This quality is known as optical sectioning.

DIC systems make use of polarised light which gives a directional 'shadowing' effect to the subject. This means that diatoms have to be positioned at a certain angle to the direction of polarisation in order to give highest contrast. Therefore, a DIC microscope should ideally be fitted with a centrable rotating stage.

Oblique and annular illumination

Oblique and annular illumination is the oldest way of gaining more contrast in transparent specimen. The light entrance of the condenser is partly blocked, so that light is directed through the specimen with a wide angle. That way, the light travels a longer distance through the specimen, which increases contrast. The angle can become as large as the maximum aperture of the objective allows, which maximises resolution.

With simple, unidirectional oblique illumination, a shadowing effect occurs. This effect, as with DIC, necessitates a way of positioning the specimen at a certain angle to the illumination for best results.

Annular illumination is also called 'circular oblique lighting'. The condenser forms a hollow cone of light, which is focussed on the specimen. Illumination is coming from all sides and does not give the shadowing effect as in unidirectional oblique illumination. Even though images have a soft tone visually, contrast is greatly increased near the theoretical limit of resolution.

Annular lighting can be quite easily accomplished by blocking the central part of the light beam in the condenser (by a so-called central stop), or by an oil immersion cardioid condenser. This condenser gives a hollow cone of light with such a wide angle that it touches the edges of the aperture of the highest NA-objectives available. With lower power objectives, this condenser gives a true darkfield effect, in which even the lightest of silicified valves are easily spotted.

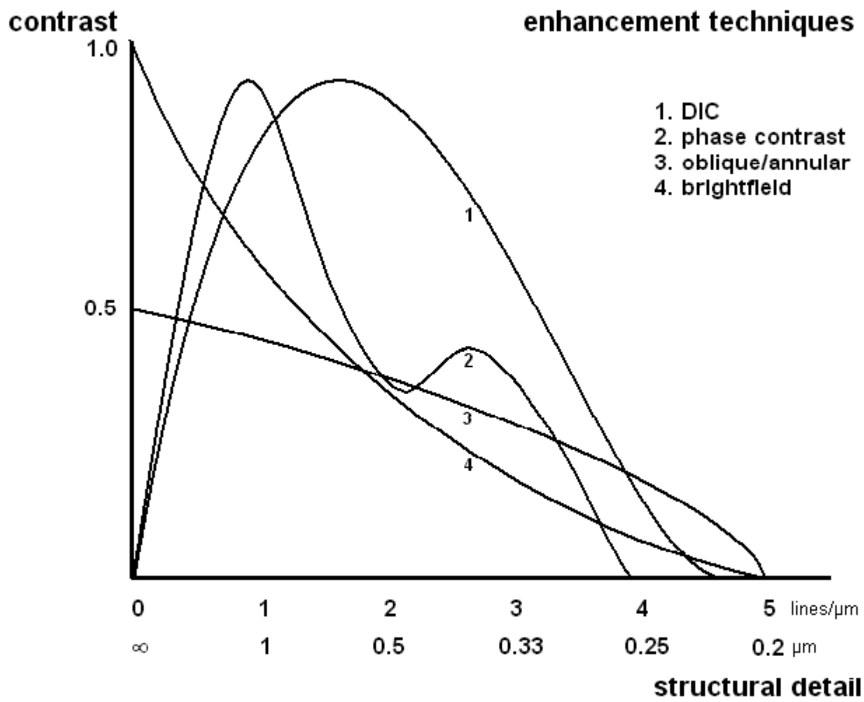

Figure 4. *The generated amount of contrast plotted against size of the structure for each of the different modes of illumination. Calculated for an objective with NA of 1.3. Adapted from Molecular Expressions.*

CONCLUSION

With all illumination methods in traditional light microscopy, contrast decreases to zero when the diffraction limit of around 0.2 µm is reached. However, when approaching this limit there are obvious contrast differences between the different contrast enhancement-modes of illumination. There is however not one 'best' method, the right choice is determined by the level of silicification and the resolution range needed in order to show details for identification.

A good quality brightfield condenser should ideally be the start of any identification. If the ultimate in resolution is needed, an oil immersion darkfield (cardioid) condenser is an inexpensive way to gain the ultimate in contrast from the finest of diatom details. In tandem with a brightfield condenser, it outperforms most phase and interference contrast sets at a fraction of the costs.

ACKNOWLEDGEMENTS

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Transcriptome and exometabolome analysis of sexual reproduction in diatoms

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The regulation of the diatom life cycle remains the greatest mystery left in understanding the biology, function, and diversification of diatoms. We present ongoing work on cell division and life cycle progression with the benthic marine species *Seminavis robusta*, which we believe is a suitable model to study life cycle regulation of pennate diatoms. In contrast to the sequenced diatom species, *Seminavis robusta* has a well described life cycle in which sexual reproduction can be induced experimentally. As meiosis only occurs in cells below the sexual cell size threshold, differences in gene expression in large and small cells are expected, induced by a cell size sensor once the critical threshold has been reached. This gene expression possibly results in the secretion of products to sense the presence of compatible mating partners, as small cells show directed movement towards small cells of opposite mating type.

We demonstrate the existence of differentially expressed genes and differentially excreted metabolites with a cDNA-AFLP transcriptome analysis and a UPLC-MS exometabolome analysis respectively and discuss ongoing research aiming to elucidate the functional role of these genes in cell-size control and the induction of sexual reproduction.

Diatom assemblages in calcareous springs in Poland and Turkey

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Springs are unique freshwater environments combining hypogean (subterranean) and epigean (surface water) as well as aquatic and terrestrial features. Thermal stability, minimized fluctuations of chemical properties and continuous water exchange in outflows are their most essential characteristics. Diatom flora in springs is rather poor, simply, and clearly reflect water and terrestrial surroundings features of (e.g. pH, salinity, water current/turbidity, pollution of the underground waters, insolation). In contrast to springs on siliceous substratum, springs located on limestone are regarded as inhabited mainly by cosmopolitan diatoms. Because the distribution and autecology of several diatoms is still poorly known, diatom assemblages from 18 springs subjected to different strength anthropogenic impacts (Tatra Mts, Krakowsko-Częstochowska Upland and Turkman Mts) are here compared.

The most abundant diatoms in springs in the Tatra Mts (water temperature: 5.5-7.0 ^{o}C; pH: 6.4-7.3; conductivity: 230-316 µS cm^{-1}) and springs of Krakowsko-Częstochowska Upland (water temperature: 8.8-9.6 ^{o}C; pH: 7.2-7.7; conductivity: 411-512 µS) were *Achnanthidium minutissimum, Cocconeis placentula, Denticula tenuis, Planothidium lanceolatum*, and *P. reichardtii*. Springs in Turkman Mts (water temperature: 12.0-26.7 ^{o}C; pH: 6.1-7.6; conductivity: 114-1572 µS cm^{-1}) were inhabited by e.g. *Achnanthidium minutissimum, Diatoma mesodon,* and *Planothidium frequentissiumum* but the most important group of diatoms consisted of small *Nitzschia* spp.

In all three areas, widespread diatoms like *Amphora pediculus, Gomphonema micropus, Meridion circulare*, and *Navicula cryptotenella* were identified. Amongst them such common, poorly known diatoms as *Stauroneis* tackei and *Sellaphora bacilloides*, were also found in eutrophicated waters. Every spring, however, possessed its own unique diatom flora in terms of assemblage structure, reflecting a probably unique set of environmental factors in every case. The distribution of some diatoms, e.g. *Nitzschia desetortum* in Turkish springs, confirmed their biogeographical affinities.

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Assessing environmental changes and reference conditions for springs in South Poland using diatoms

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Springs are threatened environments because of significant human pressures such as agriculture and urbanization. One of the most severe problems in the area is eutrophication of these systems caused by high levels of nitrates derived from agricultural run-off and wastes. The evaluation of anthropogenic impacts on these springs and an effective conservation management strategy require calibration studies and knowledge of the natural state of these freshwater environments.

In the search of baseline diatom flora in springs a paleolimnological study was applied as one of the best recognized and applied methods used to track long-term environmental changes worldwide. Little is known, however, about nature of such changes in aquatic environments fed by springs. Samples from the bottom sediments of spring-fed pond, in the Pilica Piaski were retrieved in the search for diatom assemblages, which may represent baseline conditions for springs of the Krakowsko-Częstochowska Upland.

The study focused on shifts in diatom assemblages preserved in sediments collected from a small pond, situated close to several spring outlets. They were interpreted as a record of environmental changes that had taken place during the last century. For most of the history of the pond – as recorded in this 84cm long core – the diatom assemblage was dominated by small *Fragilaria* spp., mainly *F. construens* var. *venter* Ehrenberg complex. The major shifts in species composition began in a core depth of 65 cm with a decline in the *F. construens* var. *venter* and *F. pinnata* complexes, and a concurrent increase in *Achnanthidium minutissimum* (Kützing) Czarnecki. The second change was recorded at the depth of 45 cm with a sharp decline of *A. minutissimum*, which again was replaced by the small *Fragilaria* spp. In recent years, further changes in the diatom assemblage occurred, with a notable increase in *Cyclotella delicatula* Hustedt. The assemblage shifts recorded at this site appear to be consistent with environmental changes triggered by land use (e.g. agriculture intensity) and/or possible changes in spring water discharge.

The work was partly supported by the Polish Ministry of Science and Higher Education for 2008-2011 (grant N304 092834).

Diatoms of the Vistula River mouth – taxonomy and ecological interpretation

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INTRODUCTION

Poland, as a member of the European Union, is required to implement all aspects of the Water Framework Directive. Although algal-based methods for monitoring rivers are relatively well developed, there has been little work on ecological status assessments of estuaries. This study examines diatom assemblages in an estuary of the Vistula River, the largest freshwater source in the Polish part of the Baltic Sea and an important supplier of sewage and nutrients.

We present data on both planktonic and benthic diatom assemblages in relation to environmental variables and go on to compare their response to ongoing changes in their habitat. This will then lead into an evaluation of the effects of the river water inflow on the costal zone.

MATERIAL AND METHODS

Samples of the phytoplankton and microphytobenthos were taken once a season between 2005 and 2007 from sites situated in three separate arms of the Vistula river mouth, northern Poland. Simultaneously, main water quality parameters were measured in situ and samples for chemical water analysis were taken.

The laboratory treatment of diatom samples and subsequent analysis were carried out according to Battarbee (1986). The main patterns in the diatom and environmental data were investigated using Canoco version 4.5. (ter Braak & Šmilauer, 2002). Additionally water properties were evaluated in terms of ecological spectra (life form, salinity, trophy and saprobity) and diatom indices (IPS, IDAP).

RESULTS AND DISCUSSION

A total number of 303 diatom species was identified (221 in planktonic samples and 184 in benthic). 109 taxa were common to samples of phytoplankton and phytobenthos. 115 were observed exclusively in samples of phytoplankton and 79 in benthos.

Planktonic diatom assemblages were more diverse than benthic and their structure altered significantly from season to season. During the whole studied period, autumn blooms of *Chaetoceros brevis* Schütt and spring blooms of *Skeletonema marinoi* Sarno et Zingone were recorded. Generally, the seasonal increase in number of some taxa was negatively correlated with biodiversity indices. Benthic diatom assemblages were more homogenous than planktonic ones and their structure did not vary significantly in respect of season or substrate, although some generalizations could be made (e.g. low taxonomic diversity in samples taken from macrophytes compared with sediment).

An interesting aspect of studies was the observation of teratological forms in more than 50 % of microphytobenthos samples. In this group diatoms from nine taxa were identified (mostly *Fragilaria* Lyngbye sensu lato). Frustules with malformations were most numerous in epilithic and epiphytic assemblages and made up to 1 % of total abundance.

The most significant variable for the existence and growth of studied diatom assemblages was water salinity. Concentration of phosphates (PO_4^{3-}) and silicates (SiO_4^{4-}) were next in importance (Fig. 1).

On the basis of life form analysis it was showed that studied assemblages were characterized by high number of taxa untypical for a given ecological formation (eg. benthic species in planctonic assemblages). Nonetheless the ‘allochtonous’ forms did not affect the overall picture of the ecological status of studied waters. Furthermore, dissimilarities in composition and structure between planktonic and benthic diatom assemblages did not affected results of analysis in trophy and saprobity spectra. The diatom flora was dominated by eutraphentic (with noticeable increases of hypereutraphentic forms in spring) and β-mesosaprobic and α-mesosaprobic taxa.

The results of diatom indices, calculated for benthic assemblages, showed that waters in the Vistula river mouth were moderately to heavily polluted. Index values calculated on benthic samples were, however, influenced strongly by the type of substrate and the relative abundance of planktonic forms in these samples.

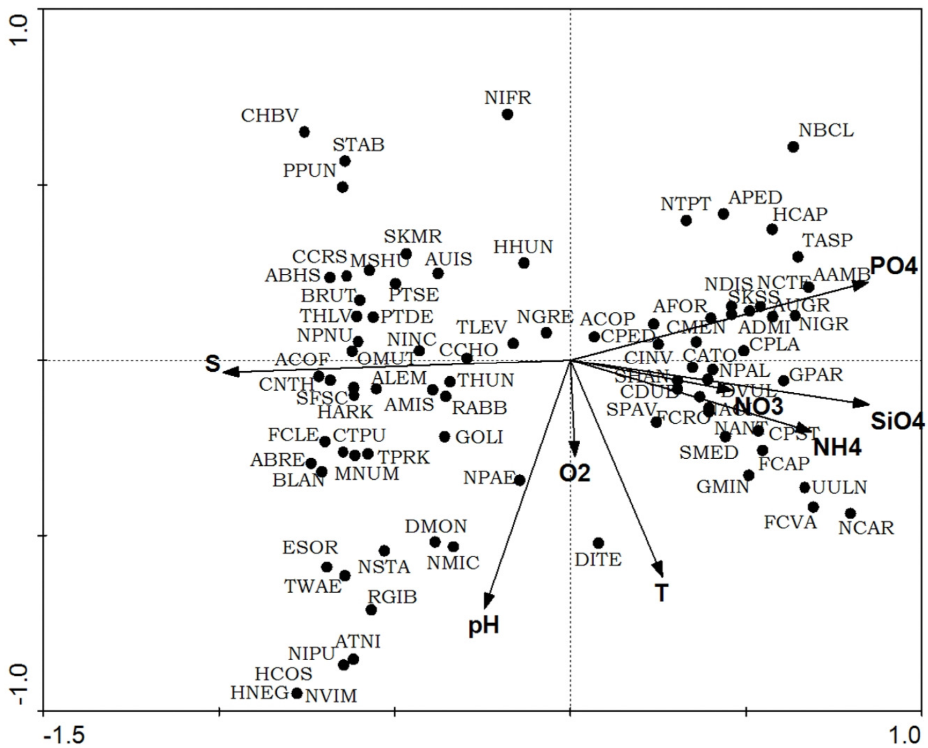

Figure. 1. *The results of CCA analysis – diatom assemblages and environmental variables.*

CONCLUSIONS

The most significant variables forming diatom assemblages in the Vistula river mouth were water salinity, followed by the concentration of phosphates and silicates.

The ddissimilarities in composition and structure between planktonic and benthic diatom assemblages did not affected results of analysis in ecological spectra. The diatom assemblages characterized waters in the Vistula river mouth as fresh-brackish to brackish, rich in nutrients and moderately polluted with organic matter.

Benthic diatom assemblages showed considerable indicative potential. The lack of autecological data for planktonic species (especially of brakish water affinity) means that data must be interpreted with great care. More particularly at the exclusion of planktonic forms influenced significantly values of calculated indices.

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Diatom communites as ecological indicators of some referece sites in Friuli Venezia Giulia

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SUMMARY

The Water Framework Directive has required evaluating the stream quality of river using bioindicators and any deviations from reference conditions; the aim of this work is to investigate the diatoms communities of some reference sites in Friuli Venezia Giulia.

First two operators have collected diatom samples in 9 very natural sites in two different hydro-ecoregions (HER) (Calcareous southern alps and dolomites (European Code 11) and the Po Plain (European Code 132)). According to the diatom index EPI-D (Dell'Uomo, 2004) all the stations were of very good quality. The results also showed two different community types corresponding to specific environmental conditions of the existing HER.

Totally we have identified 96 taxa (species, varieties or subspecies) and the most abundant taxa were *Achnanthidium minutissimum* (Kütz.) Czarn. (29.5%), *Achnanthidium biasolettianum* (Grunow in Cleve & Grunow) Lange-Bertalot (26.1%) and *Gomphonema pumilum* (Grunow) Reichardt in Lange-Bertalot (12.7 %).

According to WFD this work gives an idea of the diatom assemblage representative of a good ecological status of some possible reference sites of Friuli Venezia Giulia.

INTRODUCTION

The Water Framework Directive – WFD – (European Parliament & Council of the European Union 2000)[1] advised European countries to asses running water quality evaluating the composition and abundance of many bioindicators as diatoms as part of phytobenthos, fishes, macro-invertebrates and macrophytes (Annex V). It also have the general objective to protect, improve and restore the quality of all internal water body, of the transitional underground and costal water and it also call for applying of the "Ecological Quality Ratio" that has to be good for all European water body for 2015.

Diatom indices are used routinely in different European countries (Prygiel et al., 1999); in Italy the official method is not still present but the WFD has given new inputs to study diatom communities and the applicability of biotic indices as EPI-D (Eutrophication/Pollution Index-Diatom based, Dell'Uomo, 2004), but we have very few experimental studies in Friuli Venezia Giulia.

[1]Directive 2000/60/EC of the European Parliament and of the Council of the 23 October 2000 establishing a framework for Community action in the field of water policy. Official Journal L 327, 22 Dec. 2000.

To evaluate stream quality we have to assess the differences between the observed community to a non-disturbed reference community belonging to the same ecoregion and so reference conditions from each stream type have to been defined. Benthic diatoms in several regional mountainous areas have been already studied in the Italian Alps but there are few ecological and biogeographical studies based on composition of the diatom communities in the different European ecoregion (Tison et al., 2005; Tison et al., 2007; Rimet et al., 2007). The first aim of this work was a first characterization of diatom assemblage of some reference sites in Friuli Venezia Giulia.

MATERIAL AND METHODS

River sampling has been made in accordance to European recommendations (Kelly et al., 1998). The benthic diatoms were collected scratching with toothbrush at least five stones and then were fixed in 4% formaldehyde. From July to October 2008, 18 diatom samples (2 samples for each station) (Fig. 1) were collected by two different operator to compare the results and intercalibrate the EPI-D index. A detailed list of sampling sites is given in Table1.

For light microscope the diatom valves were cleaned out using 40% hydrogen peroxide to eliminate organic matter and hydrochloric acid to dissolve calcium carbonate. The material was mounted on permanent slides with Naphrax and at least 400 valves were counted and identified using an optical microscope with 1000x magnification according to Krammer and Lange-Bertalot (1986-1991, 2000). For most of the field measurement multiparametric probes were used to determine water temperature, dissolved oxygen, conductivity and pH.

For each sampling sites altitude, distance from the source, coordinates and hydro-ecoregion (according to CEMAGREF, 2007)[2] were determined using topographical maps.

Finally the matrix of diatom data was analyzed by cluster analyses (Euclidean distance and Ward method) with the statistical software R 2.8.1 version (2008).

RESULTS AND DISCUSSION

We have used the matrix of 96 taxa identified in the 9 sample sites by the two different operators to apply a hierarchical analyses that have defined two main clusters group (1 and 2).

Cluster 1 was composed by station 7, 8 and 9 all sites located in the Po Plain hydro-ecoregion and occurred over a range of altitudes from 20 to 36 m.

Station 8 and 9 were included in protected area (SIC) and are characterized by very natural habitat as M*olinia* meadows on calcareous, peaty or clayey-siltladen soils (*Molinion caeruleae*), *Salix alba* and *Populus alba* galleries and priority habitat as calcareous fens with *Cladium mariscus* and species of the *Caricion davalliana.*

This group was characterized by high conductivity (median value 334 μS/cm) and not so high saturation of oxygen (median value 98%). The dominant species in all the stations were *Achnanthidium minutissimum* (54.7%), *Achnanthidium biasolettianum* (8.7%), *Cocconeis placentula* Ehrenberg var. *euglypta* (Ehrenberg) Grunow (4.2%) and *Gomphonema pumilum* (3.1 %). There were also subdominant species that characterized this ecoregion from the other one and were in order of dominance *Nitzchia fonticola* Grunow, *Denticula tenuis* Kützing, *Navicula tripunctata* (O.F. Müller) Bory, *Fragilaria ulna* (Nizsch.) Lange-Bertalot, *Epithemia adnata* (Kützing) Brébisson, *Diploneis oblongella* (Naegeli) Cleve-Euler, *Amphora inariensis* Krammer and *Navicula cincta* (Ehrenberg) Ralfs.

[2]Jean-Gabriel Wasson, André Chandesris, Ana Garcia-Bautista, Hervé Pella, Bertrand Villeneuve, 2007. Relationships between ecological and chemical status of surface waters. European Hydro-Ecoregions. Rebecca, CEMAGREF.

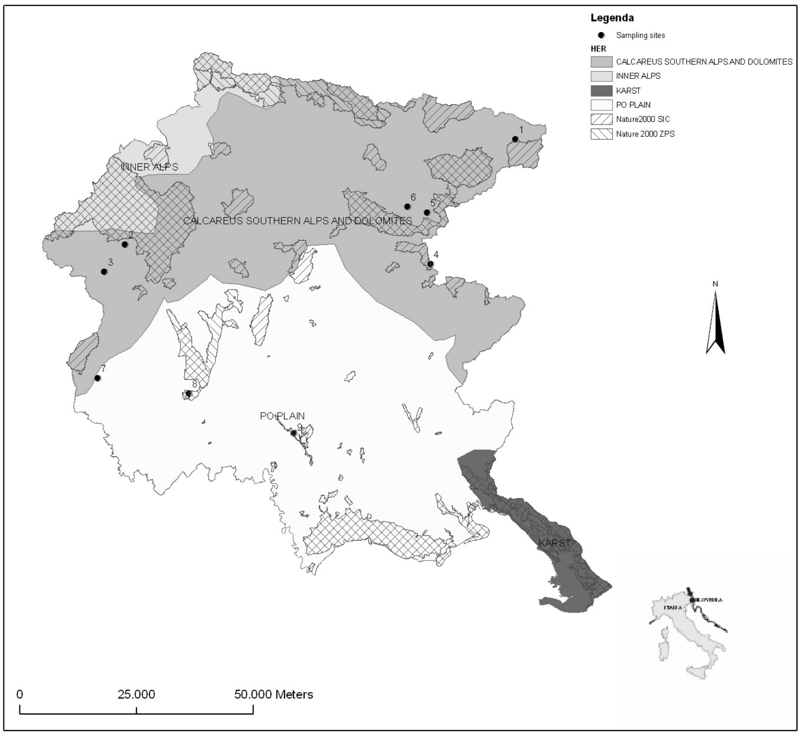

Figure. 1. *Distribution of sampling sites in the Friuli Venezia Giulia region.*

Table 1. *Characteristics of the reference sites, environmental parameters and EPI-D index values.*

Station	1	2	3	4	5	6	7	8	9
HER	11	11	11	11	11	11	132	132	132
Name of HER	Calcareous southern alps and dolomites	Calcareous southern alps and dolomites	Calcareous southern alps and dolomites	Calcareous southern alps and dolomites	Calcareous southern alps and dolomites	Calcareous southern alps and dolomites	Po Plain	Po Plain	Po Plain
Basin	Slizza	Livenza	Livenza	Isonzo	Tagliamento	Tagliamento	Livenza	Livenza	Stella
River	Bianco	Cellina	Cellina	Natisone	Resia	Resia	Livenza	Mulignan	Puroia
Locality	Fusine	Lesis	Mezzocanale	Platischis	Coritis	Zamlin	San Giovanni	Cordenons	Bertiolo
X **UTM Zone 33 N (WGS84)**	395120.24	311343.87	307024.9	376944.38	376122.38	371924.42	305594.9	325124.76	347646.59
Y **UTM Zone 33 N (WGS84)**	5149876.59	5127278.78	5121394.83	5122993.79	5134032.71	5135379.7	5098470.99	5095192.01	5086759.06
Sampling date	30/07/2008	13/08/2008	13/08/2008	11/09/2008	09/10/2008	16/06/2008	25/09/2008	10/07/2008	16/07/2008
Altitude	749	703	447	422	573	440	27	36	20
Distance from the source	0-5 km	5-25 km	5-25 km	0-5 km	0-5 km	5-25 km	0-5 km	0-5 km	0-5 km
pH	7.8	8.04	8	8.3	8.1	8	7.75	8.33	7.95
O_2 dissolved (mg/l)	11.6	14	11.8	10.5	12.5	11.3	12.7	17.4	8.76
O_2 (% of saturation)	99.9	120	98	103	106	95	114.7	92.6	86.6
Conductivity (µS/cm)	216.5	177.5	215	247	215	280	259.2	387	355
T_{water} (°C)	8.68	16	12	14.5	8.2	9.8	10.8	12	15.4
T_{air} (°C)	16.5	21	18	25	17.9	13	19	17.4	20
EPI-D (1^{rst} operator)	0.63 (I CLASS)	0.55 (I CLASS)	0.89 (I CLASS)	0.56 (I CLASS)	0.73 (I CLASS)	0.63 (I CLASS)	0.74 (I CLASS)	0.64 (I CLASS)	0.58 (I CLASS)
EPI-D (2^{nd} operator)	0.73 (I CLASS)	0.73 (I CLASS)	0.79 (I CLASS)	0.56 (I CLASS)	0.61 (I CLASS)	0.66 (I CLASS)	0.80 (I CLASS)	0.71 (I CLASS)	0.75 (I CLASS)

Cluster 2 is composed by station 1, 2, 3, 4, 5 and 6 located in the Calcareous Southern Alps and dolomites hydro-ecoregion. The sites 1 and 4 are also included in very natural habitat as *Tilio-Acerion* forests of slopes, screes and ravine and along alpine rivers the herbaceous vegetation on their banks.

Altitudes ranged mainly from 422 to 742 m. The cluster was characterized by a not so high conductivity (median value 225 µS/cm) and the median value of oxygen saturation is 104 %.

The most abundant species were *Achnanthidium biasolettianum* (35.1%), *Achnanthidium minutissimum* (16.5%), *Gomphonema pumilum* (Kützing) Kützing (3.1%), *Encyonema minutum* (Hilse in Rabh.) D.G. Mann (5.9%) and *Diatoma ehrenbergii* Kützing (4.6%). The indicator species for the cluster were *Fragilaria arcus* (Ehrenberg) Cleve, *Gophonema tergestinum* Fricke and *Diatoma mesodon* (Ehrenberg) Kützing.

CONCLUSIONS

In this study we have seen that there were different diatoms communities in the two hydro-ecoregion. In particular we have described the natural diatom assemblage for some reference sites of Friuli Venezia Giulia without anthropogenic pressure.

This approach have identified in particular two group one typical of calcareous southern alps and dolomites with sites characterized by a small distance from the source, low temperature and conductivity that have a diatom composition very similar to the one proposed in France for the HER of the Alpes (Tison et al., 2007) and in the first group proposed by Rimet et al. (2007) that represent mostly Alps an Pyrenees and one included in the fluvoglacial and alluvional sediments of the Po Plain with high temperature and conductivity, low % saturation of oxygen.

For the moment the number of reference sites and of the samples is too much restricted and create some difficulties for the generalization of the results.

To understand better the composition of diatom communities and of water quality is necessary to improve the collection of new data in order to characterize better the HER of Friuli Venezia Giulia and to compare the results at European scale.

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Diatom Taxonomy in the 21th Century

Symposium in honour of H. Van Heurck

In 1909, Henri Van Heurck, the most famous Belgian diatomist, died in Antwerp. To commemorate this date, the National Botanic Garden of Belgium will organise from the 23 till 26th of August 2009 an international symposium on diatom taxonomy.

The event will take place at the Bouchout Castle in the Botanic Garden (Meise, Belgium). We welcome everybody to attend this meeting and present results on all topics related to diatom morphology, taxonomy, genetics, molecular biology, biodiversity and biogeography.

Three invited speakers, Dr. David Mann (Edinburgh), Prof. Dr. Edward Theriot (Texas) and Prof. Dr. Wim Vyverman (Ghent), will give, each in their research field, a state-of the art key-note lecture on taxonomy, molecular biology and biogeography.

All information regarding this symposium can be found on the following website:
www.botanicgarden.be/RESEARCH/MEETINGS/VanHeurcksymposium.php

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