Newsletter of Micropalaeontology

JULY 2001
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Edited by Jennifer Pike

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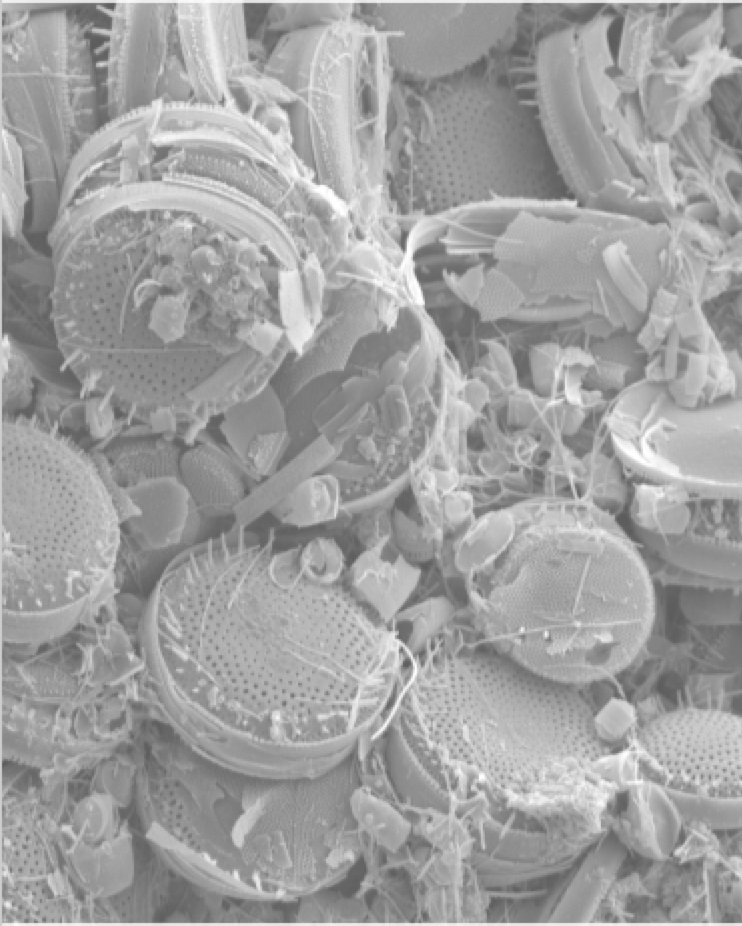

British Micropalaeontological Society

http://www.bmsoc.org

Editorial

Jenny Pike
<pikej@cardiff.ac.uk>

Welcome to the Summer 2001 edition of the *Newsletter of Micropalaeontology*.

Front Cover Credits

The photograph on the cover of this edition is a scanning electron microscope image of a cluster of early Holocene *Thalassiosira antarctica* from the Palmer Deep, west Antarctic Peninsula. The photograph was taken by Steve Moreton as part of a NERC-funded project to study the deglacial and Holocene palaeoceanographic history of the Palmer Deep which is situated in one of the most sensitive regions of west Antarctica to global change. It still remains for us to decide whether this cluster is a faecal pellet remnant or not! Photograph supplied by Jenny Pike. The Photo Gallery also features *Thalassiosira antarctica*. **A challenge**: Are the *T. antarctica* on the front cover the warm or cold morphology of this species?

If you have an interesting photograph for the front cover, send it to me with a few lines about what it is and where it is from.

Photo Gallery

In this edition we have some optical and SEM micrographs of diatoms supplied by Claire Allen. Please keep sending me your favourite microfossil photographs, particularly if you wish to highlight a project, or just because you like them. As part of the gallery in this edition, as promised, are some photographs of the Society Officers and Specialist Group Representatives.

Micropalaeontology News

The News section appears to be a hit, with more general interest information supplied in this issue. Please keep sending in those snippets. I would also like to expand this section to include short reviews of articles so if you read an exciting paper, don't just file it - write a short summary paragraph and send it to me. I don't believe there are no exciting papers being published out there!

Conference and Meeting Reports

I received no conference and meeting reports for this edition, other than those from the Specialist Groups. When you go to a conference, think about writing a short report for the Newsletter, then write it and send it to me!

Production Deadlines

The deadline for submitting copy for the next edition is 1st November 2001, but please feel free to submit things to me at anytime. If you have polite suggestions for changes or improvements to the *Newsletter*, also feel free to send them in. There is always room for improvement! Many thanks to all of you that have contributed to this edition.

Don't forget that you can send the Secretary your applications in for the BMS Grants-in-Aid and the Charles Downie Award at any time before 28th February 2002. See *Newsletter* for details.

I look forward to seeing many of you at the AGM in November.

BMS FOUNDATION

The BMS Foundation is a sponsorship scheme to help support the *Journal of Micropalaeontology*. The Foundation is made up of members, non-members and institutions who wish to support the science of micropalaeontology via the production of the *Journal*. Any level of subscription is welcome. A minimum annual donation of £25 is suggested; donors of £25 or more will be acknowledged in the *Journal* and the *Newsletter*.

Subscription is welcome at any time. Please send donations to James B. Riding, Treasurer, British Micropalaeontological Society, British Geological Survey, Keyworth, Nottingham, Nottinghamshire, NG12 5GG, UK. Please make cheques/money orders/bankers drafts payable to "**British Micropalaeontological Society Foundation**". If you wish to pay by Visa or Mastercard, please include amount you wish to donate, the card number, expiry date and cardholders address. If you wish to pay by Switch, please include the amount you wish to donate, the Switch Number, card issue number, expiry date and cardholders address.

BMS Foundation Donors of £25 or over (June 2001)

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Editors, Stereo Atlas of Ostracod Shells

Society News

Secretary's Report

James Powell
<ajp@dinosystems.co.uk>
Directory of Members

The Directory of Members is ready for release. Addresses are correct as of 8th December 2000. If there are any errors, please notify the Secretary immediately.

ANNUAL GENERAL MEETING
The 2001 AGM is scheduled for Wednesday 21st November at University College London, commencing at 2.00 pm. The venue will be Lecture Theatre One of the Cruciform Theatre (subject to confirmation). Items for the inclusion on the agenda should be sent to the Secretary by 21st October 2001. Following Society business, two lectures will be delivered by Dr Paul Smith (University of Birmingham) and Dr Jeremy Young (The Natural History Museum, London). A wine reception with posters will take place in the North Cloisters following the meeting. Individuals wishing to contribute a poster should contact the Secretary by 21st October 2001 to allow adequate hanging space to be reserved.

CHARLES DOWNIE AWARD
Two nominations were submitted for the inaugural Charles Downie Award

a. Paul Dodsworth for:
Dodsworth, P. 2000. Trans-Atlantic dinoflagellate cyst stratigraphy across the Cenomanian-Turonian (Cretaceous) Stage boundary. *Journal of Micropalaeontology* **19**: 69-84.

b. Chris Street for:
Street, C. and Bown, P.R. 2000. Palaeobiogeography of Early Cretaceous (Berriasian-Barremian) calcareous nannoplankton. *Marine Micropaleontology* **39**: 265-291.

The Committee is considering these two excellent papers and will reach a decision at its meeting on Wednesday 4th July 2001; the award will be made at the 2001 AGM.

JOINT MEETING OF AASP-BMS-NAMS
Preparations for this exciting international meeting, scheduled for 11-13 September 2002 at University College London, are progressing. Registration and abstract forms will appear in the next edition of the Newsletter. It is hoped that accommodation will be available in Ramsay Hall. As well as the symposium on 'Exploration Biostratigraphy' open sessions on other aspects of (post-Palaeozoic) palynology are also planned. Individuals willing to run post-conference field trips should contact the Secretary as soon as possible. The Organizing Committee comprises: Chris Denison (Chevron Overseas Petroleum Inc), Tom Dignes (ExxonMobil Exploration Co), Alan Lord (University College London), Jamie Powell (Dinosystems - Coordinator), Rachel Preece (Chevron Overseas Petroleum Inc) and Jim Riding (British Geological Society).

GRANTS-IN-AID
The Committee has awarded three Grants-in-Aid of £200 for 2001:

a. Claire Allen (Cardiff Univeristy) to contribute to the costs of attending ICP VII in Sapporo, Japan and to visit Dr Richard Jordan (Yamagata University).

b. Heather Austin (Univeristy of St Andrews) to help towards travel costs to the Netherlands Institute of Ecology (NIOO) to study benthic meiofaunal ecology with Dr Moodley.

c. James Eldrett (University of Southampton) to fund partially a visit to College Station, Texas for research with Dr John Firth into palynological responses to the Terminal Eocene Event in the Norwegian-Greenland Sea.

GRANTS-IN-AID

The BMS operates a grants-in-aid scheme designed to help student members of the Society in their field work, conference attendance or any other activity related to their research. A maximum of £200 will be awarded to each successful applicant, and a total of £600 is available annually. Application forms are available from the BMS Secretary, and must be submitted by 28th February 2002.

CHANGES TO THE COMMITTEE

The terms of office of the BMS Chair (John Whittaker) and Treasurer (Jim Riding) come to an end at the 2001 AGM. Nominations for their replacements should be logged with the Secretary (ajp@dinosystems.co.uk) by 21st October 2001. Nominees, Proposers and Seconders should all be BMS members in good standing.

SIXTH INTERNATIONAL WORKSHOP ON AGGLUTINATED FORAMINIFERA

The Committee has agreed to sponsor the 6th IWAF to be held at the Charles University in Prague, 1st-7th September 2001 to the tune of £250.

MISSING MEMBERS

The Secretary does not have postal addresses for the following paid-up members. If you know of their current whereabouts, please let him know as soon as possible:

Evans, I.P.	Jones, C.O.
Leary, Dr P.N.	McGoff, H.J.
White, Dr J.E.	Williams, Dr & Mrs A.
	De Hauteville-Bell, Mr

THE FUTURE OF THE WORD 'BRITISH' IN THE BRITISH MICROPALAEONTOLOGICAL SOCIETY

The Committee has been considering the appropriateness of the word 'British' in the Society's title, and is meeting in July to discuss this important matter, amongst others. Some Committee members feel that, with approximately 50% of members registered outside the UK, the title does not fully reflect the demographic make-up of the Society, and may put off some overseas individuals from joining. Others believe that dropping the word 'British' would make little difference to membership levels, and would obfuscate the fact the Society is administered largely by UK-based members.

It is possible that a postal ballot of all members will take place prior to the 2002 AGM when any changes would be ratified. In the meantime, the Committee welcomes comments from the members of the Society either for or against dropping the word 'British'; comments should addressed to the Chairman <j.whittaker@nhm.ac.uk> or Secretary <ajp@dinosystems.co.uk>.

Treasurer's Report

Jim Riding
<j.riding@bgs.ac.uk>

The Society continues to be relatively healthy financially. However significant numbers of members have not yet paid their 2001 subscriptions. May I request that you examine the address label on the

CHARLES DOWNIE AWARD

The late Charles Downie was one of the pioneers of palynology in the U.K. and a mentor who guided the thinking and development of a large number of postgraduate students who passed through the University of Sheffield. Through the efforts of former colleagues at Sheffield, a permanent memorial has now been established to recognize Charles' contribution to micropalaeontology. An annual award will be made to the BMS member, who in the opinion of the BMS Committee, has published the most significant paper, in any journal, based upon his or her postgraduate research.

The first award of £200 will be made for the best paper published during 2000 and will be presented at the BMS AGM in November 2001. Nominations for the best paper published in 2001should be submitted either to the appropriate BMS Specialist Group, or the BMS Secretary by 28th February 2002.

Dr James Powell, BMS Secretary,
Dinosystems, 105 Albert Road, Richmond, Surrey TW10 6DJ, England, UK
Tel: +44 20 8948 6443; Fax: +44 20 89405917; Email: ajp@dinosystems.co.uk

Charles Downie Memorial Award Contributors (June 2002)

R. L. Austin	A. Hossein Zahiri
G. A. Booth	W.A.M. Jenkins
B. Braham	J. K. Lentin
J. P. Bujak	R. S. W. Neville
G. Clayton	B. Owens
M. D. Crane	T. L. Potter
S. Duxbury	A. J. Powell
G. L. Eaton	S. M. Rasul
G. A. Forbes	M. Razzo
K. J. Gueinn	J. B. Riding
A. M. Harding	W. A. S. Sarjeant
R. Harland	J. Utting
K. Higgs	D. Wall
P. J. Hill	M. J. Whiteley
	G. L. Williams

envelope and ensure you have paid for this year. Remember that it is possible to pay subscriptions up to three years in advance. I must apologise to some overseas members, especially those in the U.S.A. and Australia for the late arrival of the 2001 invoices. These were sent out in January, but were wrongly sent the slowest possible mail route. Australian invoices typically arrived in April and U.S. members have apparently only just received theirs, depending upon where they live in the States. Next year they will all be airmailed.

NEW MEMBERS

The Society welcomes the following New Members:

C. Allen	A. G. Cage
D. G. Clark	S. de la Rue
T. W. Dignes	K. J. Dorning
J. Eldrett	T. A. Jack
F. Marret	W. Renema
J. Salinas-Straw	T. West
T. Wright	

Webmaster's Report

Ian Boomer
<ian.boomer@ncl.ac.uk>

The Website has been regularly updated to keep members informed of the Spring meetings of both the Silicofossil and Foraminifera Groups. Other planned field meetings were cancelled due to the Foot and Mouth outbreak but if you are planning to organise any meetings or fieldtrips in the coming months, don't forget to send details to me, preferably as a PC Word file.

I can also include pictures so send either '.jpg' or original photos and I'll incorporate them into the site.

AGM Abstracts

Wednesday 21st November, 2.00pm, Lecture Theatre One of the Cruciform Theatre (subject to confirmation),UCL. Please keep an eye on the website for updates.

Microvertebrates and macroevolution - unravelling the origin and early history of the vertebrate clade

Paul Smith, Philip Donoghue &
Ivan Sansom
University of Birmingham

The study of Early Palaeozoic microvertebrate faunas has, in the last decade, had a major impact on the understanding of vertebrate palaeobiology. A review of pre-Silurian vertebrates carried out as recently as 1991 concluded that only five species could confidently be included in the clade. Since then, a number of key discoveries have been made, many of them reliant on micropalaeontological methodologies. For example, the first armoured fish are now known to be present in the Late Cambrian, and the biodiversity of Ordovician vertebrates is far higher than previously suspected, even at high taxonomic levels. One particularly important change has been the increasing recognition that conodonts are vertebrates, which has both changed the temporal perspective of vertebrate phylogeny and increased the known generic and specific diversity by two orders of magnitude. Together, these developments demonstrate the importance of integrating micropalaeontological and traditional, vertebrate macrofossil, datasets since neither picture is complete in itself. The new discoveries have a significant part to play in elucidating the phylogeny of the group and in testing evolutionary scenarios, in assessing the completeness of the fossil record of early vertebrates, and in the determination of biogeographic and large-scale ecological patterns and processes.

Coccolithophore species - results from CODENET (Coccolithophorid Evolutionary Biodiversity and Ecology Network)

Jeremy R. Young
Palaeontology Department, The Natural History Museum, London SW7 5BD
http://www.nhm.ac.uk/hosted_sites/ina/CODENET
with collaborators from VU Amsterdam, ICM-Barcelona, U. Bremen, AWI-Bremerhaven, U. Caen, U. Lisbon, Netherlands Institute for Sea Research (NIOZ), U. Oviedo, ETH-Zuerich.

In 1997 we were successful in obtaining EU funding for a Training and Mobility of Researchers network project, CODENET, to train young scientists in interdisciplinary research and carry out basic research into coccolithophorid ecology, microevolution and phylogeny. The project was focused on six key species and included culture isolation; studies of cytology, morphogenesis, life-cycles and pigments; calibration of oxygen isotope, Sr/Ca, and alkenone palaeoproxies; plus taxonomic synthesis and molecular genetic study. This work was planned to: “(1) Probe high-level diversity in key aspects of coccolithophorid biology; (2) build a representative suite of case studies in species-level diversity and microevolutionary processes and (3) advance our understanding of the ecology of extant coccolithophorids and palaeoceanographic information recovery from fossil coccoliths.”

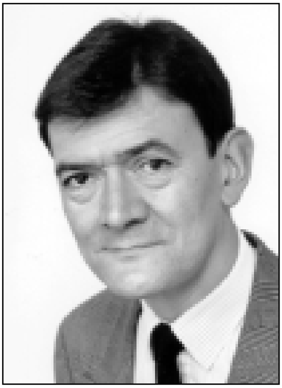
The project is now nearing its end after some three and a half years of gratifyingly productive research (it formally ends on 30th Sept 2001). This talk will briefly overview the project as a whole and discuss the potential this type of research for micropalaeontology in general. I will then focus on one topic which brings together a range of interesting research - microevolution and species concepts.

As with most microfossil groups there has been a strong tradition in coccolith studies of detailed morphometric study of key taxa and lineages, both to understand evolutionary process and to refine biostratigraphy. There has, however, remained considerable uncertainty about the correlation between such morphospecies (often based on rather arbitrary size definitions) and biological species. Within the CODENET project we were able to combine detailed morphometric study of key species in the geological record, in sediment traps, in plankton samples and in laboratory cultures. In parallel with this we used the laboratory cultures to investigate both ecophenotypic variation in selected strains and molecular genetic differentiation between multiple strains. Finally life-cycle studies have provided an unexpected source of additional information, from comparison of coccolith differentiation in the haploid and diploid phases. The work is at varying stages in the six taxa being studied but a rather consistent pattern is emerging. It appears that the individual species consist of a small set of closely-related sub-species/genotypes with distinct morphologies and discrete ecological preferences; but with overlapping geographical ranges and each with essentially global distributions. This pattern does not fit easily with either allopatric or sympatric models of microevolution, but does correlate well with biostratigraphic observations of very low diachronism and endemism in calcareous nannofossils.

Obituary

Dr. Peter James Bigg

1946 – 2001



It is extremely sad to report the recent death of Peter following a prolonged struggle against a progressively debilitating cancer. Those that knew him will not be surprised to learn that Peter tackled this final challenge with style, humour and concern for his family.

Peter came from a talented musical family and spent his teenage years in Keynsham near Bristol. His parents, twin brother Trevor and he made up a musical cabaret group – 'The Bigg Four'. They played at clubs and pubs in the West Country, and Peter was a madcap drummer, which was ideal for his sense of comedy and pantomime.

From the proceeds of his performances, Peter bought an old Morris Minor convertible. He would drive it to school regularly and park in the tiny school car park, much to the annoyance of staff members who, arriving later, had to park in the road, and to the envy of other teachers who had travelled by bus or on foot (teaching in those days was a poorly paid profession).

Peter first studied geology as a sixth former at Bath Technical School. From school he went to Exeter University in 1964, where he met Sue and obtained an Honours degree in Geology. In 1967 Peter moved to London and studied for an MSc in Applied Micropalaeontology at Imperial College under Dr. David Carter. He was a contemporary of Malcolm Hart and Will Diver, and with Will studied the Late Cretaceous foraminifera of the Plenus Marl from the Betchworth Quarry, North Downs.

Sue and Peter were married at Greenwich in 1968, spending much of their spare time (and most of their money) on theatre, concerts, ballet and opera.

In 1968 Peter was awarded a D.S.I.R. research studentship at University College to work with Prof. Tom Barnard. Peter's PhD is entitled 'The Eocene planktonic foraminifera and calcareous nannoplankton of the Aquitaine, Paris and Belgium Basins'. The results of his research were published in Revue de Micropaleontologie and Revista Espanola de Micropalaeontologia.

In 1972 Peter joined Robertson Research in North Wales as a micropalaeontologist working on UK and international material. In 1974 Sue and Peter moved to Otley when Peter joined the IGS. He worked as a Senior Scientific Officer in a group producing geological maps for the UK Continental Shelf. It was during this period in Leeds that his two sons Daniel (1977) and Thomas (1980) were born; and the drums had to be sold to help buy a family car. Peter maintained his interest in music by taking up the classical guitar.

Peter was Secretary of the British Micropalaeontological Group (the fore-runner of the British Micropalaeontology Society) between 1975 – 1977, and was the first editor of 'The British Micropalaeontologist' (1976).

In 1982, Peter joined the newly created Gearhart Geo Consultants stratigraphy group. For several months he commuted between Leeds and Aberdeen, where he assembled and trained a team destined for the Far East. He was appointed Regional Manager Far East and established successful stratigraphic and geochemical laboratory facilities in both Singapore and Jakarta, Indonesia. In addition to office based work on tropical nannofossils and planktonic foraminifera Peter spent periods offshore in the East Java Sea conducting wellsite studies. His daughter Sophie was born in Singapore in 1984.

Peter and Sue returned to Aberdeen in 1985 and set up home in Fyvie. Peter was appointed Operations Director for international activities and helped to set up regional offices in Abu Dhabi and Cairo. In 1988 Halliburton acquired the Gearhart business and Peter became Marketing and Sales Director. In 1990 he was appointed Managing Director of Smith Rae Energy Aberdeen.

It was at this time that Peter first became involved with scouting in Fyvie, and it was not long before his organisational skills were recognised and he was asked to be the Group Scout Leader. A position he thoroughly enjoyed and a role in which he made many friends.

In 1991 Peter was appointed EC Contract Manager for the Centre for Marine and Petroleum Technology (formerly PSTI). There he managed the Centre's major contract with the European Commission, promoting innovative oil and gas technologies as part of the THERMIE Programme.

In 1997 Peter became a Consultant providing business development, funding and marketing advice to various UK and International oil companies, some of which was through Grampian Enterprise and the Aberdeen Enterprise Trust. During this period Peter continued his work for the European Commission, providing technical management on another thirty THERMIE projects.

Peter will be remembered by many for his sense of humour and for being the tidiest geologist they have known. His obsession with 'order' meant he was on the receiving end of many pranks….his somewhat explosive reaction to these was legendary. Stories will be retold whenever 'bugmen' socialise and Peter's name is remembered. After the dust had settled Peter would see the funny side of it all and he thoroughly enjoyed getting his own back, he had a keen and quick wit.

At Peter's funeral the Minister from Fyvie told us the 'parable of the micropalaeontologist'. He reminded us that micropalaeontologists study impressions and that 'impressions' are what we leave behind us. Peter was a character who enjoyed life and enriched the lives of many. He certainly made his mark and left us with some wonderful memories. Peter was meticulously professional, well groomed, well mannered and great company. He had a quality that many of us would love to possess. Peter had style. He will be sadly missed, but fondly remembered.

We offer our sincere condolences to all his family especially Sue, Daniel, Thomas, Sophie, his mother and brother Trevor.

Ben Johnson
Aberdeen Stratlab Ltd.

Specialist Group News

Foraminifera Group

The Foraminifera Group Spring Meeting took place on Friday the 4th of May 2001 in the now familiar venue of the Palaeontology Demonstration Room of the Natural History Museum. Over 40 micropalaeontologists attended the meeting, which is one of the largest turn-outs to date. Nine talks were presented and four posters were displayed. The standard of the presentations was excellent and a wide range of topics were covered. Chevron Petroleum again generously agreed to sponsor the meeting. Unfortunately due to the situation involving the Foot & Mouth disease outbreak and the resultant restrictions on movement in rural areas, the field trip did not take place. Hopefully normal service will be resumed next year.

All abstracts have been published on the BMS website *http://www.bmsoc.org* and are also include below:

"*The Proceedings of the Fifth International Workshop on Agglutinated Foraminifera*" have been published by the Grzybowski Foundation. The 479-page A4-format hard-cover book contains 29 research articles on agglutinated foraminifera published by the participants of the IWAF-5 meeting in Plymouth. The book is richly illustrated with numerous plates. The book can be ordered by contacting Mike Kaminski <m.kaminski@ucl.ac.uk>. Price is £40 for individuals or £49.95 for libraries.

Andy Henderson
Foraminifera Group Chair
<a.henderson@nhm.ac.uk>

Abstracts from Group meeting, 4th May 2001

An integrated micropalaeontological biozonation for the Danian and Late Cretaceous chalks of the Central Graben are, North Sea

BAILEY, H. W., GALLAGHER, L. T. & HAMPTON, M. J.

Network Stratigraphic Consulting Limited, Unit 60, The Enterprise Centre, Cranborne Road, Potters Bar, Hertfordshire, England, EN6 3DQ.
<100710.1020@compuserve.com>

An integrated micropalaeontological zonation, based on calibrated microfaunal and nannofloral distributions has been constructed for the Late Cretaceous and Danian Chalks of the North Sea. Data is drawn from a total of thirty two oil exploration wells spread throughout the Central Graben region, spanning the triple junction of the Norwegian, Danish and the United Kingdom offshore areas.

Pre-existing commercial micropalaeontological data and forty new microfaunal analyses have been calibrated with new nannofloral results produced from over seven hundred and twenty new nannoplankton analyses, carried out primarily on cored sections.

The biozonation scheme has been calibrated in detail with the lithostratigraphic divisions identified in the wells studied, including the Ekofisk and Tor Formations, together with three new formations (the Narve, Thud and Magne) representing the Turonian to Late Campanian succession. This multidisciplinary stratigraphy for the North Sea Chalks permits definitive interpretations to be applied to individual wells and across the whole region, including the onshore areas of southern

England and Germany. The well interpretations are illustrated in a summary format using simple “Gapogram” diagrams, with the stratigraphy for selected wells being calibrated against the absolute timescale defined by Gradstein *et al*. (1995).

Gradstein, F. M., Agterberg, F. P., Ogg, J. G., Hardenbol, J., Van Veen, P., Thierry, J. and Huang, Z. (1995) A Triassic, Jurassic and Cretaceous Time Scale. SEPM Spec. Publ., 54, 95–126.

Morphometric evidence for gradual evolution in the Hantkeninid planktonic foraminifera

COXALL H. K.[1], HUBER B. T.[2] and PEARSON, P. N.[3]

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[2]Department of Paleobiology, National Museum of Natural History, MRC-121, Smithsonian Institution, Washington, D.C. 20560.
[3]University of Bristol, Department of Earth Sciences, Wills Memorial Building, Queen’s Road, Brisol, BS8 1RJ
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Morphometric analysis is employed to investigate evolution in the planktonic foraminiferal family Hantkeninidae. Morphometric data (over 22,000 measurments on 827 specimens) measured from contact microradiographs, demonstrate that the evolution was generally gradual rather than stepwise, showing periods of accelerated morphological change alternating with periods of relative stasis. Trends in chamber inflation, tubulospine angle and the position of the tubulospine on each chamber show the most significant changes, highlighting the biostratigraphic and taxonomic potential of these characters. Rapid shifts in morphometric variables occur from 40-38 Ma indicating accelerated evolutionary rates over a short (2 million year) period. During this interval the most dramatic modifications to the hantkeninid shell occurred, including significant lateral chamber inflation, rapid reduction in tubulospine angle and a shift to more involute coiling. Following these changes, morphological variation within all variables increased considerably and further morphological developments to the primary aperture occurred producing forms with distinctive areal apertures (*Cribrohantkenina*). This evolution occurred at the same time as known major palaeoceanographic changes during the middle and upper Eocene and correlates with the shift in hantkeninid ecology from a deep to a surface water habitat. Trends in morphological evolution could not be resolved in the latest Eocene and preceding the extinction of the hantkeninids at the Eocene-Oligocene boundary owing to the presence of a hiatus spanning this interval at our principle study site (Ocean Drilling Program Site 865). Univariate and multivariate statistical analyses reveal that more than one morphological population potentially existed at several stages in the lineage, providing evidence for phylogenetic branching.

Keywords: Eocene, planktonic foraminifera, evolution, morphometrics, microradiography

Temporal variation in deep-sea benthic foraminifera: results from the BENBO Project

GOODAY, A. J. & HUGHES, J. A.

Southampton Oceanography Centre, Empress Dock, European Way, Southampton SO14 3ZH
<ang@soc.soton.ac.uk>

An important recent discovery has been

that foraminiferal populations in the deep sea may vary over time, for example, seasonally. We describe temporal changes at a 1900m-deep site in the western Rockall Trough (NE Atlantic) that was studied as part of the BENBO NERC Thematic Programme. Samples were collected in 1998, before (May) and after (July) the spring bloom and the resulting input of organic matter (phytodetritus) to the seafloor. Foraminiferal assemblages at this site were highly diverse with >100 'live' species present in multicore samples (0-1cm layer, >63µm fraction). Total population densities are substantially higher in May than in July. Two species stand out as being particularly response to the phytodetritus pulse. *Eponides pusillus* and *Nonionella iridea* are both much more abundant in July samples compared to those from May. These tiny species exhibit an interesting contrast in microhabitat preferences. *Eponides pusillus* is most abundant in the phytodetritus layer and is almost always embedded within phytodetrital aggregates whereas *N. iridea* is most abundant in the 0.5-1.0cm layer and usually covered by an agglutinated cocoon of fine sediment. Among other things our results suggest that, in general terms, calcareous foraminifera are more closely linked to organic matter inputs than agglutinated species.

Mid-Pleistocene origin of <u>Neogloboquadrina pachyderma</u> sinistral

KUCERA, M.[1] and KENNETT, J. P.[2]

[1]Department of Geology, Royal Holloway University of London, Egham, Surrey TW20 0EX, UK
[2]Department of Geological Sciences and Marine Science Institute, University of California, Santa Barbara, CA 93106, USA
<m.kucera@gl.rhul.ac.uk>

The sinistral (left) coiling variety of *Neogloboquadrina pachyderma* is the only planktonic foraminifer species inhabiting polar waters of both hemispheres. Its cold-water affinity has long been recognised as a powerful climate indicator in the geological past and its shells preserved in deep-sea sediments provide the most important source of high-latitude biogenic carbonate for reconstructions of ancient surface water properties.
Neogloboquadrina pachyderma evolved from its ancestor *N. continuosa* in the early Late Miocene (~ 8 Ma). The left coiling variety, now considered a separate species, first appeared in the latest Miocene. However, there is a growing body of evidence suggesting that the early sinistral forms were distinct from the modern cold-water species.

We have examined the origin of cold-water affinity in *N. pachyderma* sinistral in Pliocene and Pleistocene sediments from ODP Site 1014 in the Northeastern Pacific. Using morphometric and stable-isotope data, we conclude that the Pliocene populations of *N. pachyderma* sinistral were morphologically and ecologically different from modern *N. pachyderma* sinistral. Our data thus provide a decisive piece of evidence against the use of *N. pachyderma* sinistral as a climatic indicator before 1 Ma.

At Site 1014, the modern form evolved rapidly within the Jaramillo Chron at about 1 Ma. The timing of this event and subsequent evolution of mean shell size coincide remarkably with observations from the North Atlantic. Such a hemispheric synchronicity in evolution implies the existence of a trans-Arctic gene flow. The rapid evolution of the modern-type form took place during an interval of decreased climate variability in the mid-Pleistocene. This suggests a link between evolution and climate dynamics: The evolution of the cold-water affinity may have been facilitated by a temporal relaxation of the magnitude of climate fluctuation.

Keywords: planktonic foraminifera, evolution, morphology, stable isotopes, Quaternary

The importance of phylogeny in micropaleontological data analysis and hypothesis testing

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Phylogenies provide a rich source of information that should be exploited in designing quantitative hypothesis tests in all paleobiological contexts. Viewing such data analysis problems through the prism of phylogenetically-structured comparisons can help add realism and depth to paleobiological data analysis strategies. As an example of the power of such analyses—as well as the pitfalls of ignoring phylogenetic data—the hypothesis of spines and the ability to harbour photosynthetic symbionts being planktonic foraminiferal adaptations to life in shallow marine depth habitats is evaluated from non-phylogenetic and phylogenetic perspectives. Result suggest that the presence of spines and photosynthetic symbionts in Neogene-Recent species are not adaptations to living in shallow-intermediate planktonic depth habitats, but rather represent exaptations whose occurrence frequency among Recent, shallow-dwelling species is an example of phylogenetic consrvatism. Until such time as defensible phylogenies are available for microfossil lineages it is unlikely that substantial progress will be made in evaluating a wide variety of alternative functional, ecological, and biogeographical hypotheses, or understanding the systematics and paleobiology of these groups.

Use of benthic foraminifera as environmental proxies

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Benthic foraminifera are good palaeoecological indicators of broad environments (brackish lagoon, inner shelf, etc) but their use as proxies of precise values of environmental parameters has yet to be developed. In an ideal world, there would be good correlation between a change in abundance of one or more taxa and a change in the chosen environmental parameter. The reality is different and this talk discusses possible explanations including the niche concept and the role of critical thresholds. At present there is greatest interest in using benthic foraminifera as proxies for low oxygen and palaeoproductivity (rate of supply of organic material from the ocean surface). For oxygen, it is only as the lower critical threshold is reached that it becomes important as a limiting factor for benthic foraminifera. When oxygen is abundant it appears to exert no control on species abundance and there is no upper citical threshold. The nature of organic matter may be as important as the quantity in controlling the distribution and abundance of species and assemblages. There is resource partitioning in benthic foraminfera, even in the deep sea. Most taxa are tolerant of a range of organic flux rates and this is no doubt an effective adaptive strategy.

Keywords: proxy, niche, critical threshold, oxygen, palaeoproductivity

Late glacial to Holocene distribution pattern of deep-water Uvigerinids in the northeastern Atlantic

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Phases with massive abundances of the genus *Uvigerina* have been recorded in North Atlantic deep sea cores and were either attributed to water mass properties or to extended high productivity during the last Glacial. A foraminiferal study of 34 cores from the northeastern Atlantic ranging from 29° to 55°N and 500 to 4200 m water depth revealed that the glacial Uvigerinids belong to different taxa in comparison to their modern counterparts in this area. The recent, common deep-water Uvigerinids are *Uvigerina peregrina* and *Uvigerina auberiana*, whereas *Uvigerina pygmea* dominates the late Pleistocene assemblages below 2000 m water depth. *Uvigerina pygmea* lives today in the Gulf of Guinea (10°N to 5°S), but was present up to 55°N during the Last Glacial Maximum. It retreated south- and northwards with the Termination I and disappeared in the northeastern Atlantic to the West of Rockall Plateau 8300 years ago, shortly before the early Holocene climate optimum. To the South, *Uvigerina pygmea* was replaced by *Uvigerina peregrina* spreading out from isolated occurrences at the mid-continental slope off western Iberia and the high productivity areas at the NW-African continental margin. Co-occurrences with indicators of pulsed paleoflux and algal remains indicate that *Uvigerina pygmea* is adapted to pulsed seasonal productivity. *Uvigerina peregrina*, however, requires twice time higher food fluxes and more steady conditions than *Uvigerina pygmea*. Hence, boundary processes at oscillating oceanic fronts or intensified seasonality of the pelagic food chains may have ruled the benthic food supply in the northeastern Atlantic rather than steady state high productivity during the last Glacial.

Keywords: benthic taxa; foraminifera; paleoproductivity; biogeography; East Atlantic

Chemical analysis of Recent benthic foraminiferal tests using laser ablation inductively coupled plasma mass spectrometry: methodology and preliminary results

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Preliminary chemical analysis was carried out on foraminferal tests from Restronguet Creek, Cornwall, south-west England. A relatively new technique Laser Ablation Inductively Coupled Plasma Mass Spectrometry was used to determine levels of metal accumulation in deformed and undeformed calcareous tests. With respect to the foraminifera this is a new technique and formed part of a research programme investigating the post impact responses of Recent benthic foraminifera to metal pollution and their use in pollution monitoring.

The laser ablation technique determined a quantified difference between deformed

and undeformed tests in terms of metal accumulation. The metals Al, Cu, Pb, Ni and Fe were all higher in the deformed tests as median, mean and maximum values. The minimum values for Al, ^{63}Cu and Ni in both the deformed and undeformed tests were closely similar which suggests these are reference levels for each element. With respect to Zn, the difference between deformed and undeformed tests was insignificant and consequently this metal is not considered, therefore, to be toxic to the foraminifera.

The variables, salinity and temperature are within a range typical of estuaries and the percentage of carbon is not considered to be unusually high. The C/N ratio levels suggests that there is sufficient nutrition for the foraminifera. Within the period of investigation these variables did not vary unusually and are unlikely, therefore, to account for the high levels of test deformity that has been observed in Restronguet Creek. The metal concentration discharged into the Creek from Wheal Jane tin mine has, however, declined between January 1992 and the cessation of sampling in October 1996, but most particularly after 1994.

Laser Ablation ICP-MS provides a direct analytical technique capable of individual test and chamber analysis, which in this case has defined a relationship between metal bioaccumulation and test abnormality. These preliminary results suggest that it is desirable that this form of micro-analysis be developed further.

***Bolivinoides* saves Ipswich from flooding disaster!!**

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Project Orwell, a £33 million pound scheme to reduce flooding in the town of Ipswich was the first major civil engineering project since the channel tunnel to actively use biostratigraphy in its planning and construction.

The tunnel, 5.5 Km in length, 3m in diameter and in places over 50 m deep, was constructed within the *Gonioteuthis quadrata* Zone of the Campanian White Chalk (“Upper Chalk”). High-resolution foraminiferal biostratigraphy was used to select a suitable tunnel horizon between flint bands (a potential hazard to machine tunnelling), and monitor its progress during construction.

The use of micropalaeontology was a major contributing factor to the success of the scheme, which was completed 6 months ahead of schedule in December 1999.

POSTER ABSTRACTS

The Jurassic - Early Cretaceous foraminifera of Tethys

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The Jurassic of Tethys has yielded sequences of foraminiferal faunas recognisable in thin sections of marine limestones, which enable broad stratigraphic correlations from the Belearic Islands in the west to Iraq and Yemen in the east.

Benthic foraminifera are described for the first time from the upper part of the >460-m-thick Gibraltar Limestone Formation of the Rock of Gibraltar (BouDagher-Fadel, Rose, Bosence and Lord, 2001). They compare closely with poorly-known taxa from Italy, Spain and Morocco, and are consistent with an Early Jurassic (Sinemurian) age. Most are textulariids and more primitive than species well known from the later Early Jurassic (Pliensbachian) of the Mediterranean region, especially Morocco and Italy. They include distinctive smaller foraminifera such as *Siphovalvulina* with depressed chambers. The biota as a whole is characteristic of the inner carbonate platform environments widespread along the rifted western margins of the Early Jurassic Tethys, notably those recorded from Morocco, Italy and Greece as well as southern Spain.

The dasyclad alga *Palaeodasycladus* is abundant and well preserved, consistent with deposition in shallow marine inner platform conditions.

Foraminifera which are internally complicated with pillars and/or intramural alveoli (e.g. *Amijiella, Haurania, Socotraina*) (Septfontaine 1981, 1984; Banner *et al.* 1997; Bassoullet 1998) and large, complex, agglutinating benthic foraminifera (e.g. *Cyclorbitopsella, Pseudocyclammina*) (Septfontaine 1984; Banner *et al.* 1997) did not appear until Pliensbachian time. Other foraminifera with complicated internal morphology occur stratigraphically even higher in the Mesozoic. Large, complex, internally complicated agglutinating benthic foraminifera with pillars and/or intramural alveoli such as *Orbitopsella* did not appear until the latest Sinemurian-Pliensbachian time. The upper part of this interval also contained *Cyclorbitopsella.*

Cyclorbitopsella continued into the latest early Jurassic (Toarcian) but *Orbitopsella* is missing and new forms with solid walls but subradial partitions such as *Socotraina* appeared and characterised the Toarcian. Although the Toarcian is the youngest stage of the Early Jurassic it also yields the earliest species of the Mid Jurassic forms such as *Amijiella* and *Haurania* which are common in the Bajocian-Bathonian. *Trochamijiella* replaces these taxa in the Late Bathonian. The later part of the Mid Jurassic (Bathonian-Callovian) is also characterised by *Pfenderina* with secondary infillings and internal partitions. *Pfenderina* continued into the Early Cretaceous of southern Europe But not in the Middle East.

In the Late Jurassic *Kurnubia* with reticulate hypodermis evolved and persisted until Late Kimmeridgian times. It was joined by more complicated litulolids with intramural alveoli such as *Everticyclammina, Pseudocyclammina, Pseudospirocyclina, Anchispirocyclina*, and *Alveosepta (Alveosepta), Alveosepta (Redmondellina).*

Only a very few forms from the earliest Jurassic survived (e.g. *Everticyclamimina*, *Pseudocyclammina*) in the shallow water marine carbonates which prevailed at the onset of Early Cretaceous time along both stable inner and unstable outer shelves of the south margin of the Tethys. On the other hand, many new forms with hypodermal alveoles such as *Bramkampella* dominate the Early Cretaceous assemblages.

Palaeoecology and environmental significance of some Middle Eocene cold water planktonic foaminifera

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Palaeoecological and biogeographical analysis of two little-known groups of middle Eocene plantkonic foraminifera suggests that their distribution was tied to high levels of ocean productivity and/or cool water. *Clavigerinella colombiana*, *C. akersi* and *Paragloborotalia bolivariana*/*griffinae* are absent or extremely rare in most deep-sea pelagic sediments but are occasionally found in abnormally large numbers in more marginal settings, which are presumed to have been sites of intense biological productivity attributable to the upwelling of nutrient-rich waters from beneath the thermocline. Here, we report new stable isotope analyses of multiple species (12) of well-preserved lower middle Eocene (P9-P10) planktonic foraminifera from Endeavour Seamount, West African margin (25°22'N, 19°18'W). Our data show a substantial range in both $\delta^{13}C$ (~+3.2 to +0.49‰ vPDB) and $\delta^{18}O$ (+0.60 to –1.53‰ vPDB), which we divide into four categories: (i) mixed layer- symbiotic (ii) mixed layer-asymbiotic, (iii) thermocline and (iv) temporary upwelling indicators. Based on our results, the clavigernillids lived deep within or at the base of the thermocline, while *P. griffinae* apparently lived in waters that were thermally and chemically similar to those inhabited by benthic foraminifera at our site. These findings are consistent with the hypothesis that 'unusual' abundances of *Clavigerinella* and *P. bolivariana*/*griffinae* provide assemblage proxies for enhanced surface palaeooceanographic productivity levels.

Recent foraminifera from western Pomerania (NE Germany), southern Baltic Sea

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For the whole of the Baltic seen few is known about the foraminiferal associations. This is particularly true of the western Pomerania region (Vorpommern, NE Germany). The little attention paid to this group is mainly caused by low diversity of foraminifera under brackish water conditions and the poor preservation of tests within the prevailing organic rich sediments.

Fifteen recent species are known so far from the open Baltic Sea (salinity about 9 to 15 ‰) of western Pomerania: *Astrammina sphaerica* (HERON-ALLEN & EARLAND), *Hippocrepina flexibilis* (WIESNER), *Reophax aduncus* BRADY, *Reophax dentaliniformis regularis* HÖGLUND, *Miliammina fusca* (BRADY), *Labrospira jeffreysii* (WILLIAMSON), *Ammotium cassis* (PARKER), *Eggerelloides scabrus* (WILLIAMSON), *Quinqueloculina seminulum* (LINNAEUS), *Laryngosigma hyalascidea* LOEBLICH & TAPPAN, *Asterellina pulchella* (PARKER), *Ammonia batavus* HOFKER, *Cribrononion asklundi* (BROTZEN), *Cribroelphidium excavatum* (TERQUEM) f. *clavata* and *Cribroelphidium incertum* (WILLIAMSON) (after LUTZE 1965, LUKASHINA 1995 and FRENZEL unpublished data). *C. asklundi*, *C. excavatum* and *M. fusca* are the dominant species. The abundance of living foraminifera is about 100 specimens/10cm^2 in the western part of the area, lower at the periphery of the Arkona basin with about 10 specimens/10cm^2 and lowest with only 1-2 specimens/10cm^2 in the deeper parts of the basin (LUTZE 1965).

We have found the following five species within the shallow lagoons (Greifswalder Boden, Strelasund and Kubitzer Bodden; after KREISEL & LEIPE 1989, FRENZEL 1996 and FRENZEL unpublished): *Miliammina fusca*, which is clearly dominating, *Jadammina macrescens* (BRADY), *Ammonia batavus* HOFKER, *Cribrononion albiumbilicatum* (WEISS) and *Cribroelphidium gunteri* (COLE). Here the lateral distribution of foraminifera is highly variable in time and space and does not exceed 5 specimens/10cm^2. Below a salinity of about 6-7 ‰ foraminifera are lacking.

Keywords: Foraminiferida, Baltic Sea, Pomerania, Holocene, brackish water.

Pleistocene climatic history reflected in planktonic foraminifera from ODP Site 1073 (Leg 174A), New Jersey margin, NW Atlantic Ocean

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Site 1073 (ODP Leg 174A), located on the continental slope offshore New Jersey, NW Atlantic Ocean (39°13.5214'N, 72 °16.5461'W; 639 m water depth), recovered a thick (519.8 m) Pleistocene sequence dominated by clays, silty clays, sandy muds, and muddy sands. Planktonic foraminifera (>150 µm) were studied in detail from 0-519.8 mbsf (Pleistocene) and their abundances were compared with published records of oxygen isotopes, percentage of calcium carbonate, and coarse sediment fraction data in order to reconstruct the Pleistocene climatic history of the region. Six planktonic taxonomic groups dominate the total foraminiferal assemblage at Site 1073: *Neogloboquadrina pachyderma* (d) (mean 33.8%), *Turborotalita quinqueloba* (18.5%), *N. pachyderma* (s) (18.4%), *Globigerina bulloides* group (11.4%), *Globorotalia inflata* group (9.4%), and *Globigerinita glutinata* (4.1%).

N. pachyderma (s) displays seven peaks of abundance (labelled Nps1-7) which correlate, for the most part, with $\delta^{18}O$ increases, decreases in calcium carbonate percentages, increases in coarse fraction percentages, and low *N. pachyderma* (d) abundances. These intervals are interpreted as representing cooler/glacial conditions. *N. pachyderma* (d) displays eight peaks of abundance (Npd1-8) which correlate, for the most part, with depleted $\delta^{18}O$ values, increases in calcium carbonate percentages, low coarse fraction percentages, increased planktonic fragmentation (greater dissolution), and low *N. pachyderma* (s) abundances. These intervals are interpreted as representing warmer/interglacial conditions.

Abundances of *N. pachyderma* (s and d) identify three intervals of varying relative sea surface temperature (SST): Interval III (310-510 mbsf) (coldest), Interval I (0-83 mbsf) (intermediate) and Interval II (83-510 mbsf) (warmest). Relative SST changes are represented by abundances of *N. pachyderma* (d) - *T. quinqueloba* - *N. pachyderma* (s) (proceeding from warmest to coolest SST respectively).

Six peaks/peak intervals of *G. bulloides* abundance (Gb1-6) are matched by peaks in *G. glutinata* (Gg1-6) and occur within Oxygen Isotope Stage (OIS) 2 (upper part) 3, 5, 8, 9 (upper part), 11 and 13(?). We speculate that these intervals reflect increased upwelling during both glacials and interglacials. Eight peak intervals of *G. inflata* (Gi1-8) which occur within the Pleistocene section may reflect lowered nutrient and warmer surface waters.

Keywords: planktonic foraminifera, palaeoclimatology, Pleistocene, New Jersey margin, Atlantic

Nannofossil Group

Firstly, I should inform you that Ben Walsworth-Bell has taken up a post-doctoral position in the University of Milan, and feels that he can no longer serve the group to the best of his ability. He has consequently stepped down, while I have taken up the reigns.

Secondly, a meeting scheduled for mid-September is in preparation and will be held in London (UCL or NHM). Proposed subjects for presentations will range from extant coccolithophore studies to the importance of nannoplankton in the understanding of high-frequency climate cycles, to Mesozoic climates. Although somewhat isolated from 'the field' here in the metropolis, a one day trip to the Gault Clay is also planned.

If anyone would like to submit titles for posters or talks, please send them to me (c.street@ucl.ac.uk) or Jackie Lees (j.lees@ucl.ac.uk). We particularly call upon our industrial colleagues to attend to rejuvenate the link between academia and the industrial world. Any other members of the BMS who would like to join us, or would like to be kept abreast of nannofossil group activities, please e-mail me.

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Ostracod Group

Things have been fairly quiet on the Ostracod Group front since our last report, largely due to the fact that our customary Spring Fieldtrip (this time, to Yorkshire) had to be postponed due to the onset of Foot and Mouth disease. It is now hoped that the trip, which will take in several classic coastal sections (including Upper Jurassic clays, the Lower Cretaceous Speeton Clay, Upper Cretaceous Chalks and the Quaternary Bridlington Crag) can be rescheduled to September (the ongoing F&M situation permitting). Interested participants should contact either myself or Ian Slipper for further details.

Otherwise, we are pleased to report that there will be a strong British contingent venturing out to Shizouka, Japan for the 14th International Symposium on Ostracoda (July 27th-Aug 8th) this year. Papers being presented include:

I. Boomer, U. von Grafenstein, F. Guichard & S. Bieda: The distribution of modern and Holocene Ostracoda (Crustacea) in the Caspian Sea.

D.J. Horne: Homology and homeomorphy in ostracod limbs.

D.J. Siveter, S.E. Gabbot, R.J. Aldridge & N.J. Theron: The earliest myodocopids: ostracods from the late Ordovician Soom Shale lagerstätte of South Africa.

I.J. Slipper: Ostracod diversity and sea-level changes in the Late Cretaceous of Great Britain.

R. Smith & T. Kamiya: The ontogeny of the entocytherid ostracod *Uncinocythere occidentalis* (Crustacea).

R.C. Whatley, S. Ballent & J. Szcechura: Tertiary progonocytherids: *Majungaella* Grekoff, the last genus of a long lineage.

We wish everyone a safe journey and plenty of good sushi!

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Palynology Group

Acritarch and marine microflora discussion meeting, University of Sheffield, Wednesday 21st March 2001

The Palynology Group's first meeting for several years was held at the University of Sheffield in March. Ken Dorning hosted this successful event that brought together members from across the U.K. and as far afield as Eire and Norway. The twenty-five people who attended came from various universities, oil industry operating companies and service companies.

The morning session dealt mainly with dinoflagellates. Martin Head (University of Cambridge) began proceedings with his talk entitled, "Dinoflagellates and hydrography of the SW Baltic during the last interglacial (Eemian, ca. 130ka)". Rex Harland (Dinodata Services) and K. Grosfjeld (Geological Survey of Norway) reported, "The distribution of dinoflagellate cysts from inshore areas along the coast of southern Norway (from Kragero to Kristiansand)". Paul Dodsworth (University of Sheffield, current address Ichron Ltd.) gave the first of three presentations dealing with phytoplankton changes across postulated faunal mass extinction intervals, "Palynology of the Cenomanian-Turonian boundary succession in Crimea, Ukraine". We broke for lunch at the University's '197 Club'.

The afternoon session was devoted to acritarchs. Dan Fiucane and Ken Higgs (Univerisy of Cork) discussed, "Microphytoplanktonic decline in the Devonian-Carboniferous boundary beds at Riescheid, Northern Rheinisches Schiefergebirge, Germany". Dave Gelsthorpe (University of Leicester) spoke about, "Microplankton changes across a mass extinction interval: preliminary results from the Early Silurian Ireviken Event". The meeting then changed to a less formal format of discussion sessions. Gareth Hughes (Univerity of Cork) outlined his doctoral research undertaken to date and his plans for future work, "Biostratigraphic correlation of the new Devonian timescale using palynology". Ken Dorning (Pallab Research) initiated debate on anomalous high recovery of acritarchs in the Tremadoc and their extensive stratigraphical and geographical reworked distribution. Craig Harvey (University of Sheffield, current address Ichron Ltd.) summarised his doctoral research on the Devonian Campo Chico Formation in Venezuela, leading to debate on palaeogeographic floral realms and the identification of marine incursions in predominantly terrestrial environments. Ken Dorning and Craig Harvey initiated a discussion on the importance of acritarch size in taxonomy and the problems of standardising sieve mesh size in studies of samples. Ken Dorning continued discussion on biozonations in general with reference to specific Silurian acritarch schemes in the Welsh Basin. Dave Gelsthorpe threaded together a lively debate on acritarch morphology and its possible functions.

The Palynology Group was joined by a number of other geologists for the Sorby Geological Forum lecture by former Sheffield graduate Jason Hilton (Scottish Museum) who spoke about, "Strange things from Chinese coal seams; a guided tour of the coal swamp plants of China and their significance". Both groups retired to the 'Red Deer' for refreshments.

The next Palynology Group meeting, possibly to be held at the Natural History Museum in London, will take place in early 2002.

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Silicofossil Group

One of the sunniest days in May saw the second meeting of the Silicofossil Group held at UCL Environmental Change Research Centre. It was kindly organised by Cathy Stickley (UCL) and convened by Cathy and myself. We also shared the chairing of the meeting, which was well attended by diatom specialists. I was surprised to see so few representatives/ contributors from other siliceous groups and also industry. Alex Mitlehner (Harwich School Geography Dept) kicked off the first section with a whistle stop tour of the Early Cretaceous to Holocene diatom distribution in NW Europe. Much of this was based on his postgraduate research unravelling the taxonomic complexities of the North Sea Palaeogene. Alex has also provided the key to understanding the complex taxonomy of these diatom rich sediments, but workers in industry have yet to fully embrace his results, possibly due to the commercially sensitive nature of their data. Alex outlined diatom development due to the evolving situations within the Earth's atmosphere/environments from the Early Cretaceous. Changes were related to prolonged episodes of nutrient enrichment or eutrophication with a fundamental shift in composition occurring in Eocene, which saw the changeover from “Greenhouse” to thermohaline circulation, concurrent with the isolation of Antarctica and the stepwise cooling of the poles being more marked during the Miocene. Further, more recent cooling occurred, leading to enhanced diatom production during vigorous upwelling and glacial maxima. Alex left us with the thought that future atmospheric greenhouse forcing should cause roughly synchronous global temperature changes. Antarctic diatoms provided the focus for the next three talks. Claire Allen (Cardiff University) in her second year of PhD study presented on *Eucampia antarctica* from the Southern Ocean. Differences in morphology and distribution of this taxon can probably be related to environmental changes. The basic shape differences used were; the termination of processes, which may be flat or pointed; the level of symmetry of shape (ranging from asymmetrical to symmetrical) and the aspect ratio. The latter feature appears to be related to glacial maximum populations restricted by size with abundances possibly additionally related to the proximity of glacial ice sheet. Symmetry levels were related to temperature. Cumulative distribution patterns of these features should allow Claire to unravel changes that have occurred in the Weddell Sea and Southern Ocean over the recent past. *Thalassothrix* diatom mat development theory also seems to be an area of flux, with two authors using monospecific distribution sets from the Weddell Sea/ East Antarctic areas for distinguishing environmental changes related to oceanic regimes and/or glacial front movements. Ivo Grigorov (from Southampton Oceanography Centre) gamely allowed me to move his talk forward with no notice. He discussed *Thalassiothrix antarctica* diatom mats from laminated cores from the Southern Ocean, ODP Leg 177. The cores, which even to the naked eye are differentially laminated, were analysed using SEM and optical techniques. This was to test the potential of using *Thalassiothrix antarctica* lamina successions to study rates of deposition, which in the end appear to be reflected as annual couplets or triplets. Such patterns also infer exceptionally high local pelagic sedimentation rates of 50-80 cm kyr^{-1}, implying that deposition to the sediments may have been much higher than previously suggested. Ivo also showed that whilst *Fragilariopsis kerguelensis* is the dominant species from ocean waters an analysis of the *Fragilariopsis*/*Thalassiothrix* ratio from deposited sediments indicates that the

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latter is the basic opal depositor. Jenny Pike (Cardiff University) also discussed *Thalassiothrix* diatom mats, this time from the Holocene of the East Antarctic Margin. She indicated that there are two methods presently cited for production of *Thalassiothrix* diatom mats concentrations. These either relate to concentration and sinking along major oceanic fronts, or secondly to “Fall Dump” which is due to concentration at a seasonal thermocline/pycnocline and subsequent deposition as stratification breaks down, However, Jenny thinks there may be another hypothesis specifically for this part of the Antarctic Ocean, as neither of the previous mechanisms can be invoked. Instead, she suggests that the cyclical repetition of centimetre-thick layers may potentially be related to the dynamics of ice sheet edge movements. Although this is a preliminary finding, she is sure that such distribution patterns can be used for global warming/cooling indications. Richard Telford (Newcastle University) presented his experiences of web teaching/instruction which have arisen due to some of the inherent difficulties in conveying diatom taxonomy to Geography students. Problems range from students who may have had precious little experience using microscopes, to problems with being able to judge whether a student has grasped the basics of taxonomy. The basic premise is that this package can be used interactively to introduce terminology and basics of species identification. The package invites users to measure, identify and finally count diatoms. The beauty of this type of teaching aid is that the student’s response has to be correct before being allowed to moving on (hopefully in such a way as not to dampen enthusiasm; by electric shock perhaps?), and also their progress can be fairly accurately monitored. Richard has kindly agreed to put this package up on the web for people to inspect and possibly use or adapt (www.staff.ncl.ac.uk/r.j.telford/diatoms/). During one of the intervals I initiated a discussion on the state of funding for siliceous groups within Earth Sciences. This led to a lively discussion on the relative success of diatom workers in attracting funding, whilst other siliceous groups appear to be languishing. Fundamental reconnaissance and taxonomic research is still much required for both diatom and radiolarian groups, but these topics in themselves are apparently unpalatable to funding bodies. It is obvious that in order to attract a higher level funding these basic requirements for research should be tied into more integrated topics. The day was wrapped up by Jenny Pike and the wine and nibbles provided by the BMS provided the impetus for further discussion about funding and siliceous groups, although as a radiolarian worker I felt a tad outnumbered!

John Gregory
Kronos Consultants
and the Natural History Museum

Abstracts from Group meeting, 24th May 2001

From the Greenhouse to the Icehouse - and back? Diatoms and climatic change since the Early Cretaceous

Alexander G. Mitlehner

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Diatoms are today the most abundant and diverse group of algae, occurring in both marine and freshwater environments. Planktonic species predominate in the oceans, although marine benthonic species have a longer fossil record, extending back to at least the Lower Cretaceous.

The earliest record of truly planktonic

diatoms occurs in the Campanian, when the group as a whole expanded rapidly, possibly in response to prolonged episodes of nutrient enrichment or eutrophication. Diatom resting spores - an adaptation to adverse environmental conditions- also appeared. These show a marked increase at the K-T boundary, although the group as a whole shows no great extinction crisis, with 84% of species surviving into the Danian. Assemblages show gradual changes during the Palaeocene, but a fundamental shift in composition occurred by the Eocene, and non-marine diatoms appeared for the first time in the Western Interior Basin of North America. Marine assemblages expanded rapidly at this time, with marked provincialism of assemblages between basins occurring for the first time. This signifies the changeover from "Greenhouse" to thermohaline circulation, concurrent with the isolation of Antarctica and the stepwise cooling of the poles. During the Miocene this differentiation became more marked when upwelling episodes became more firmly established, and a further rapid expansion in new diatom taxa is related to this process. Further cooling occurred during the Pliocene and through the Quaternary, when episodes of vigorous upwelling during glacial maxima are indicated by enhanced diatom production. Recent research suggests that further switches in ocean circulation may have triggered these periods of ice advance and retreat, and that any future atmospheric greenhouse forcing should cause roughly synchronous global temperature changes.

Palaeoceanographic significance of diatom-rich sediments in the Southern Ocean.

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Diatom-rich sediments have recently proved to be effective indicators of past oceanic conditions. High sedimentation rates permit high-resolution reconstructions of palaeoceanographic parameters based on quantitative palaeoecological studies of diatom assemblages. Studies of this nature have been successfully carried out throughout the world's oceans including the Mediterranean Sea and the Gulf of California. The diatom ooze belt of the Southern Ocean provides a setting for comparable studies which will provide a detailed account of oceanic variability since the Last Glacial Maximum.
The cores used in this study cover a range of high latitude oceanic environments and span from the Falkland Trough, through the Scotia Sea to the western shelf of the Antarctic Peninsula. Sedimentation rates are typically between 10-30cm/ka affording the potential for high-resolution palaeoecological analysis. Diatom ooze layers of varying thickness, texture and species composition have already been recognised during initial sedimentological analysis. Detailed assemblage data will be collected and examined within the broader context of Southern Ocean stratigraphy. The spatial and temporal setting of the cores should allow the oceanic regimes of the region to be determined on annual to millennial time scales. It is hoped that this study will document the time transgressive nature and dynamic character of oceanic zones within the Southern Ocean. It will also promote understanding of the communication links between different ocean masses and the feedback mechanisms operating between atmosphere and oceans during the climatic shifts of glacial-interglacial cycles. Preliminary results will be presented and discussed.

***Thalassiothix* diatom mats from Holocene East Antarctic Margin Sediments**

Jennifer Pike [1], Amy Leventer [2], Caroline Olsen [2] and NBP0101 Shipboard Scientific Party

[1] Department of Earth Sciences, Cardiff University, PO Box 914, Cardiff, Wales, CF10 3YE, UK
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Thalassiothrix Cleve & Grunow is a genus of cosmopolitan pennate diatoms that are widespread in the marine environment. Tropical and subtropical regions tend to be dominated by *T. longissima* Cleve & Grunow, whereas the high southern latitudes *T. antarctica* Schimper ex. Karsten becomes more important. This genus of diatoms is characterised by the tendency of the diatoms to form almost mono-specific, tangled, mesh-like mats that are sedimented intact to the seafloor. These mats are important to global biogeochemical cycling because they export a large volume of organic carbon to the seafloor and, when they reach the seafloor, act to subjugate burrowing organisms and further enhance carbon and silica burial.

Two mechanisms exist in the literature to account for large accumulations of *Thalassiothrix* diatom mats in the geological record. The first mechanism invokes concentration and sinking along major oceanic fronts, and the second mechanism involves concentration at a seasonal thermocline/ pycnocline and subsequent deposition as stratification breaks down (the “Fall Dump”). During a recent (February-March 2001) cruise to the eastern Antarctic margin, a suite of cores were recovered that showed cyclical repetition of centimetre-thick layers of *Thalassiothrix* mats throughout the Holocene. Ship-board stratigraphy indicates these cycles are regional in extent and suggests they are centennial in occurrence, however, it seems difficult to apply either of the two known mechanisms of formation of sedimentary *Thalassiothrix* mat layers to these deposits. This talk will present the initial results of an investigation into these potentially unique Antarctic deposits, dominated by *Thalassiothrix* diatoms.

Teaching diatom identification on the web

Richard Telford

Geography Department, Newcastle University, Newcastle-upon-Tyne NE1 7RU, UK
www.staff.ncl.ac.uk/r.j.telford/diatoms/

Students (and others) find a microfossil identification a difficult skill to lean. This can result in poor quality data for student projects, especially class projects when data is combined. Traditional methods teaching methods are not always successful: there is insufficient time; all the terminology is new; the names are in Latin and students lack practice using microscopes.

This talk presents a internet-based skills aquisition tool that can be used to help teach diatom identification. After introducing the terminology and the species, the package invites users to measure diatoms, identify diatom and finally count diatoms. It can be easily modified to deal with other taxa.

Southern Ocean laminated diatom ooze: potential for palaeo-flux studies, ODP Leg 177, Site 1093.

Ivo Grigorov, Richard B. Pearce & Alan E. S. Kemp

School of Ocean and Earth Science,

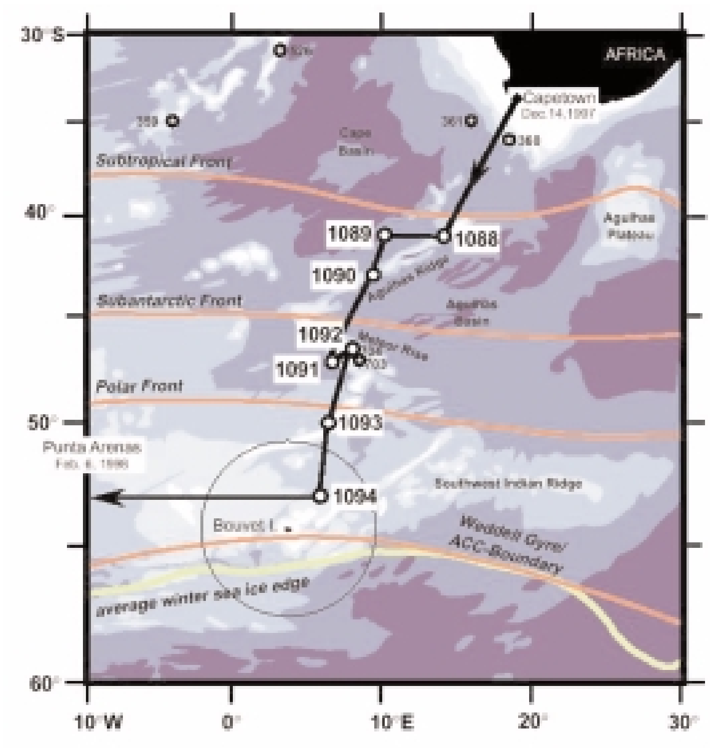

Fig. 1 Location of ODP Leg 177 transect in relation to the major oceanic fronts (Shipboard Scientific Party, 1999)

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Laminated diatom ooze samples, collected during ODP Leg 177, are analysed using SEM and optical techniques in order to test their potential as high resolution records of Polar Front hydrography, surface production and export flux. SEM analysis from two intervals, MIS 29 and the MIS 12/11 transition, recovered from ODP Site 1093 (50^{o}S)(Fig. 1), show abundant and well preserved *Thalassiothrix antarctica* diatom mats, thought to be indicative of rapid surface export and deposition on the sea bed. A preliminary analysis of lamina successions indicate possible annual lamina couplets or triplets, which infer exceptionally high local pelagic sedimentation rates of 50-80 cm kyr^{-1}. Such high accumulation rates imply that local export from the surface layer and sequestration of biogenic silica and organic matter to the sediments may have been much higher than previously suggested.

Reference

Shipboard Scientific Party, 1999. Leg 177 Summary: Southern Ocean Palaeoceanography. In Gersonde, R., Hodell, D.A., Blum, P. *et al.*, 1999. *Proceedings of the Ocean Drilling Program, Initial Reports, vol. 177*. College Station, TX (Ocean Drilling Program). 1-67.

On the Quaternary hydrological structure of the Sea of Okhotsk by radiolarian data

(not presented at meeting)

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The radiolarian assemblages were analysed in 4 sediment cores obtained in the Sea of Okhotsk in 1996-1998 by the Russian-German expeditions within frame of KOMEX Project (Kurile Okhotsk Marine Experiment). An age model of the recovered Quaternary sediments is controlled by the litho- and biostratigraphic parameters, and by the oxygen isotope data. The radiolarian records allow us to speculate about the Quaternary palaeoceanography of the Sea of Okhotsk. By the recent planktonic and sediment data, radiolarian species *Cycladophora davisiana* may be an indicator of the upper intermediate water of the Sea of Okhotsk (SOIW) distributed at the depths 200-600 m with the potential density 26.8-27.0, uniform temperature 1-2 (C and salinity 33.3-33.8 ‰ (Abelmann *et al.*, 2000). Hence the high content of *C.davisiana* in the glacial sediments (as a rule higher compared to the Late Holocene) must be a signal of the intense production of the glacial SOIW, i.e. large ventilation of the glacial Sea of Okhotsk on the intermediate depths. From the analysis of the Quaternary variations of *C.davisiana*, SOIW production exhibits a possible analogy of the modern and glacial states of the Sea of Okhotsk. A serious difference of the glacial Sea of Okhotsk from the modern one is reflected in the glacial radiolarian assemblages by the high abundance of species *Stylochlamydium venustum, Nephrospyris*? sp., and some other being typical for the modern Bering Sea and the northernmost subarctic Pacific. The sediment trap study in the North Pacific and the southern Bering Sea shows the greatest fluxes of these species in spring and autumn (Takahashi, 1997), before maintenance and after elimination of the seasonal dichothermal structure when the convection penetrates the entire upper layer. From these data one may conclude that the high abundance of the above-mentioned species indicates the environments in the strongly mixed layer above the principal halocline with the uniform temperature (1-3 (C) and salinity (33-33.2 ‰). By radiolarians, during the Pleistocene glaciations in the upper 500-660 meters of the Sea of Okhotsk could exist as two layers with uniform hydrological parameters. On the depths 0 to 150-200 m was a layer of remarkable mixing with temperature <3 (C and salinity <33.2 ‰. As in the modern Bering Sea, an interannual magnitude of the sea surface temperature fluctuations was not large (<7 (C). At depths from 200 to 500-600 m the layer of water was identical to the modern upper SOIW with the temperature 1-2 (C and salinity ca. 33.5 ‰. Probably, the temperature difference of both layers was insufficient, and the dichothermal structure in the upper layer appeared weakly. The boundary between layers may have served the “narrow” halocline, which did not create the great density gradient and, therefore, did not prevent the formation of the intermediate water. The recent interglaciation (Late Holocene) of the Sea of Okhotsk appears unique by the radiolarian distribution and has no analogues during the last 350 kyr. The modern SOIW production is exhibited in the moderately high abundance of *C.davisiana* in the radiolarian assemblages. A peculiar radiolarian fauna indicates the general structure of the upper several hundred meters of the water column: strongly stratified (dichothermal) layer within depths 0-200 m, and relatively homogenous intermediate layer within depths 200-500 m. A specific distinction of previous interglacial optima during the last 350 kyr is the dominance of species *Amphimelissa setosa* in radiolarian assemblages. It is the most typical species in the modern radiolarian fauna of the Greenland Sea, and indicates the cold Arctic surface water with the lower summer surface temperature and higher summer surface salinity than in the Sea of Okhotsk. Moreover, the Greenland Sea is an area of the intensive convection in the upper layers of the interacted Polar, Arctic, and North Atlantic waters, which causes the weak vertical water stratification. One may conclude, that during the interglacial optima, when *A. setosa* dominated, the surface waters in the Sea of Okhotsk could have lower summer temperature and higher summer salinity than now. Probably, the sharply expressed dichothermal structure of the Okhotsk type was not formed, and the water layer above the intermediate one was well mixed. As for SOIW, its formation was possible during the substages 7a-c, 7e, and 9a-c judging from the high abundances of *C.davisiana*. However, during the last interglacial optimum (the substage 5e) the SOIW production has been strongly reduced or even eliminated, because *C.davisiana* content decreased down to several percent as in the modern subarctic Pacific where intermediate water is not formed. It is evident from the higher content of typical Pacific boreal species, that on the environments of last interglacial optimum in the entire Sea of Okhotsk influenced the warmer waters of the North Pacific. During the other optima such influence was far weaker. All interglacial optima in the range of the studied time interval were short enough, and for the most part even oxygen isotope stages did not differ from the glaciations.

Micropalaeontology News

Successful Masters Theses on Foraminifera

The BMS Foraminifera Group would like to congratulate three University College, London students who have successfully completed their M.Sci. theses on the subject of Foraminifera.

Matthew Box wrote a thesis on the subject of Holocene benthic foraminifera from the Sea of Marmara, supervised by Mike Kaminski & Ali Aksu (Memorial University of Newfoundland). Studies of benthic assemblages from three piston cores record the bottom water history of the Marmara Sea since the last ice age.

Lucy Burn (M.Sci. Geology) wrote a thesis entitled “The Phanerozoic Diversity of Agglutinated Foraminifera”. Lucy constructed a database of stratigraphic ranges of the agglutinated foraminiferal genera based on the work of Loeblich & Tappan (1987) and later authors. Diversity, extinctions, and originations of the genera were plotted against the new geological time scale.

Rhiannon Davis (M.Sci. Paleobiology) travelled to Gubbio to sample the uppermost Maastrichtian in the Bottacioni Section. Her study of the agglutinated foraminifera in acid residues, supervised by Mike Kaminski & Rodolfo Coccioni (Univ. of Urbino), demonstrated that a surprising amount of faunal change occurred within the 2 metres below the K/T boundary. The faunal changes within the K/T boundary interval are by no means abrupt.

We extend our hearty congratulations to all the masters students who have been successful with their projects.

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News from the USA

Marie-Pierre Aubry has been appointed Professor of Stratigraphy in the Geology Department at Rutgers University effective 1 January 2001; Bill Berggren will be Distinguished Visiting Professor in the same department. Together they hope to enhance the already active program in basic and applied micropalaeontology which has characterised the department for many years.

There is an active program of drilling on the New Jersey-Maryland Coastal Plain and shallow offshore run by Ken Miller (currently department chair). Micropalaeontology has played an integral/significant role in this program in dating stratigraphic sequences and sequence boundaries (M.-P. Aubry, R.K. Olsson) and providing information on palaeoenvironments and palaeodepth histories (Mimi Katz). This program is continuing and now includes further micropalaeontological input from Pete McLaughlin (formerly Exxon-Mobil; now at the Delaware Geol. Survey).

Future Plans for Marie-Pierre Aubry include the tying of the shallow marine and deep sea records with emphasis on the origin of deep sea unconformities and their relationship to those on margins; the continuation of the taxonomic revision undertaken for Cenozoic calcareous nannofossils and now extended to the Mesozoic taxa with a view to stabilise generic assignments and synonymies (and to address evolutionary processes in the calcareous nannoplankton); and the establishment of a stratigraphic index for

Cenozoic calcareous nannofossils. Of particular interest for micropalaeontologists is the new availability at Rutgers University of a reference collection for Cenozoic calcareous nannofossil assemblages from many regions of the world. The information in this collection is in the process of being compiled using CompuStra, a remarkably performant Database manager available through Micropaleontology Press.

They are currently jointly involved in studies of the Palaeocene-Eocene sections of the Upper Nile Valley (Egypt) with a view to establishing a Global Boundary Stratotype Section and Point (GSSP) for the P/E boundary. This program integrates biostratigraphy, palaeomagnetics, stable isotopes, sedimentology and cyclic stratigraphic analysis, and involves a team of Rutgers-Woods Hole and European geologists. It is conducted with the Geology Department of the University of Assiut (Egypt). Bill Berggren is involved in a group effort on the part of the Working Group on Palaeogene Planktonic Foraminifera in preparing an Atlas of Eocene Planktonic Foraminifera similar/ comparable to the Palaeocene Atlas published in 1999.

For more information, please see the Rutgers University Department of Geology website at http://www-rci.rutgers.edu/~geolweb/

Rachel Preece
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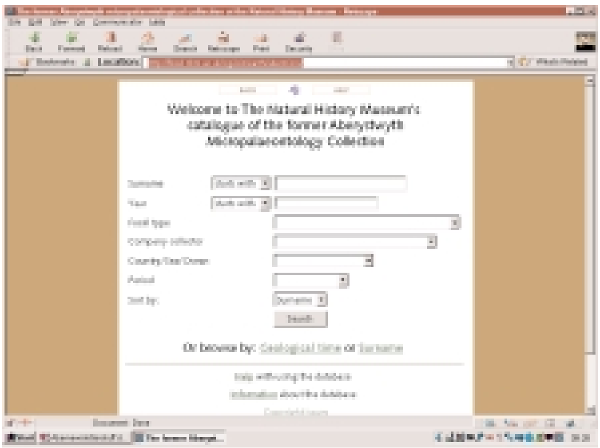
Catalogues of two important collections at The Natural History Museum go on-line

The Former Aberystwyth Collection

In the last edition of the *Newsletter of Micropalaeontology* (No 63), John Whittaker reported that the M.Sc., Ph.D. and research micropalaeontological collections previously housed at Aberystwyth University, have now been transferred to the Natural History Museum, London. We are pleased to announce that a catalogue of this collection is now available on the Museum website at:

http://www.nhm.ac.uk/palaeontology/micro/collections/aber/abermicro.html
Searches of the database can be made by requesting one or more of the following criteria: surname, year, fossil type, company collector (eg BP, Shell, ODP), country/sea/ocean, or Geological Period. The database can also be browsed by the first letter of a surname or by Geological Time based on any unit given in the Gradstein and Ogg (1999) timescale:

Successful searches will provide a list of one or more possible matches arranged by surname along with dates and title of the collection. By selecting an underlined



surname on the list, all data for an individual collection will be displayed. This information includes the year, student/researcher status (eg M.Sc., Ph.D.), fossil type, information about the collector (eg if material was collected by BP, Shell, or ODP), the title of the collection and an indication if we hold the thesis and/or record files for the collection. Geographical and stratigraphical information is also given for the collection.

A guide to searching the database is included as a link on the front page. The database, particularly the "Associated publications" section, is currently being expanded. If you know of any additional information that could be added then please contact Giles Miller at the address below:

Dr Giles Miller
Department of Palaeontology
The Natural History Museum
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The Former BP Micropalaeontology Collection.

In 1991 BP donated to The Natural History Museum their Micropalaeontological Collection. This collection has an extensive geographical and stratigraphic coverage and is a record of BP's exploration activity since the 1950s.

The Collection has subsequently been curated and catalogued and we are now pleased to announce that a major part of the Collection is available online as a searchable database.

The database hold details of material from over 3,500 individual well runs. The collection includes micropalaeontological assemblage slides and residues; palynological slides and residues and nannofossil slides from wells and outcrop from over 120 countries world-wide:

Mediterranean:
Italy , Greece, Sicily, Turkey, Malta, offshore Adriatic.

North West Europe:
Netherlands, onshore and offshore U.K., offshore Norway, Germany, Austria, Spain, Luxembourg, offshore Ireland, Poland, Switzerland, Denmark, Sweden, Belgium.

Central and South America:
Colombia, Ecuador, Brazil, Venezuela, Peru, Bolivia, Mexico, Guatemala, Honduras, Chile.

West Indies area:
Trinidad, Jamaica, Barbados, Antigua, Haiti, Cuba, Bahamas, Puerto Rico, Dominican Republic.

Pacific and North America:
Arctic, Alaska, Canada, Newfoundland, Greenland, U.S.A. (California and Texas).

North Africa:
Libya, Tunisia, Morocco, Algeria, Canary Islands.

West Africa:
Nigeria, Guinea Bissau, Namibia, Gabon, Congo, mid Atlantic (St. Helena).

East Africa:
Tanzania, Somalia, Kenya, Madagascar, Mozambique, Ethiopia.

South East Asia:
Fiji, Papua New Guinea, China, Indonesia (Sumatra, Java, Borneo, W. Irian Jaya), Malaysia, Philippines, Thailand, Vietnam, Guam, Tonga.

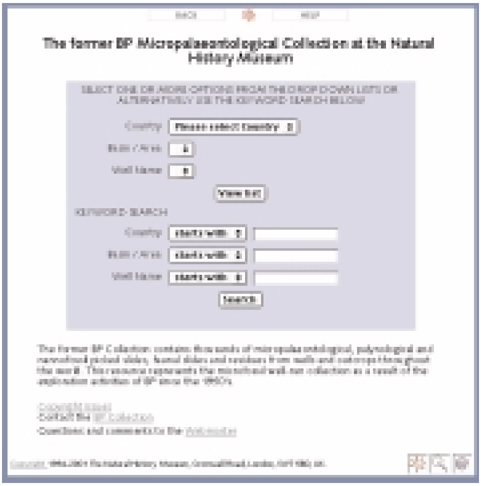
Middle East and surrounding areas:

Egypt, Abu Dhabi, U.A.E., Kuwait, Pakistan, Yemen, Oman, Iraq, Qatar, Israel, India, Iran, Syria, Jordan.

Australasia:
New Zealand, Australia.

The collection is available for study by all interested parties, subject to some restriction and has been utilised previously as a source for a diverse range of academic and commercial research as well as student projects. The present curator of the BP collection is Jayne Dunn.

The searchable database is available on the Museum website at:
http://www.nhm.ac.uk/palaeontology/micro/collections/bp/bp.html



Please e-mail BP-Collection@nhm.ac.uk for details and additional information.

Photo Gallery

To accompany the picture of a cluster of *Thalassiosira antarctica* on the front cover, Claire Allen (Cardiff Univeristy) provides some pictures to demonstrate the intraspecific variation seen in this species of diatom. If you have any favourite photographs that you would like to see included in the Newsletter, please send them to me.

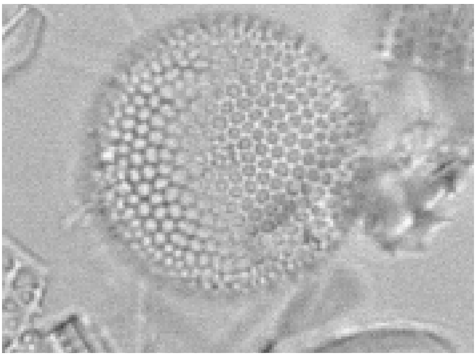
Jenny Pike
<pikej@cardiff.ac.uk>

Thalassiosira antarctica

Claire Allen
<claire@ocean.cf.ac.uk>

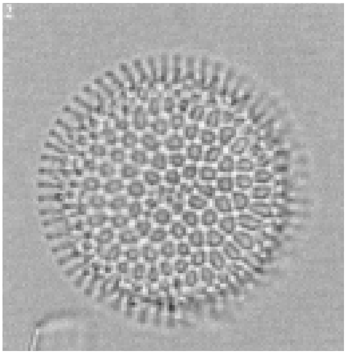
Morphological differences in the marine diatom *Thalassiosira antarctica* are shown. Common throughout the Southern Ocean, these varieties have been tentatively linked to cold and warm water environments. The cold water form is found to dominate in the Ross Sea whereas in the open ocean and Antarctic Peninsula region the warm water form is common.

Figure 1: *Thalassiosira antarctica* (Ross Sea - cold water form).
Collected: Mouth of the Falkland Trough, NW of South Georgia (52º09'S, 41º11'W). Water depth = 3760 m. BAS core KC073, sample depth in core = 212cm below sea floor.



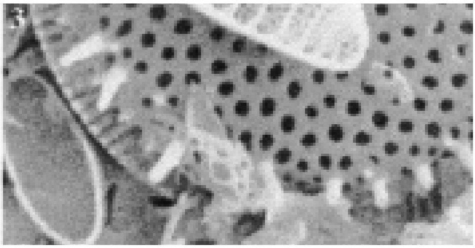
Approx. 10µm

Figure 2: *Thalassiosira antarctica* (warm water form)
Collected: Mouth of the Falkland Trough, NW of South Georgia (52º09'S, 41º11'W). Water depth = 3760 m. BAS core KC073, sample depth in core = 76 cm below sea floor.



Approx. 10µm

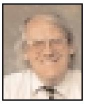
Figure 3: Scanning electron microscope image showing the detail of the marginal rings of strutted processes as seen on the warm water form.



A Challenge: are the *T. antartica* on the front cover the warm or cold morphology of this species?

Rogues Gallery

Ever wondered what your Officers and Group Representatives looked like??



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Jenny Pike
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Rachel Preece
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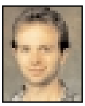
Webmaster



Andrew Henderson
Foraminifera Group Chair

Norman MacLeod
Foraminifera Group
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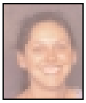

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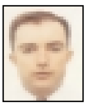
“...a man of mystery”



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Forthcoming Meetings

INTERNATIONAL SCHOOL ON PLANKTONIC FORAMINIFERA

Dipartimento di Scienze della Terra, University of Perugia (Italy)

1° course
CRETACEOUS PLANKTONIC FORAMINIFERA
18-22 February 2002

Prof. Isabella PREMOLI SILVA
University of Milano

The course will include lectures (taxonomy, biostratigraphy and paleoceanography) on Cretaceous planktonic Foraminifera and practical sessions studying washed assemblages and thin sections.

Correspondence and for information contact:
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http://www.unipg.it/~denz/

*6*th *INTERNATIONAL WORKSHOP ON AGGLUTINATED FORAMINIFERA*

The 6th IWAF is to be held at the Charles Univeristy in Prague, 1st - 7th September 2001

LECTURES

A. G. Al-Dhubeeb: to be announced
A. Almogi-Labin: Recent agglutinated foraminifera from the SE Mediterranean, off Israel.
V. Balík: Investigations on Testacea in the Czech Republic teritory: History and present knowledge.
A. Bartakovics: Neogene agglutinated foraminifera from Vienna Basin (Slovakia).
G. M. Andersen Bremer: Foraminiferal stratigraphy at the Jurassic/Cretaceous transition reflecting the Mjolnir impact (Barents Sea).
M. Bubík: Cambrian to Ordovician Foraminifera of the Barrandian area.
R. Coccioni: Spiroplectammina in the Umbria-Marche Basin.
S. T. Goldstein: Life cycles and reproductive pattern or on taphonomy and selective preservation.
M. B. Hart: Agglutinated foraminifera of the Lower Cretaceous in the Lusitanian Basin, Portugal.
A. S. Henderson: Agglutinated foraminifera from the Kimmeridge Clay, England.
K. Holcova: Silurian and Devonian foraminifers from the Barrandian area.
G. W. Hughes: Late Permian foraminifera of Saudi Arabia.
R. W. Jones - M. D. Simmons: Palaeoenvironmental interpretation of Lower Cretaceous carbonates, Middle East.
M. A. Kaminski: Phanerozoic Diversity of Agglutinated Foraminifera.
M. A. Kaminski: A revised classification of Agglutinated Foraminifera.
V. A. Krasheninnikov: Agglutinated foraminifera of the abyssal (red clays) Cretaceous sediments of the Pacific and Indian Oceans.
D. H. McNeil: An Atlas of Cretaceous Foraminifera from Western Canada.
D. H. McNeil: The Cretaceous Agglutinated Foraminiferal Record from the Centre of the North American Western Interior.
T. Moorkens: Agglutinated versus calcareous benthic foraminiferal ratios in the Belgian Paleogene, compared with those of the North Sea Basin.
Y. Papin: Bini-organization of animate nature is basement of organic world classification
D. Peryt: Upper Cretaceous agglutinated foraminifers from Central Poland.
V.M. Podobina: Agglutinated foraminifera of Cenomanian-Turonian Boundary in the Northern Hemisphere.
J. Salaj: Agglutinated foraminifera from the flysch of middle Váh walley.
D. B. Scott: The earliest multichambered

foraminifera - marsh-like agglutinated foraminifera from the Cambrian (Nova Scotia, Canada).
C. Schroder-Adams: The Cretaceous Western Canada Sedimentary Basin: A paleoenvironment dominated by agglutinated foraminifera.
M. D. Simmons: Mesozoic “cyclamminids” from the Middle East.
A. Szydlo: Tithonian-Berriasian agglutinated foraminifera of the Polish Outer Carpathians.
O. S. Tendal: Taxonomic position and phylogenetic relationships of Xenophyophora (Protista).
J.Tyszka: Palaeoecology of Albian agglutinated foraminifers (case study).
J. E. Whittaker: to be announced

POSTERS

J. Bielawska: Upper Cretaceous foraminifera from the Subsilesian Unit (Polish Flysch Carpathians).
M. Bubík: Agglutinated foraminifera response to KT boundary event in sub-CCD flysch facies.
M. Bubík: Iconography to the taxonomic revision of the Cretaceous to Paleogene Recurvoidinae of the Alpine-Carpathian realm.
E. Geslin: Vertical distribution (microhabitat) of living (stained) agglutinated foraminifera.
R. Green: Miocene deep water benthic foraminifera from the Gulf of Mexico.
M. Gustafsson: to be announced
K. Holcova - M. Lorencova: Recent thecamoebians from the Sumava Mts. (SW Bohemia).
G. W. Hughes: Late Jurassic - Early Cretaceous agglutinated foraminifera of Saudi Arabia.
G.W. Hughes: Palaeoenvironments of Aptian agglutinated foraminifera of Saudi Arabia.
D. Ivanova - E. Koleva-Rekalova: Agglutinated foraminifers in the framework of the South-western Bulgaria palaeoenvironmental evolution during the Upper Jurassic - Lower Cretaceous.
M.A. Kaminski – The new and reinstated genera of AF published between 1997 and 2000.
W. Machowiak: to be announced
A. Muftah: Agglutinated Foraminifera from Santonian Al Hilal Formation, Northeastern Libya.
S. Newman: Saltmarsh foraminifera as sea-level proxies in western Ireland.
J. Paruch-Kulczycka: Miocene Silicoplacentina (Testacea) from northern part of the Carpathian Foredeep (Poland).
V.M. Podobina - G.M. Tatyanin: The stage of agglutinated foraminifera development during the Cretaceous-Paleogene in Western Siberia.
V.M. Podobina - T.G. Kseneva: Upper Senonian secreted-agglutinated foraminifera of Western Siberia.
R. Preece: to be announced
J. Smole: Lower Cretaceous agglutinated foraminifera from the boreholes of central Poland (biostratigraphy and palaeogeography).
O. S. Tendal: Large overlooked foreminifera: The Schizamminidae.
J. Tyszka: to be announced
A. Waskowska-Oliwa: Assemblages of small foraminifera of Paleocene-Eocene deposits of Subsilesian Unit (Polish Flysch Carpathians).

FIRST INTERNATIONAL PALAEONTOLOGICAL CONGRESS

6-10 July 2002
Sydney, Australia

The First International Palaeontological Congress, sponsored by the **International Palaeontological Association**, and hosted by the **Australasian Association of Palaeontologists** and the **Macquarie University Centre for Ecostratigraphy and Palaeobiology**, will take place in **Sydney on 6-10 July 2002**. It is programmed to follow on from the Australian Geological Congress (30 June-5 July) to be held in Adelaide. Formal sessions of IPC-2002 will take place principally at Macquarie University.

SYMPOSIA will include the following:

1. Global extinction events: abrupt, gradual or polyphase (including chemostratigraphy)
2. Evolutionary palaeoecology, chronofaunas and -floras: is biogeohistory punctuated?
3. Organic-rich facies, faunas and genesis
4. Evolution of the pelagic realm through time
5. Environmental and astronomical records in skeletal materials
6. Early Palaeozoic vertebrate biogeography
7. Permian events
8. Environmental signatures of Cretaceous and Cainozoic floras
9. Palaeozoic communities revisited
10. High precision biostratigraphic alignments
11. Computer biogeography
12. Towards zonation of the Proterozoic
13. Black smoker' and cold seep faunas – past and present
14. Molluscan functional morphology and biogeography
15. Early mammalian evolution
16. Late Cainozoic terrestrial faunas including cave faunas
17. Dinosaur biogeography and palaeoenvironments
18. Trace fossils
19. Living fossils (fauna and flora)
20. Experimental taphonomy. Unusual preservation
21. Spongiomorphs
22. Museums in the 21st Century
23. **Geoffrey Playford Symposium**: studies in palynology and micropalaeontology
24. **Jane Gray Memorial Symposium**: conquest of the land – terrestrialisation

Coupled with the Congress will be meetings of **IGCP 410** ***The Great Ordovician Biodiversity Event: implications for global correlation and resources*** and **IGCP 421** ***North Gondwanan mid-Palaeozoic bioevents/biogeography patterns in relation to crustal dynamics*****.** The Congress will be an appropriate venue for showcasing other activities of IUGS subcommissions on stratigraphy, and IGCP projects with a significant biochronologic focus. Suggestions of associated meetings and workshops, and additional or alternative symposia, are welcome. Associated with the Congress will be a **Symposium in honour of Prof. Geoffrey Playford's** sustained contribution to palynology and micropalaeontology and the **Jane Gray Memorial Symposium** celebrating Jane's lifetime commitment to innovative research.

For the full version of the **First Circular**, containing details about field excursions, special events associated with the meeting and local area and accommodation, visit the IPC-2002 web page:
http://www.es.mq.edu.au/mucep/ipc2002/

Abstract submittal deadline:
1st February 2002

11-13 SEPTEMBER 2002

AASP-BMS-NAMS JOINT MEETING 2002 EXPLORATION BIOSTRATIGRAPHY

University College London

The American Association of Stratigraphic Palynologists (AASP), the British Micropalaeontological Society (BMS) and the North American Micropaleontology Section of SEPM (NAMS) are holding a joint meeting in September 2002 at University College London.

The theme of this international meeting will be recent developments in applied biostratigraphy, and will not be restricted to palynology alone. Contributions will be invited on four main themes:

1. Sequence biostratigraphy.
2. Deep-water exploration.
3. Reservoir/Development studies.
4. Outcrop analogue studies.

The vision for the meeting is to encourage trans-Atlantic exchange of ideas, ultimately to seed new research initiatives. In particular, we aim to develop an integrated multidisciplinary approach in both the academic and industrial realms. There will be no taxonomic or geographical restriction on contributions. Posters will be invited on any micropalaeontological, nannopalaeontological, palynological or biostratigraphical theme.

An open session on post-Palaeozoic palynology is also planned.

Post-meeting excursions are planned to the Dorset Coast (Jurassic - Cretaceous), the Isle of Wight (Cretaceous - Paleogene), Kent and Essex (Paleogene), and Suffolk (Neogene).

The deadline for abstracts and early registration will be 31st March 2002. Expressions of interest should addressed in the first place to the BMS Secretary, address below.

Convenors: Chris Denison (Chevron), Tom Dignes (ExxonMobil), Alan Lord (UCL), David Pocknall (BP Amoco), Jamie Powell (Dinosystems), Rachel Preece (Chevron) and Jim Riding (BGS).

Contact Convenor: Dr James Powell, 105 Albert Road, Richmond, Surrey TW10 6DJ, England, UK
Tel: +44 20 8948 6443;
Fax: +44 20 8940 5917;
Email: ajp@dinosystems.co.uk.

The Book Shelf

If you see a new micropalaeontology-related book and would like to review it for the *Newsletter*, send me all the details - title, authors, publishers, ISBN number - and I'll contact the publishers and get you a review copy. You get the book and the publishers and *Newsletter* get an informative review of the book.

Jenny Pike
<pikej@cardiff.ac.uk>

Book Reviews

Silurian Cycles: Linkages of Dynamic Stratigraphy with Atmospheric, Oceanic and Tectonic Changes

Ed Landing and Markes Johnson (eds)
1998. James Hall Centennial Volume, New York State Museum Bulletin 491, ISSN 0278-3355, ISBN 1-55557-206-5, ix+327pp.

Everything comes in cycles. Dean Martin has recently enjoyed a resurgence of appreciation, and members of my family tell me that even flares can again occasionally be worn without (too much) embarrassment. So it was in the Silurian - anyone looking for long at sedimentation or biotic turnover in rocks of this age can readily discern patterns of repetition at various scales. These simple observations have recently spawned a plexus of explanatory hypotheses, varying from eustatic sea-level changes to climatic oscillations to tectonic pulses, or involving various combinations of these factors.

This burgeoning interest clearly meant that the time was ripe for a get-together to discuss the patterns and their causes, and it was eminently appropriate that Markes Johnson, who has done much over the past decade to publicise and analyse Silurian cyclicity, should be the scientist to arrange the forum for the debate. And so it was that the Second International Symposium on the Silurian System, held at the University of Rochester, New York, in 1996, took cycles as its primary theme. The volume under review documents the science presented in a poster session and workshop on Silurian cyclicity mounted at the Rochester conference, supplemented by a few papers solicited by the editors to 'round out the collection'.

And it is, indeed, a pretty round set of articles. The papers cover all the major themes, and tackle cyclicity at local to global level. There is some variation in quality, but all the contibutors provide something of interest and there is quite a lot of new information. The volume is divided into four parts: Physical evidence for Silurian eustasy, Temporal faunal patterns related to eustasy, Short-term cycles, Isotope studies. As will be evident from these headings, there is an inclination towards hypotheses of (at least partially glacially driven) sea-level cyclicity, but climatic changes and tectonic influences also get a hearing. There is, perhaps, an over-enthusiasm to take the published sea-level curves as established, rather than as hypotheses for testing, with some authors bending backwards almost horizontally to make their data fit the expected pattern; but the discerning reader is usually provided with enough information to draw his/her own conclusions about how good the correspondence really is.

I'm not sure that this newsletter is the place to detail the contents of each paper; suffice it to say that anyone interested in the Silurian biota, Silurian biostratigraphy, and any aspect of palaeo-cyclicity will find this an indispensible volume. What I'm going to do instead is climb onto a familiar hobby-horse and rant about what really strikes me as a micropalaeontologist about this collection of papers - this is, of course, the near-absence of the consideration of any evidence from microfossils.

Actually, this is not strictly true, as ostracods get an occasional mention and conodonts are reasonably well represented, especially in Lennart Jeppsson's summary of his ocean/atmosphere cyclicity model which is primarily based on an analysis of the conodont record (and also, diabolically, in Tesakov *et al.*'s error-strewn contribution on the East Siberian Basin, in which Silurian conodont biostratigraphy is completely re-written in an apparent attempt to make sea-level curves match). But, otherwise, the emphasis is clearly on the invertebrate macrofauna, as a quick glance at the titles of papers demonstrates: they mention graptoloids, cephalopods, gastropods, trilobites and reefs, while a flick through other papers shows that brachiopods continue to be regarded as especially significant. I do not decry the evidence that these elements of the biota undoubtedly provide, but I searched in vain for more than a sideways nod in the whole book to the importance of acritarchs, prasinophyte algae, chitinozoans or scolecodonts. This is not the fault of the symposium organisers, the editors, or the contributors; it's ours. We are surely missing an opportunity here to champion the fundamental import of the phytoplankton, in particular, in reflecting, and probably in influencing, the development of cyclicity in ancient oceans. Sure, it's difficult to interpret the record, but there's a mass of information out there that certainly has something to tell us if we only make the effort to understand it. Having said this, I'm delighted to see that palynologists are now beginning to enter the debate in a major way, as is exemplified by the stimulating recent paper by Dorning and Harvey (1999) on Wenlock cyclicity.

So to a final comment. Another major message that comes through to me from the James Hall Centennial Volume is that the development and testing of our theories on Silurian cyclicity are currently severely handicapped by the limitations of the exisiting framework of biostratigraphical correlation. For example, in the very first paper, Johnson *et al.* present a very interesting approach to testing Silurian eustasy using the burial and erosion of coastal margins, but the results are manifestly marred by the uncertainties and inaccuracies of dating the inundations of rocky shorelines worldwide. Elsewhere, it is evident that difficulties in making accurate correlations between graptolitic and shelly sequences can confuse interpretations. However, we are unquestionably struggling successfully towards a greater understanding of Silurian cyclicity, and open debate on the issues raised in this volume will undoubtedly propel us further forwards in unravelling the complexity of factors that have influenced the record we have been bequeathed to study. An improving biostratigraphy will clearly help us in this endeavour, and, micropalaeontologists, we surely have a role to fulfil here as well!

Reference:
Dorning, K. J., and Harvey, C. 1999. Wenlock cyclicity, palynology, and stratigraphy in the Buildwas, Coalbrookdale, and Much Wenlock Limestone formations, Shropshire, England. *Bolletino della Societa Paleontologica Italiana*, 38, 155-166

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Palaeoecology of Africa and the Surrounding Islands

Volume 26, edited by L. Scott, A. Cadman and R. Verhoeven, 1999. Published by A.A. Balkema Uitgevers B.V., Rotterdam. ISBN 90 5410 476 7. Price: 75 Euros. xiii + 260 pp

This bright yellow curiosity landed on my desk unannounced. It comprises a series of papers presented at the 3rd Conference on African Palynology held at Witwatersrand University in Johannesburg, in September 1997. The volume starts with a Foreword and Preface, and an Obituary on Hermann Flohn (1912-1997) a Member of the Advisory Editorial Board of Palaeoecology of Africa. The bulk of the book is divided into three parts: Palaeopalynology (three papers), Quaternary and Recent Palynology (seven papers), and Pollen Morphology (seven papers), as well as three book reviews tucked in at the end. There is not an index. Generally speaking the presentation of the volume is very good with mostly excellent plate quality (although, regrettably, there are not many of these).

The three palaeopalynology papers are by Jim Doyle (The rise of angiosperms as seen in the African Cretaceous pollen record) - a rather wordy keynote contribution; Veena Srivastava and Emma Msaky (Albian-Cenomanian microfloral assemblages from Coastal Tanzania) - subsurface assemblages rich in pteridophyte spores, gymnosperm and angiosperm pollen, as well as dinoflagellate cysts, but with plates of a substandard quality;and R.E Dunay, P.A.R. Brenac and P.G. Edwards (Palynology and micropalaeontology of the Messinian-Zanclean sequences offshore Equatorial Guinea). The last paper is the most impressive from my point of view and comprises a reservoir-scale study of the Zafiro area. Although age constraints are poor (abundant Pediastrum are characteristic), the authors present an interesting account of the palaeoenvironments and their impact on a predictive model for reservoir sandstone distribution. Essentially, the reservoir sequence is governed by incised submarine canyons (originated during Messinian sea level drop), infilled by sediments transported from coastal plain settings. This paper is a neat example of the application of micropaleontology to sequence stratigraphy and reservoir modelling, and deserves a wider audience. I suspect, however, it may sink without much notice in this book. If applied micropaleontology is your bent, I recommend you check the volume out, if only for the value of the Dunay et al. paper.

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Biostratigraphy in Production and Development Geology

edited by R.W. Jones and M.D. Simmons, 1999. Geological Society Special Publication No. 152. ISBN 1-86239-031-2. Price: £70. 318 pp.

This excellent volume is the result of a very successful meeting of the Geological Society's Petroleum Group (Biostratigraphy in Production and Development Geology) held at Aberdeen University in June 1997.

There are sixteen diverse papers and a decent looking index. All the papers are of excellent quality and some include colour diagrams. There are not many plates, but those present are generally very good; the exception being the palynological plates in the paper by Simmons et al. - the figures must have been taken using a filthy microscope, and embarrassingly one of them finds its way onto the front of the book. Even one of the Magnus Field Trochammina specimens would have been better!

When the volume first appeared, the price of oil had plummeted, and the it had rather an 'end of an era' feel about it - the end of the golden years of biostratigraphy perhaps, and indeed there are some golden papers in this collection. The first paper by Simon Payne, Dave Ewan and Mike Bowman (The role and value of 'high-impact biostratigraphy' in reservoir appraisal and development) sets the tone and deserves a special mention (although the phrase 'high-impact biostratigraphy' still makes me squirm; it's defined by Payne et al. as "The alignment of high-resolution biostratigraphy with the attainment of business goals"). Despite the jargon, the authors have an important message for the application of biostratigraphy which should be noted by any practising biostratigrapher in the industry today (and their clients - the geologists, geophysicists and reservoir engineers). Payne et al. summarize their approach as follows:

a. keep the focus on understanding the business aim - what questions need to be answered?
b. think field scale and field specific, and push the data hard
c. think 'bioevents' not 'biozonation'
d. communicate confidence limits on your data points
e. integrate and iterate with other geoscience
f. realize the 'technology' can work at the well site.

The rest of the volume essentially comprises a series of case histories, eleven from the North Sea (including Payne et al.), two from Nigeria and one each from Borneo, Venezuela, and the Gulf of Mexico. Without exception, all these contributions are excellent. I haven't seen a better collection of applied biostratigraphy papers since the Gulf Coast Section of SEPM's 'Innovative biostratigraphic approaches to sequence analysis: new exploration opportunities' published back in 1987. The volume should be at the desk of every industrial biostratigrapher at work today. Whether it would be of interest to geologists, geophysicist and reservoir engineers is debateable as there is a high technical quotient. However, if biostratigraphers keep the message of Payne et al. in mind, the impact of biostratigraphy in reservoir and development studies is likely to get higher and higher.

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Unlocking the Stratigraphical Record: Advances in Modern Stratigraphy

edited by Peter Doyle and Matthew R. Bennett, 1998. John Wiley and Sons. ISBN 0 471 97463 3. Price: £24.95 (paperback). viii + 532 pp.

I wish they had had books like this when I was an undergraduate (mind you, I wish they had had sequence stratigraphy then too!). A lot has changed in stratigraphy in the 20+ years since I graduated, and this volume is a useful compendium of many of these changes. The editors describe the volume as not so much an introduction to the subject, but rather as an exploration of "the advanced tools with which to order and interpret the stratigraphical record". The volume comprises eighteen chapter written by twenty contributors, acknowledged experts in their specialities. After the Introduction, the chapters are divided into two parts: “Establishing the Sequence” (twelve chapters) and “Interpreting the Record” (five chapters). Part I covers the topics of lithostratigraphy, remote sensing, complex tectonic areas, evolutionary concepts, event stratigraphy, cyclostratigraphy, isotope stratigraphy, subsurface logging, seismic stratigraphy, sequence stratigraphy, geochemistry and chronostratigraphy. Part II comprises facies analysis, sea levels, palaeoenvironments, palaeoclimates and orogenic belts. The construction of the book, and the examples used, betray the academic background of most contributors. This is entirely appropriate for the undergraduate market, but don’t expect to find many petroleum exploration and development case histories. I get the impression that this is a volume to dip into if you want to know something about remote sensing, for example. Some of the chapters are too wordy for my liking, and the use of more diagrams would have been helpful; I’m not quite sure how well the chapters on complex tectonic areas and interpreting orogenic belts fit in. From a personal perspective, I would have liked to see more on biostratigraphical techniques (in addition to evolutionary concepts), as well as a chapter on industrial applications. But the most glaring omission is quantitative stratigraphy in general and graphic correlation in particular (very important arenas in modern stratigraphical studies). There is a useful index at the back, but you wont find “micropalaeontology” listed, which tells you something. In summary, the volume reflects a broadly academic approach to advances in modern stratigraphy, and it’s admirable in this respect. There’s not much directly relevant to the industrial micropalaeontologist, but you may get some ideas from a few chapters. However, if you want to brush up on event stratigraphy, for example, then this would be as good a place as any to start. At £24.95, the paperback version looks like very good value.

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Journal of Micropalaeontology

Sale of Backparts of Volumes 1 to 12

The BMS holds stocks of backparts of Volumes 1 to 12 of the *Journal of Micropalaeontology*. The Journal was instigated in 1982 and has rapidly developed into one of the leading journals in the field; the subject matter and geographical scope varies widely and all microfossil groups are represented. Society members, non-members and institutions may purchase backparts of Volumes 1 to 12 inclusive for £2.20 each including second class postage. Domestic postal charges are significantly less, the more copies ordered, for example, full sets in the UK are £28 (£20 + £8 for parcel post and packing). Overseas clients should remit £3.50 per part inclusive of surface mail postage. Pre-payments are acceptable, but clients (especially from continental Europe and overseas) are advised to request an invoice to avoid over- and under-payments. The parts are £1 each exclusive of postage, therefore clients able to buy them direct from the Treasurer (address below) can make substantial savings. Individual copies (offprints) of papers are available at £0.70 each inclusive of (domestic) postage and packing. Author of papers wishing to purchase multiple copies should direct enquires to the Treasurer; bulk discounts are available on papers from certain parts. Please indicate the parts you require in the left-hand column below; a tick will indicate one copy. Should you wish to order multiple copies, please clearly indicate the number you require.

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_____	Volume 10, Part 1	August 1991	Fifteen papers, 114 pp.
_____	Volume 10, Part 2	December 1991	Eleven papers, 120 pp.
_____	Volume 11, Part 1	June 1992	Eleven papers, 105 pp.
_____	Volume 11, Part 2	December 1992	fifteen papers, 137 pp.
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