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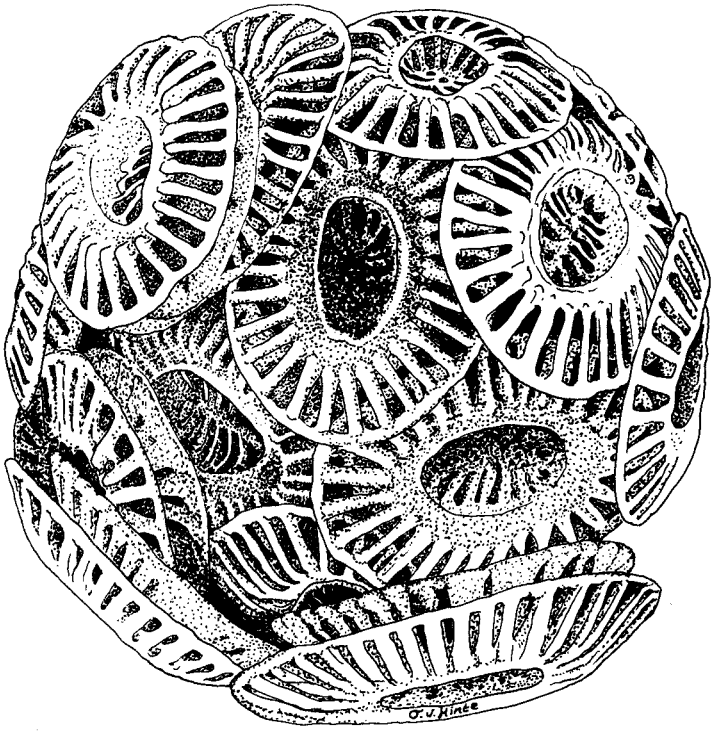
# INA NEWSLETTER




INTERNATIONAL NANNOPLANKTON ASSOCIATION

VOLUME 12 NUMBER 3 1990

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**BIBLIOGRAPHIES: Please send reprints of any coccolith, calcisphere or silicoflagellate articles to the relevant bibliographer.**

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NEWSLETTER MATTERS: Send all contributions, suggestions etc. to the editor. *Deadline for next issue 15th March 1990.* For advice to contributors see inside back cover.

INA NEWSLETTER: Published by the International Nannoplankton Association. Printed by Archer Press, London.
ISSN-0255-013X

# INA NEWSLETTER

Proceedings of the International Nannoplankton Association

Volume 12 Number 3 November 1990

## EDITORIAL ITEMS AND ANNOUNCEMENTS

This issue is a joint production with Jeremy Young doing the initial work and Paul Bown the final editing and organisation of printing and mailing. We hope this works and apologise in advance for any glitches.

**Silicoflagellate bibliography:** Stacia has completed the new silicoflagellate bibliography and it is currently being proof-checked by Shirley van Heck. It is rather long and will be published in instalments starting next issue.

**Prague meeting:** Organisation for this is progressing well despite the uncertainties in Czechoslovakia. The time scale is almost finalised, the excursion guide has been written, and costings worked out. It is somewhat more expensive than we had hoped, but still substantially cheaper than a conference in Western Europe. The second circular and application form are enclosed. Note that accommodation should be booked as soon as possible since there is a shortage of hotel space in Prague.

**Subscriptions:** Subscriptions are due now, invoice enclosed. If it is equally convenient to you please pay in £UK rather than $US, it saves us time and transfer fees. Many overdue members responded to the reminders sent out in the last issue, this has definitely helped INA funds.

**Reviews:** We are watching out for books of interest to nannoplankton workers to review. In addition it would be good to review any monographs or other separately published works dealing exclusively or largely with nannofossils or living nannoplankton. Please could authors of such works arrange with their publishers to send review copies to the editor.

*Paul Bown, Magdy Girgis, Jeremy Young*

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## SPECIAL OFFER - PROCEEDINGS INA FLORENCE MEETING

*Editors: Franca Proto-Decima, Domenico Rio, and Simonetta Monechi*

The proceedings of the 1989 Florence INA Meeting are being prepared for publication as a special issue of the Memorie di Scienze Geologiche - a high quality A4 format publication of the Department of Geology, University of Padua. It will include some 30 refereed papers on diverse aspects of coccolith biostratigraphy, taxonomy, and palaeoceanography from the Recent to the Jurassic. Publication is due in Spring 1991, price approx. $120, **£60**.

We are able to offer *exclusively through INA* a prepublication order price of only **£38**. At about £1.20 per paper this is a very cost effective way of improving your library - and using this offer will help the editors (who need advance sales). Please send payment now (in any case before 1-3-1991) to Magdy Girgis, normal INA account. Copies will be sent by surface mail immediately after publication, £10 extra for air mail outside Europe. *This offer is open to libraries and institutions as well as INA members.*

**Prepublication order price: £38 surface mail, £48 air mail.**
**Send to: Magdy Girgis, Robertsons Group, Llandudno, Gwynedd LL30 1SA, UK.**
**Bank Account details: INA Account. / Acc no. 0205466 / Lloyds Bank / Branch Code 30-95-13.**

**********

# INA CONFERENCE - PRAGUE

*8-14 September 1991 - Second circular and call for abstracts*

## TENTATIVE PROGRAMME

| | |
|---|---|
| 6-8 Sept. | Arrival in Prague |
| 8 Sept. | Morning (& ?afternoon): Informal workshop 1 (Palaeontology Dept. Charles University). |
| | 13.00 - 19.00: Excursion to Cretaceous of the Bohemian Basin |
| 9 Sept. | 08.00 - 18.00: Registration, opening session and scientific sessions (Novotného lávka). |
| | Evening: Welcome party. |
| 10 Sept. | 08.00 - 18.00: Scientific sessions |
| | Evening: Concert. |
| 11 Sept. | 08.00 - 12.00: Scientific sessions |
| | 13.00 - 18.00: General discussions or Informal Workshop 2. |
| | Evening: Farewell Party. |
| 12 Sept. | 08.00 - 12.00: Sightseeing in Prague, Informal Workshops 3 & 4 (Palaeontology Dept., Charles University). |
| | 14.00: Departure for Excursion 2. |
| 13 Sept. | Excursion 2 (West Carpathians, South Moravia). |
| | Evening: Dinner in wine vault. |
| 14 Sept. | Excursion 2, returning to Prague at 18.00. |

## SCIENTIFIC SESSIONS

About 120 specialists have shown interest in taking part. Requests for topics of scientific sessions have been as follows: Living coccolithophores 27: Morphology and evolution of nannofossils 44; Paleoecology, palaeoceanography 63; Biostratigraphy 82; Reliability of biostratigraphic data 56. So, the authors are asked for their talks and posters on these five topics.

## INFORMAL MEETINGS, WORKSHOPS

3 or 4 informal meetings or workshops will be held in the Dept. of Paleontology, Charles University before and after the main scientific sessions. Possible workshops topics are given on the application form and the most demanded will be chosen. Light microscopes and if necessary an SEM will be at the disposal of these meetings.

## EXCURSIONS

**Excursion 1:** Bohemian Cretaceous Basin (Turonian, Coniacian). Sept 8th. Price 30DM (50DM after 1 June).

**Excursion 2:** West Carpathians, South Moravia (Miocene, Paleogene, Cretaceous, Jurassic), Sept. 12 -14. Price 170DM (200DM after 1 June), includes coach, accommodation, and meals.

## VENUES

Registration and lecture sessions: Klub techniku, Novotného lávka 5, Prague.

Informal workshops, excursion departure: Dept. of Paleontology, Charles University, Albertov 6, Prague.

## WELCOME PARTY

A welcome party is planned for Monday, Sept. 9th. Price **60DM**.

## CONCERT

A concert of baroque music is planned for Tuesday, Sept.10th, preliminary price **20DM**.

## REGISTRATION FEE

**170 DM** (German Marks) for INA Members
**220 DM** Non-members and late registrants (after 1 June 1991).
**100 DM** Students
Or equivalent in US$ at current exchange rate.
Payment of fees should be by money order (inc. Eurocheques) or bank transfer to:
KOMERCNI BANKA HODONIN, NARODNI TRIDA 67, 69500 HODONIN, CZECHOSLOVAKIA

| | | |
|---|---|---|
| Bank account numbers: | DM payment | 34278 - 228656 - 671 |
| | US$ payment | 34833 - 228656 - 671 |

PLEASE PAY BEFORE 1st June 1991.

*SPECIAL NOTE* - UK REGISTRANTS ONLY. *Please pay registration fee direct to Jeremy Young (this will cover abstract volume cost). £58, students £34. Cheques to* J.R.Young - INA Account. *Lloyds Bank (30-13-49), Acc. No. 0181929.*

## POSTERS

The size of individual posters is 1 x 1.5m

## ORAL PRESENTATIONS

All talks must be presented in English. During the sessions slide-projectors (24x36 mm), overhead projectors and light microscopes will be available. Please let me know if you also need video tape recorder, computer etc.

## PROCEEDINGS

Proceedings will be published as a special number of "Knihovnickas Zemni Plyn a Nafta"

## ACCOMMODATION

For hotel accommodation contact the office of Cedok Travel Agency in your country or the Cedok Travel Agency in Prague **as soon as possible.** Price will depend on hotel category. There are Cedok Travel Agencies in: Amsterdam, Belgrade, Berlin, Brussels, Bucharest, Budapest, Copenhagen, Frankfurt, London, Moscow, New York, Paris, Rome, Sofia, Stockholm, Vienna, Warsaw, and Zurich.
Cheaper accommodation has been reserved in the student hostel (provisional price 40DM per night). If you are interested please fill in carefully the application form. We will send you the details immediately.

## ENTRY INTO CZECHOSLOVAKIA

A valid passport and a Czechoslovak visa are required for entry. For visas consult embassies and consulates of the Czechoslovak Federal Republic worldwide. Visas are NOT needed for nationals of the USA, Canada or most European countries (Austria, Belgium, Bulgaria, Denmark, Germany, Ireland, Italy, Finland, France, Hungary, The Netherlands, Norway, Poland, Portugal, Rumania, Spain, Sweden, USSR, UK, Yugoslavia).

## DEADLINES

| | |
|---|---|
| February 28th 1991 | Deadline for receipt of application form. |
| May 1 1991 | Deadline for receipt of abstracts. |
| June 1 1991 | Deadline for receipt of fees. |

THE THIRD CIRCULAR WITH FULL DETAILS OF ORGANIZATION AND THE PROGRAM WILL BE SENT IN SPRING 1991.

## ABSTRACT SUBMISSION

The abstract volume will be produced as a special issue of the INA Newsletter, and the normal conventions of the Newsletter should be followed, as outlined below. Abstracts may be submitted *either* as proof ready copy *or* on computer disc.

**Proof ready copy:** Submit on A4 paper (210x297mm) with 2.5cm left, right and top margins, 3.5cm bottom margin. Single spacing, 15 point (elite) text. If possible use a laser printer.

**Submission on disc:** Include print-out (2 copies), and details of system used. The following are preferable. *IBM/MS-DOS*, any format, 5.25" or 3.5", discs (ideal 5.25", 1.2 Mb). Text as WordPerfect, WordStar, Smart, DCA, Navy DIF, MultiMate, or ASCII files (ideal WordPerfect 5.0). *Macintosh,* 3.5" discs, MS-Word, MacWrite or ASCII files. *Amstrad,* 3"discs, Locoscript, Wordstar, Tasword or ASCII files.

**Length:** Up to 500 words, and up to 1 page of diagrams (NO plates).

**Title:** Use following format

CLARIFICATION OF *RETICULOFENESTRA PERPLEXA* (BURNS) WISE 1983
*Wuchang Wei, Dept of Geology, Florida State University, Tallahassee, USA*

Backman (in Heck, 1981) first pointed out that ....

**Diagrams:** Submit as very clean computer printouts, photographs, or photocopies of final size, do not send large or delicate originals. Plates cannot be included.

**References:** Use standard (World List) abbreviations, and *format of examples below*. ODP & DSDP volumes should be treated as periodicals using the following abbreviations: IRDSDP; Proc. ODP Init. Rep.; Proc ODP Sci. Res.

Spencer S. & Dobb A. 1988: New observations on Upper Cretaceous vombatidae. J. Wom. Res., **25**, 35-67.
McCarthy J.J. 1980: Nitrogen. In, Morris I. (ed.) "The Physiological Ecology of Phytoplankton", Blackwell, p.191-234.

**Send Abstracts To: Bohumil Hamrsmid, add Mikropaleontologie, MND Hodonin Uprokova 6, Hodonin 695 30, Czechoslovakia. Deadline 1st May 1991. Late abstracts will not be included.**

## MEETING REPORT - *HUXLEYI* SYSTEM WORKSHOP, Blagnac Sept. 1990

*Convenors; Peter Westbroek, Jan van Hinte, Patrick Holligan*

As we are all well aware coccolithophores have roles in the greater scheme of things beyond shedding dinky little plates onto the sea-bottom to record the age of rocks. Within the oceanic ecosystem they are one of the main primary producers, and so foodstocks for zooplankton and ultimately fish. They have a major impact on "global biogeochemical cycles" and on world climate through their activities as photosynthesisers, carbonate producers and dimethyl sulphide emitters. In the geological column they provide records of temperature change from organic biomarkers and oxygen isotopes, and productivity records from carbon isotopes and bulk carbonate sedimentation rates, with further signals from assemblage composition and intraspecific variation.

So coccolithophores are of interest to scientists from a very wide range of disciplines and are as liable to appear in discussions of global warming as of stratigraphy. The purpose of this meeting was to investigate whether a special study could be devised which would usefully focus these interdisciplinary interests. Specifically an integrated study of aspects of the physiology, population dynamics, taxonomy, and input to oceanographic fluxes of *Emiliania huxleyi* was discussed. *E.huxleyi* has much to commend itself as a model system - it is enormously abundant and so probably one of the most ecologically important single species on earth. It is readily cultured in the laboratory and much is already known about its biology and biochemistry. It is detectable from space since blooms of *E.huxleyi*, apparently uniquely, are characterised by production of vast numbers of loose reflective liths.

The workshop was organised for two main research groups, with various other guest participants. The Dutch group consisted of about a dozen workers from the Leiden Biogeochemistry Unit, Amsterdam Geology Dept. and NIOZ (The Netherlands Ocean Research Institute). This group has a funded project, with cruises, post-docs etc. The British group is less organised, being currently an informal grouping of about nine scientists from The Plymouth Marine Laboratory and half-a-dozen others. In all some thirty scientists attended from a bewildering range of disciplines. Nannoplankton specialists included Judith van Bleiswijk, John Green, Derek Harbour, Michael Knappertsbusch, Hans Thierstein, Paul van der Wal and Peter Westbroek.

The venue was a French Chateau on the Dordogne River - conveniently owned by our hosts Jan and Dorien van Hinte. The wonderful setting contributed to a very pleasant atmosphere, and we were exceptionally well fed and watered. We had a day and a half of talks followed by another day and a half of workshop sessions - largely held on the chateau lawns.

Was the meeting productive? Certainly it was a success in itself, we all enjoyed meeting workers from quite different disciplines, and benefitted from discussing a wide range of subjects. The concept of synthesising our disparate research topics into a common project was exciting. The degree and nature of future progress still depends on the vagaries of research proposals, and of individuals personal priorities and opportunities, but we did conclude that there was a real opportunity to exploit "the *huxleyi* system as a window on global geo-biosphere interactions".

*Jeremy Young, The Natural History Museum, London*

## OCEAN DRILLING PROGRAM NEWS

*John Firth, ODP, Texas A&M University*

**ODP Leg 129** drilled the Pigafetta and East Mariana Basins of the western Pacific, in search of Jurassic sediments and basement. It succeeded at ODP Site 801, where Middle Jurassic (Callovian) sediments were found. Age assignments were based solely on radiolarians. Nannofossils were virtually absent in the Jurassic sequence, but present in overlying middle Cretaceous sediments. Nannofossil palaeontologists aboard the JOIDES Resolution were *Elisabetta Erba* (U. of Milan, Italy) and *Mitch Covington* (FSU, Tallahassee, FL).

**ODP Leg 130** drilled the Ontong-Java submarine plateau in the western equatorial Pacific in order to investigate the Cretaceous-Recent paleoceanography and palaeobathymetry of the plateau along depth transects. 5 sites were drilled, recovering a record 4.8 km of core. Sites 803 and 807 recovered complete K-T boundary sections, one in a silt/claystone sequence, the other in a carbonate sequence. Nannofossil workers for Leg 130 were *Jan Backman* (U. of Stockholm, Sweden) and *Toshiaki Takayama* (Kanazawa Univ., Japan).

**ODP Leg 131** drilled the toe of the Nankai Trough accretionary prism to study the hydrogeology, physical properties and structural styles of the deformed sediments. A complete section through the frontal thrust fault, decollement, and basement was achieved at Site 808. Extremely detailed structural, physical properties, and geochemical data were compiled, along with new in-situ measurements of temperature, stress, and pore pressure. The sequence was of middle Miocene to Recent age, with no unconformities. Nannofossil workers on Leg 131 were *Gunnar Olafsson* (U. of Stockholm, Sweden) and *John Firth* (ODP, College Station, TX).

**ODP Leg 132** was an engineering leg geared to testing new drilling technology such as a Diamond Coring System (DCS) in hard chert and limestone strata. It also drilled a Pleistocene to Campanian carbonate sequence on the Shatsky Rise.

**ODP Leg 133** (Aug. - Oct. 1990) drilled the Northeast Australia Margin to study high resolution Neogene paleoceanography and sea-level history, and the development of the Great Barrier Reef. Drilling revealed that the Great Barrier Reef may be only 500,000 years old, and that there appear to have been multiple sea-level drops resulting in "deaths" of reefs on this margin through the Neogene. The nannofossil workers for Leg 133 were *Stefan Gartner* (Texas A&M, College Station, TX) and *Wuchang Wei* (FSU, Tallahassee, FL).

**ODP Leg 134** (Oct. - Dec. 1990) will drill the Vanuatu arc-ridge collision zone. Nannofossil workers will be *Thomas Staerker* (FSU, Tallahassee, FL).

**ODP Leg 135** (Jan. - Feb. 1991) will drill the Lau Basin, an actively spreading backarc basin. Nannofossil workers will be *Paula Quinterno* (U.S.G.S., Menlo Park, CA) and *Michael Styzen* (Shell Offshore, New Orleans, LA).

**ODP Leg 136** (March 1991) will drill the Hawaiian Arch, south of Honolulu. A hole will be cored to provide a test site for emplacement of an Ocean Seismic Network station. The nannofossil worker on board will be *John Firth* (Ocean Drilling Program).

**ODP Leg 137** (April 1991) will re-enter Hole 504B, the deepest hole drilled into oceanic basement, in order to clear the hole of debris and prepare for future drilling and downhole tool experiments. No palaeontologists will sail on this cruise.

**ODP Leg 138** (May - June 1991) will drill in the eastern equatorial Pacific Ocean, to study Neogene high resolution paleoceanography. The nannofossil palaeontologists will be *Jose-Abel Flores* (University of Salamanca, Spain) and *Isabella Raffi* (Universita di Parma, Italy).

**ODP Leg 139** (July - Sept. 1991) will drill in the sediment covered spreading centres of the Juan De Fuca Ridge and the Gorda Ridge in the northeastern Pacific, to study submarine hydrothermal systems and hydrothermal deposits. The nannofossil palaeontologist will be *Shaozi Mao* (FSU, Tallahassee, FL).

**ODP Leg 140** (Sept.-Nov. 1991) will drill either in Hole 504B (ocean crust) or on the East Pacific Rise (again ocean crust). No palaeontologists will sail on this cruise.

## BOOK REVIEWS - LIVING COCCOLITHOPHORES

Nannoplankton workers of whatever type have a need for information on the biology of living coccolithophores, their taxonomy and their relationship to other groups. There is, as yet, no single book which conveniently summarises all the relevant information but three new works approach aspects of this subject and deserve attention.

### HANDBOOK OF PROTOCTISTA

*Editors L. Margulis, J.O. Corliss, M. Melkonian and D.J. Chapman*

*Jones and Bartlett Publishers, Boston. 1990. pp. xli + 914. ICBN 0-86720-052-9. ca. £190. Hardcovers*

This is a massive book which aims to provide high class reviews of the biology of all the groups in the kingdom Protoctista; i.e. all unicellular eucaryotes - and some multicellular algae. It comprises 35 chapters each dealing with a single phylum, several of which are sub-divided with essays on different classes. The classification is essentially that of Margulis and Schwartz (1988). The chapters are written by different authors but uniformity is provided by a standard plan to each chapter of INTRODUCTION (General characteristics, occurrence, literature, history of knowledge, practical importance); HABITATS AND ECOLOGY; CHARACTERIZATION AND RECOGNITION (usually the main section including cytology, lifecycles and classification); MAINTENANCE AND CULTIVATION; EVOLUTIONARY HISTORY; BIBLIOGRAPHY.

The introductory chapters provide an interesting discussion of modern ideas on protoctist relationships and biology. At the end of the book there is an etymological appendix, an extensive glossary (80 pages, c.2000 terms), and three indices (organism, author, general).

The chapter on prymnesiophytes (pp.293-317) is co-authored by John Green, Peter Westbroek, and Katharina Perch-Nielsen and is reasonably representative of the strengths and weaknesses of the systematic chapters in general. The authors are all distinguished specialists and so the chapter is free from the mistakes and misrepresentations of many general texts. It is not, however, entirely up to date since it was written several years ago - the handbook has been in preparation since 1980! The main coverage is of cell biology, with good discussions of flagella structure, scales, coccolithogenesis, life cycles and mitosis. Taxonomy, biogeography, and evolution by contrast are only briefly outlined. Diversity is illustrated by a page of line drawings of cell types, another of scale types and one plate of, very fine, SEMs. The bibliography is a restrained list of about 140 significant references. Thus the chapter is neither an exhaustive compilation of knowledge nor an identification guide, but rather a useful summary of the biological characteristics of the group - as indeed was intended.

The other chapters cover a very wide range of groups, micropalaeontologists and marine biologists might divide these into four categories. First there are the groups we are used to, although often with less familiar names; chlorophytes, ciliates, diatoms, dinoflagellates, forams, radiolaria, silicoflagellates, and of course coccolithophores. Second there are less familiar groups which are still directly relevant such as bisoecids, choanoflagellates, and eustigmatophytes. For some of these groups these are virtually the only reviews available. Third there are benthic algae and fresh water groups which are useful for comparative purposes. Fourth there are parasitic and mould organisms of only peripheral interest to us. The book is of course not organised along these lines, nor does it follow any existing classification. Instead the phyla are organised in four groups based on the presence / absence of complex life cycles and undulipodia (= cilia and eucaryote flagella). This has the desired effect of emphasising the probable artificiality of classifications but results in a more or less chaotic distribution of the groups we might recognise.

The idiosyncratic organisation, unfamiliar names, and the fact that the contents page is buried 31 pages from the beginning make the handbook rather daunting. Nonetheless it will be an invaluable reference for any workers who need information on the biology of these groups. The price is obviously too high for normal individuals but research groups and laboratories would be well advised to buy copies, as well as ensuring that it is present in their institution libraries.

## THE CHROMOPHYTE ALGAE - PROBLEMS AND PERSPECTIVES

*Eds. J.C. Green, B.S.C. Leadbeater, and W.L. Diver*

*Systematics Assoc. Spec. Vol. 38, Oxford University Press. pp. xii + 425. ICBN 0-19-857713-3. £60 Hardcovers*

Subtitles such as "Problems and Perspectives" usually indicate a heterogeneous assemblage of papers published together for no more reason than that they came out of a single conference. This volume is an interesting exception, the papers do come from a conference (held in Plymouth in April 1988) but it evidently had an unusually sharp focus. Recent work, in particular by Cavalier-Smith has suggested that the brown and golden-brown algae (including coccolithophores) form a natural group which should be accorded Kingdom status (see fig.1). In order to test and develop this concept the conference assembled specialists working on a wide range of groups and investigating very varied aspects of their biology. The result is a heterogeneous mix of papers but with a strong inter-connections.

There are 21 papers of three types. 9 papers deal with particular aspects of chromophyte biology of possible phylogenetic significance - including chloroplast structure, biochemistry and molecular genetics, flagellar structure, and mitosis. Another 9 papers deal with individual groups, particularly those of uncertain affinity with the core-chromophytes. There is no individual chapter on the Prymnesiophytes but they are well dealt with in the non-systematic chapters. Finally there are 3 overview papers. The sequence of papers is logical, they are rather well cross-referenced and the editing is immaculate.

Three characters emerge clearly as typifying the chromophytes: possession of flagellae with stiff tubular hairs (retronemes); chloroplasts with chlorophyll a and c (vs chlorophyll a and b in chlorophytes / green algae); and the embedding of the chloroplasts in a four-layered membrane derived from the endoplasmic reticulum. Core-chromophytes have all these characters and include the diatoms, chrysophytes (including the silicoflagellates), raphidophytes, eustigmatophytes and xanthophytes. The probable relationship of other groups to these is shown in Fig.2. The prymnesiophytes appear as a virtually unique group since they have typical chromophyte chloroplasts (and similar scale formation to chrysophytes) but have quite different flagellar structure - smooth flagellae and a haptonema. Dinophytes differ markedly from core chromophytes and appear to be only distantly related.

Looking over the groups included it is striking that they dominate the modern phytoplankton, but that none of them has a pre-Mesozoic geological record. Moreover, many of the tentative phylogenies in this volume show prymnesiophytes as diverging very early in the evolution of the chromophytes. This raises the real possibility that the entire Kingdom Chromista may be a post-Palaeozoic development and that the first appearance of coccolithophores in the Triassic may record a rather more profound event than merely the development of planktonic calcification. It would be fascinating to see the result of cladistic analysis which should be possible using the data in this volume, and in the Handbook of Protoctista.

## ATLAS DU PHYTOPLANCTON MARIN - Volume 3

*Series editor: A. Sournia. Editor: M.-J. Chretiennot-Dinet*

*Editions du CNRS, Paris, 1990. pp.261. ISBN 2-252-04325-5. Softcover. 250FF*

The Atlas du Phytoplancton Marin is a French language generic level guide to marine phytoplankton. Volume 1 (Sournia 1986) covered dinoflagellates with short sections on cyanophytes and raphidophytes. Volume 2 (Ricard 1987) dealt with the diatoms. This final volume covers nine miscellaneous groups and the prymenesiophytes, which account for about half the book. A uniform format has been adopted throughout the series. Each group has one chapter with an introductory section on biology, classification and methodology, followed by systematic descriptions. These are based on genera and include data on type species, etymology, and references plus discussions of generic characteristics and specific differentiation. The organisation is taxonomic rather than alphabetic with notes on all the higher taxa. There are also tabular summaries of generic characters. Each volume has a unified bibliography, index and

list of taxa. The text is followed by a generous section of plates (50 in volume 3), with line drawings, light and electron micrographs. It is a pity the text could not have been organised to face the plates but this arrangement is doubtless cheaper and certainly preferable to random interspersing of text and plates. The series as a whole provides a unique overview of phytoplankton genera of value to any workers in the field.

The Prymnesiophyte chapter includes, as well as the familiar oceanic coccolithophores, strange weakly calcified genera such as *Wigwamma* and *Quaternariella,* restricted marine genera such as *Hymenomonas* and *Pleurochrysis,* and their non-calcifying relatives such as *Prymnesium* and *Phaeocystis.* This alone gives it considerable value and it is probably the first published attempt at a comprehensive generic level review of the coccolithophores since Schiller. It is, however, rather less than authoritative, with numerous misleading comments, a few mistakes and much obsolete taxonomy. The examples given are a selection from the groups I know best. All the placolith bearing coccolithophores are included in the coccolithaceae, and although *Emiliania, Gephyrocapsa* and *Crenalithus* (sic) are grouped together on the generic key this is only on the basis that they are all small and elliptical! The Syracosphaeraceae is split into four; the Calciosoleniaceae, Deutschlandiaceae, Halopappaceae, and Syracosphaeraceae. Several redundant genera are included, for instance *Halopappus,* a clear synonym of *Michaelsarsia.* The small form of *Neosphaera coccolithomorpha* is separated as *Cyclolithella annula.* This distinction is dubious at species level distinction, and ridiculous at generic level, and in any case the type of *C. annula* was a large form specimen. Notes on genera include such oddities as a suggestion that *Coccolithus* includes three certain and six dubious species, and that *Braarudosphaera* is restricted to the Atlantic and the English Channel.

The basic cause of this unreliability is clearly that the chapter is not a synthesis of an experts working knowledge but a literature review and moreover a partial one. The phycological literature is very well cited, but there are almost no palaeontological references (not even Perch-Nielsen 1985), and the oceanographic literature is underused. The INA bibliography was evidently missed since the Loeblich and Tappan bibliographies are cited with a comment that they need updating.

The book is still certainly useful, and affordable, but users will regret that the extra collaboration needed to produce a definitive synthesis was not sought.

*Jeremy Young, The Natural History Museum, London.*

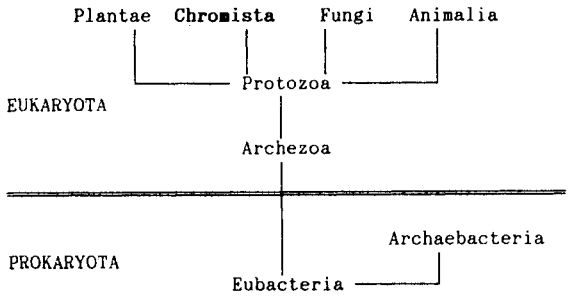


Fig.1: The eight kingdom classification of Cavalier-Smith

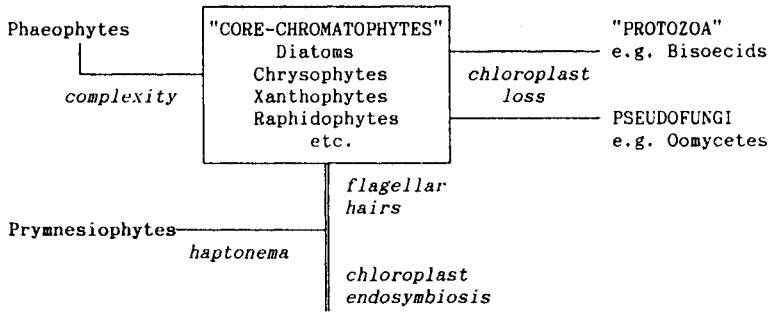


Fig.2: Schematic indication of possible relationships between the chromphyte groups, synthesised from several papers.

## HANDBOOK OF CENOZOIC CALCAREOUS NANNOPLANKTON BOOK 4: HELIOLITHAE (HELICOLITHS, CRIBRILITHS, LOPADOLITHS AND OTHERS).

*M.-P. Aubry*

*Micropaleontology Press, New York, 1990. pp.381.*

This book deals with the systematics, morphology, evolution and biostratigraphy of the genera *Placozygus, Zygodiscus, Lophodolithus, Helicosphaera, Neocrepidolithus, Pontosphaera* and *Scyphosphaera*.

The first twelve pages (i-xii) are devoted to a preface and introduction which explain the organisation of the book, the symbols and codes used in the text, the taxonomic key and the philosophy behind the systematics. There is also a summary of the common characteristics of the genera under discussion.

In the chapter on the genus *Placozygus*, the author restricts her discussion to a single species, *Placozygus? sigmoides*.

In the following chapters, the genera *Zygodiscus, Lophodolithus, Helicosphaera, Neocrepidolithus, Pontosphaera* and *Scyphosphaera* are discussed in detail and the author illustrates all the published species assigned to the above genera. Evolutionary lineages of *Helicosphaera, Neocrepidolithus* and *Scyphosphaera* are illustrated (the latter two were adopted from Perch-Nielsen, 1981b and Perch-Nielsen, 1985 respectively).

The information presented is mainly confined to a literature survey and contains very little original research material. No biometric or quantitative studies have been made on any group by the author. A biometric study on the *Scyphosphaera, Helicosphaera* (*H. carteri*) or *Pontosphaera* would have been particularly useful. In our opinion, a figure showing line drawings of the holotype of every *Scyphosphaera* in transparent paper would be helpful for specialist readers.

Considerable effort has been expended in compilation of this book and an extensive review of published information has been undertaken. This book is a very useful reference, particularly for the non-specialist, the beginner, and specialists who are not routinely working on the genera discussed. The integration of subsequent observations and illustration of the original description, the recognition of synonomies, discussion of certain taxonomic problems together with the stratigraphic ranges of species and lineages, are the greatest assets of this book. However, the usefulness of the book as a reference volume for the specialist already working on the genera discussed has, to a certain extent, been reduced by the availability of works such as the Catalogue of Calcareous Nannofossils by A. Farinacci and Cenozoic Calcareous Nannofossils (in Plankton Stratigraphy) by Perch-Nielsen (1985).

We have objections on several specific points some of which are given below.

1. Photographic illustrations are not clear and in particular the SEM micrographs do not show sufficient detail (e.g. imbrication of elements).

2. We found the use of the term bar/bridge very confusing since it is used in exactly the opposite way to Theodoridis (1984). In this book the bar is in optical continuity with the basal plate whilst the bridge exhibits optical discontinuity with the basal plate.

3. According to the author, imbrication of elements in the flange is dextral in all genera discussed in this book.
   "Dextral imbrication: the condition in a heterococcolith in which each segment overlaps the one to the right when viewed from the center of the cycle. Ant. sinistral imbrication". (Glossary of Geology, Bates and Jackson, 1980).
   According to the above definition the flange is made up of sinistrally imbricated elements in *Lophodolithus, Pontosphaera, Zygodiscus, Helicosphaaera* and *Scyphosphaera*, whilst dextrally imbricated elements are present in *P?. sigmoides* (not in *Placozygus*; see below) and *Neocrepidolithus*.

In our opinion, the direction of imbrication in the flange or distal cover is of critical

importance for taxonomic studies and therefore must be identified correctly. It is on this basis that we can separate Mesozoic taxa from similar Tertiary forms since most of the Mesozoic forms exhibit dextrally imbricated elements in their flange.

It must also be stated here that imbrication does not change depending on whether we look from proximal or distal view; unlike coiling direction which alters depending on the point of observation.

4. Figure 1 suggests that *Helicosphaera* species with a 'bar' belong to the Zygodiscaceae, but without a bar to the Pontosphaeraceae. This does not make sense systematically.

5. *P?. sigmoides* is wrongly placed within the genus *Placozygus* which by definition has juxtaposed elements in its flange (protolith). In contrast, *P?. sigmoides* has dextrally imbricated elements in its flange (zeugoid/loxolith). This book would have been the ideal place to assess these taxonomic differences and to erect a new genus to include *P?. sigmoides* which does not easily fall into any known genus.

6. *Z?. pamerolii* is not related to *Zygodiscus* because of major structural differences. The latter genus has sinistrally imbricated elements in its flange while *Z?. pamerolii* (*P. emergeri* of other authors) has dextrally imbricated elements. In the book, however, their relationship is rejected on the grounds of the large interval of time between their occurrences rather than the above mentioned criteria.

7. The introduction to the genus *Helicosphaera* appears to contain several errors:
   - p. 42, fig. 3: the orientation of the bridge in *H. obliqua* is incorrect in distal view.
   - p. 55, table 2: the wing type OS (overlapping with spur) is indicated as O (overlapping) only.
   - p. 62-63, the determination key contains the following mistakes:
   *H. intermedia* has a transverse bar perpendicular to the long axis according to the key, but in table 1 and on the pictures it is parallel to the long axis.
   *H. moorkensii* and *H. gertae* are placed in group IV with a bridge, but according to table 2 they have no bridge.

8. p. 53: naming the types of distal cover and types of interference figure as separate characteristics does not make sense, since one is the result of the other.

9. "If the *H. sellii* LAD appears to be reliable, the use of *H. recta* and *H. ampliaperta* are open to criticism". We sincerely do not understand the philosophy behind the above sentence. Does that mean that in one genus if one species is a poor marker it automatically makes all other species poor markers.

10. The author has introduced parallel evolutionary lineages within the genus *Helicosphaera*. Although, we are not fully convinced of this, this situation may be possible. However, if the author is positive that *Helicosphaera* is biphyletic she should subdivide it into two genera.

11. The author then puts very strong emphasis on the occurrence of species of *Helicosphaera* in the Paleocene, and therefore rejects *Lophodolithus* as the ancestor of *Helicosphaera*. *Helicosphaera* is recorded by Haq (1971) in the Middle Paleocene of Iran and we also observed it in sediments of the same age from Pakistan but as a result of contamination (burrowing). We have yet to be convinced of the in situ occurrence of *Helicosphaera* in the Paleocene. Therefore we still believe *Lophodolithus* is the ancestor of the genus *Helicosphaera* (with bar).

12. p. 65: wrong citation: *Helicosphaera seminulum* is quoted as (Bramlette & Sullivan) Jafar & Martini, but this is not a new combination, nor a new rank! By introducing *H. seminulum seminulum* Bramlette & Sullivan also automatically introduced *H. seminulum*, so Jafar & Martini have nothing to do with that and should not be cited.

13. p. 183: *Discolithina millepuncta* Gartner should read *Pontosphaera messinae* Bartolini.

14. To illustrate the confusion in terminology, an example serves on p. 69: (*H. gartneri*): 'proximal plate is of type II with bar', while type II is defined as being without a bar! The preface says that original descriptions will be edited to use more appropriate terminology: this should have been done here.

15. *H. truncata* has priority over *H. recta* (ICBN article 60 states that "In no case does a name have priority outside its own rank").

16. We are not convinced that the forms *N?. biskayae* and *N?. bukryi* belong to the genus *Neocrepidolithus*. Since they have a distal cover, they should be transferred to another genus.

17. *Neocrepidolithus* has dextrally imbricated elements in its flange as in *Crepidolithus*. In Romein (1977) it is wrongly described as having clockwise imbricated elements (sinistral) and this definition has been adopted in this study.

18. In our opinion *Transversopontis* is justifiably separated from *Pontosphaera*. The former has two large performations and a strut in the distal cover whilst *Pontosphaera* lacks both. Moreover, stratigraphically *Transversopontis* is restricted to the Palaeogene whilst *Pontosphaera* ranges from Palaeogene to Recent.

19. "Finally, if distinction of *Transversopontis* was justified solely by the presence of two perforations then, for the sake of consistency, it would be necessary to subdivide *Helicosphaera* into two genera".

Is there any rule that says that we have to apply the same criteria for every genus. We should be flexible enough to use various criteria to erect species of genera as long as it helps us to organise the taxonomy better.

We do strongly believe that our above comments do not reduce the value of the book, since a vast amount of data is presented for the convenience of the nannopalaeontologist. We strongly recommend this book to any co-workers particularly those who do not subscribe to the Catalogue of Calcareous Nannofossils by Farinacci.

*Osman Varol, The Robertson Group, Llandudno, Wales and Shirley van Heck, NAM, Assen, The Netherlands*

# THE ICBN: THINGS YOU NEED TO KNOW - 3

*Shirley E. van Heck, NAM, Assen, The Netherlands*

Article 4.1 of the ICBN states that "..... *A plant may ... be assigned to taxa of the following ranks (in descending sequence) regnum, subregnum, divisio, subdivisio, classis, subclassis, ordo, subordo, familia, subfamilia, tribus, subtribus, genus, subgenus, sectio, subsectio, series, subseries, species, subspecies, varietas, subvarietas, forma, subforma*". Having dealt with specific epithets in the last two issues we shall now look at names of taxa below the rank of species. These are dealt with in articles 24 to 27.

*ARTICLE 24*

*24.1: The name of an infraspecific taxon is a combination of the name of a species and an infraspecific epithet connected by a term denoting its rank.*

An item often overlooked in this respect is that the infraspecific epithet should be preceded by a term denoting its rank. This applies not only when introducing a new taxon, but also when quoting one, since the article clearly states that this term is part of the name. Therefore *Discoaster tanii nodifer*, which is commonly used, should correctly be cited as *Discoaster tanii* subsp. *nodifer*. Although the term is abbreviated as 'subsp.' in the ICBN, the abbreviation 'ssp.' is also very common, and can be considered correct.

*24.2: Infraspecific epithets are formed as those of species and, when adjectival in form and not used as substantives, they agree grammatically with the generic name (see Art.32.5).*

This implies that the rules outlined in the previous two issues also apply here. When quoting the reference to Art.32.5 in the previous issues, I neglected to quote the article and show its relevance, so I shall do so here:

*32.5: Names published with an incorrect Latin termination but otherwise in accordance with this Code are regarded as validly published; they are to be changed to accord with Arts. 17-19* [super-generic taxa], *21* [genera], *23, and 24, without change of the author's name or date of publication (see also Art. 73.10)*

The explanations in square brackets are mine, the remaining Articles have been discussed previously. We will return to this article in a future issue.

Arts. 24.3 and 24.4 have never caused us problems, and I doubt they ever will, so I shall omit them. The next one, however, has caused confusion:

*24.5: Infraspecific taxa within different species may bear the same epithets; those within one species may bear the same epithets as other species (but see Rec. 24B).*

This recommendation is:

*24B.1.: Authors proposing new infraspecific epithets should avoid those previously used for species in the same genus.*

This is a sensible recommendation, because a change of rank might otherwise cause problems. However, if the recommendation is not followed, the Article clearly states that this does not make the taxon invalid. Example: *Marthasterites nunnii* was introduced as a *nomen novum* for *Marthasterites bramlettei*. The latter was thought to be invalid because of the existence of the name *Marthasterites furcatus* var. *bramlettei*. Because of Art.24.5, however, it is clear that *M. bramlettei* is the correct name, and *M. nunnii* is superfluous (for a fuller discussion see van Heck 1980). If, however, *M. furcatus* var. *bramlettei* were to change rank, a new name would have to be introduced for it to avoid homonymy.

In this context it might be useful to quote one more article:

*64.4: The names of two subdivisions of the same genus, or of two infraspecific taxa within the same species, even if they are of different rank, are treated as homonyms if they have the same epithet and*

*are not based on the same type. The same epithet may be used for subdivisions of different genera, and for infraspecific taxa within different species.*

Example: If someone were to introduce '*Marthasterites furcatus* ssp. *bramlettei*' then this should be regarded as a homonym of the variety with the same name, and the subspecies would be illegitimate.

*ARTICLE 25*

*25.1: For nomenclatural purposes, a species or any taxon below the rank of species is regarded as the sum of its subordinate taxa, if any. In fungi ....*

This is a straightforward, but important concept. Example: Quoting *Umbilicosphaera sibogae* implies *U. sibogae* var. *foliosa* as well as *U. sibogae* var. *sibogae*.

*ARTICLE 26*

*26.1: The name of any infraspecific taxon that includes the type of the adopted, legitimate name of the species to which it is assigned is to repeat the specific epithet unaltered as its final epithet, but not followed by an author's name (see Art.46). Such names are termed autonyms (Art.6.8; see also Art.7.21).*

*26.2: The first valid publication of a name of an infraspecific taxon that does not include the type of the adopted, legitimate name of the species automatically establishes the corresponding autonym (see also Arts. 32.6 and 57.3)*

In practice two problems seem to occur:
1. Not all authors are aware that in introducing a subspecies they automatically introduce the subspecies containing the type of the species. Thus, they are inclined to formally describe both subspecies (which is useful but not necessary), and to attach their name to the autonym (which is incorrect).
2. Citation of the name of the subspecies containing the type causes some problems. The code states that the subspecies should not be followed by an authors name, but in Art.32.6 (referred to in Art. 26.2) it says that this subspecies is established at the time the other subspecies was introduced. Fortunately, the code gives examples (Art.57, Ex. 7-9) which we might translate as follows:

In introducing *Lithraphidites alatus* Thierstein 1972 ssp. *magnus* the authors automatically introduced *Lithraphidites alatus* Thierstein ssp. *alatus* (the fact that they actually named the latter is irrelevant), which they cited as *Lithraphidites alatus alatus* Thierstein, 1972. According to the ICBN the subspecies should have been cited as follows: *Lithraphidites alatus* Thierstein 1972 ssp. *alatus* (1987) and *Lithraphidites alatus* Thierstein ssp. *magnus* Covington & Wise 1987. The addition of (1987) behind the autonym is the correct citation as given in the code, but it may be confusing, and perhaps better omitted.

The other articles referred to are not relevant at this point. The last article on infraspecific epithets should be well known:

*ARTICLE 27*

*27.1: The final epithet in the name of an infraspecific taxon may not repeat unchanged the epithet of the correct name of the species to which the taxon is assigned unless the two names have the same type.*

Finally there are some detailed recommendations on dealing with subordinate taxa. Since in the nannoplankton literature more than one rank below the level of species is exceptional, I shall omit these. If, however, you do want to subdivide subordinate taxa, make sure you have the right order, as given above (Art.4.1).

## REFERENCES:

Greuter, W., 1988: International Code of Botanical Nomenclature. *Koeltz Scientific Books*, 328 pp.
Heck, S. E. van, 1980: Bibliography and taxa of calcareous nannoplankton. *Int. Nannoplankton Assoc. Newsl.* **2(1)**: 33.

erratum

In the previous issue I used as an example the name *hintii* after van Hinte. This should, of course, be *hintei*.
Thank you, Katharina, for pointing this out to me!

# A NEW TECHNIQUE FOR CONSTRUCTING CAMERA-READY RANGE CHARTS USING A MACINTOSH COMPUTER

*Wuchang Wei, Geology Dept., Florida State Univ., Tallahassee, FL 32306, USA*

Nearly every micropaleontologist needs to construct distribution charts of fossil taxa from time to time. Unfortunately, preparing camera-ready range charts (required by most journals) has been quite difficult or costly, because there has not been a computer program that can do the entire job. The popular Checklist II or spread sheet programs, such as Lotus 1-2-3 or Microsoft Excel, can easily be used to present abundance data but cannot deal with zonal names and boundaries, let alone show hiatuses, lithology, etc. This is probably the major reason that Ocean Drilling Program has required its contributors to submit all figures in camera-ready form except for range charts, which are believed to be too difficult for contributors to prepare in finished form.

I have recently developed a new technique to construct camera-ready range charts with ease using a Macintosh computer (Macintosh Plus or later models). It takes advantage of Microsoft Excel* for entering abundance data and MacDraw II** for drawing zonal boundaries, lithology, magnetostratigraphy, etc. It is quick, extremely versatile, and can produce more sophisticated range charts than one might expect from a personal computer. A specimen range charts prepared using this new technique is included. The procedure is as follows.

1. Turn off the Multifinder (if it is on) unless your computer has a very large memory. This is done by going to the special menu to select set startup, followed by clicking finder. Then restart the machine.
2. Open Microsoft Excel.
3. Highlight the first column, then go to the Format menu to execute change column width to make the column wide enough to accommodate your sample names. Repeat this step for the second column if you wish to enter sample depth data. Highlight enough columns on the right to accommodate the number of species. Change the widths to "1" to allow for the entry of species abundance data.
4. Enter sample numbers and species abundance data as you would fill in a form (you will enter the species names later in MacDraw II). Remember that you can move columns around to order them by first occurrence, last occurrence, taxonomic groups etc. as you desire.
5. Turn off print row and column headings and print gridlines, followed by click on OK.
6. Go to the File menu and save the document.
7. Highlight (press the mouse and drag) the area of the chart that you want to include in your final range chart (exclude column number and row number).
8. While holding down the Shift key, go to the Edit menu and execute copy picture.
9. Click as shown when printed followed by OK.
10. Go to the File menu and exit and Excel program.
11. Double-click the MacDraw II icon to open this program.
12. Select Turn autogrid off from the Edit menu, and chose the Times or Helvetica font from the Font menu.
13. Go to the Edit menu and execute paste to transfer your chart to MacDraw II.
14. Select Group from the Arrange menu, and then chose the Times or Helvetica font.
15. Drag the pasted chart to the proper position so that you have room for adding species and zonal names, litho-, magneto-stratigraphy, etc.
16. Click a blank area to unselect the pasted picture, and then select italic from the Style menu.
17. Double-click the text tool (A), and type the species names in column but remember to click the next line to start typing next species (Do not worry about alignment or even line spacing but try to achieve a small line spacing). Click the pointer tool (arrow on the left upper screen) when finished typing all the species names.
18. Select all the species names by pressing and dragging the mouse to enclose the names, group them from the Arrange menu, then select rotate.
19. Grab a corner, rotate it counterclockwise 90°, and then drag it to its intended position so that the first species name lines up with its corresponding data column.
20. Execute Ungroup from the Arrange menu, then click on the pointer tool.

21. Drag the last species name so that it lines up with the last data column.
22. Press and drag the mouse to enclose all the species names and select alignment from the Arrange menu. Click align and bottom on the right side, distribute on the bottom, followed by OK. This will align the names with their respective columns.
23. Use the text, line, and other tools to complete the range chart the way you like it. Refer to the MacDraw II manual if you wish to perform more complicated tasks. You can be assured that the MacDraw II program will allow you to draw virtually anything you need.

I recommend using a 0.2 size pen for lines and printing the range charts at ~75% of the original size. This not only saves page space, but also makes the range charts more eye appealing.

If you have a DOS Mounter program on your Macintosh computer, you can open a spreadsheet file (such as Lotus 1-2-3 for IBM computers) directly from the Excel program, edit it if necessary, and save it in Excel. This is very useful if you have already entered or prefer to enter your data in an IBM (or compatible computer, and you only use a Macintosh computer to do the final touch on the range chart that cannot be done using a IBM computer.

The disclosure of this new technique is intended as a service to the community. You are welcome to contact me (my electronic mail address is: Wei@FSU.Bitnet) if you have any questions, but please know that I may not be able to provide detailed answers to every question.

Acknowledgments: I wish thank Professor S.W. Wise for suggesting that I write this article for the INA Newsletter and for reviewing the manuscript. Sarah Wise, a high school student with no previous Macintosh experience, helped test the technique by preparing the range charts shown in Wei (this volume). This study was supported by an equipment grant from the Amoco Foundation and by NSF grant DPP8917976 to S.W. Wise.

* Microsoft Excel is a program for Macintosh computers and can be purchased from its producer: Microsoft Corporation, 16011 NE 36th Way, Box 97017, Redmond, WA 98073-9717, USA.

** MacDraw II is a program for Macintosh computers and can be purchased from its producer: Claris Corp., 440 Clyde Avenue, Mountain View, CA 94043, USA.

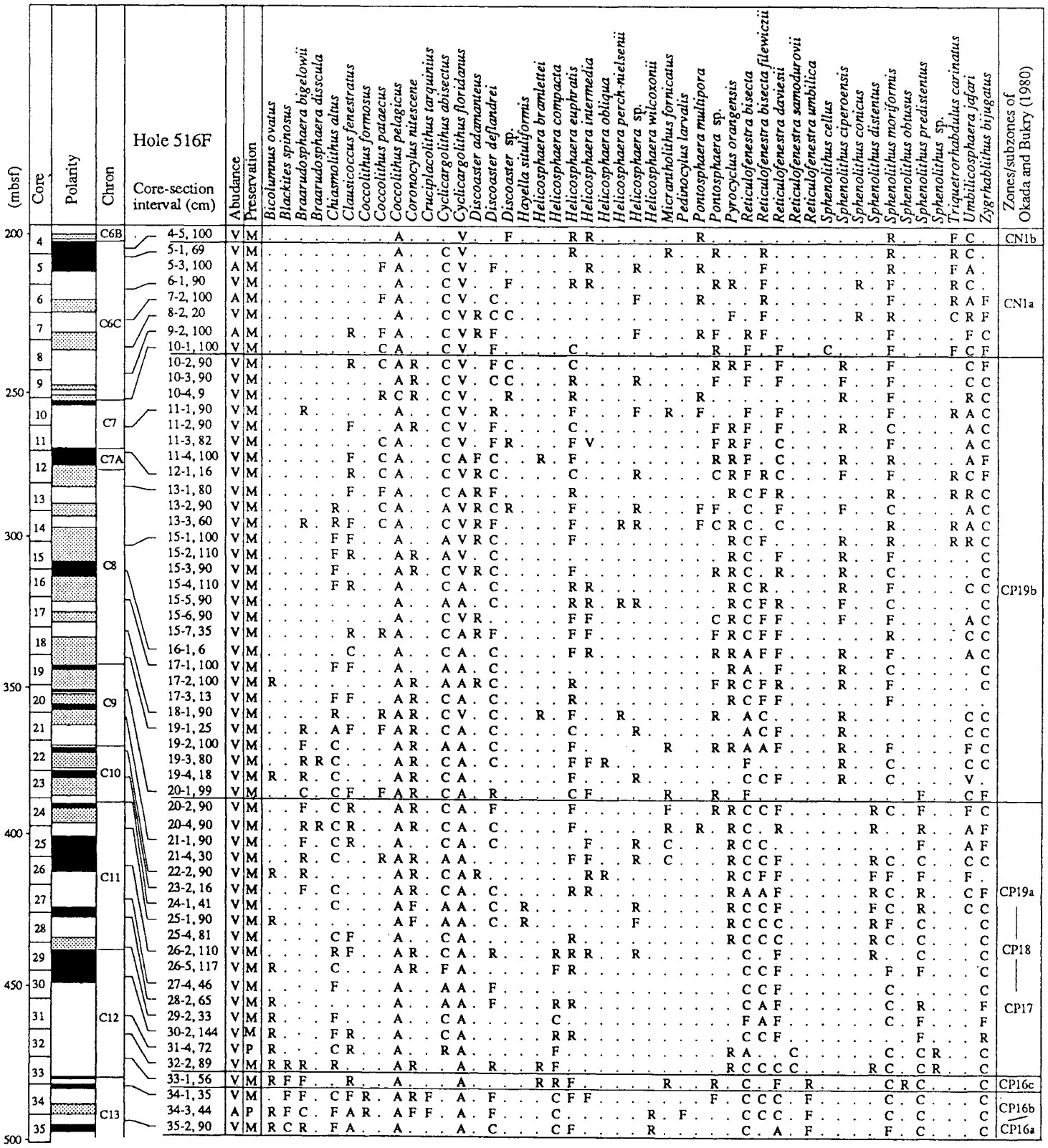


Fig. 1. Stratigraphic distribution of Paleogene calcareous nannofossil species and its correlation with the magnetostratigraphy of Berggren et al. (1984) for DSDP Hole 516F. Black interval indicates normal polarity; white interval indicates reversed polarity; and shaded interval denotes no paleomagnetic data. For nannofossil abundance, V=very abundant; A=abundant; C=common; F=few; and R=rare. For preservation of nannofossil assemblages, M=moderate; and P=poor.

# NON-CORRELATION OF NANNOFLORAL COMPOSITION WITH ISOTOPIC VARIATION IN CENOMANIAN CHALK-MARL RHYTHMS, SOUTH-EASTERN ENGLAND

*Jackie Burnett, Department of Geological Sciences, University College London*

## INTRODUCTION

Ditchfield & Marshall (1989) noted a difference in O-isotope composition between chalks and marls in Cenomanian chalk-marl rhythmic bedding of the Kent coast, south-eastern England. The chalks gave consistently lighter values of $\delta^{18}O$ than the marls. A survey of the nannofloras showed no systematic variation through the section (see below), this enabled the authors to deduce that $^{18}O$ composition was not affected by differences in biogenic fractionation of different coccolithophorid groups. They concluded that the $^{18}O$ signal recorded cyclical variations in the temperature of photic zone water (probably 23°C for marl deposition and 25°C for chalk deposition, with a maximum variation of 4.5°C), which was also recorded as cyclical nannofloral productivity. Due to the lack of consistent variation the nannofossil data was not included in the original paper, but as a matter of general interest to other workers in this field, I felt it would be worthwhile to publish it here.

## NANNOFLORAL RESULTS

Simple counts of approximately 500 specimens per smear-slide were made, the samples being taken from 10cm intervals over a 1.2m section of rhythmically-bedded chalks and marls cropping out between Folkestone and Dover. These were entered onto the Checklist II range-chart database and a chart of relative abundances was produced (Figure 1). The section falls into NF Subzones CC9C/10A (as defined in Perch-Nielsen 1985), between the FO of *Corollithion kennedyi* and the LO of *Microstaurus chiastius.* Fifty-six species were identified. Diversity fluctuated between 38 and 44 species per sample, the more consistently higher diversities occurring in the lower 0.5m of the section. The nannofloras are dominated by *Biscutum ellipticum* and *Watznaueria barnesae* throughout the section, with *Discorhabdus ignotus, Eiffellithus turriseiffelii, Prediscosphaera cretacea, Tranolithus orionatus* and *Zeugrhabdotus erectus* being consistently represented, although not in great numbers. No systematic floral change was observed in relation to the lithology to account for the regular change in $\delta^{18}O$ composition.

## ACKNOWLEDGEMENTS

Thanks to Dr. Katharina von Salis Perch-Nielsen for prompting me to publish the nannofloral data and to Dr. Alan Lord for passing his critical eye over the manuscript. The work was carried out under the funding of the Natural Environmental Research Council Research Grant No. GR3/6767.

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Ditchfield P. & Marshall, J.D. 1989: Isotopic variation in rhythmically bedded chalks: Paleotemperature variation in the Upper Cretaceous. *Geology,* 17, 842-845.

Perch-Nielsen K. 1985: Mesozoic calcareous nannofossils. In: Bolli, H.M., Saunders, J.B. & Perch-Nielsen, K. "Plankton Stratigraphy" 329-426.

Figure 1: Nannofossil counts and stratigraphical distribution, Cenomanian chalk-marl rhythms, Kent.

RANGE CHART OF GRAPHIC ABUNDANCES BY LOWEST APPEARANCE

Key to Symbols

/ = Very Rare ( 0- 2 Percent)
X = Rare ( 3- 5 Percent)
O = Few ( 6- 15 Percent)
● = Common ( 16- 25 Percent)
■ = Abundant ( 26- 100 Percent)

? = Questionably Present
. = Not Present

| | 1 Amphizygus brooksii | 2 Axopodorhabdus albianus | 3 Biscutum ellipticum | 4 Broinsonia signata | 5 Chiastozygus litterarius | 6 Corollithion exiguum | 7 Corollithion kennedyi | 8 Corollithion signum | 9 Cribrosphaerella ehrenbergii | 10 Cyclagelosphaera margereliii | 11 Cylindralithus nudus | 12 Discorhabdus ignotus | 13 Eiffellithus turriseiffelii | 14 Eprolithus floralis | 15 Gephyrorhabdus coronadventis | 16 Lithraphidites acutus | 17 Lithraphidites carniolensis | 18 Manivitella pemmatoidea | 19 Microstaurus chiastius | 20 Prediscosphaera cretacea | 21 Prediscosphaera spinosa | 22 Radiolithus planus | 23 Retecapsa angustiforata | 24 Retecapsa crenulata | 25 Rhagodiscus achylostaurion | 26 Rhagodiscus angustus | 27 Rhagodiscus asper | 28 Rhagodiscus plebeius | 29 Rhagodiscus splendens | 30 Rhombolithion rhombicum | 31 Rotelapillus crenulatus | 32 Scampanella bispinosa | 33 Scapholithus fossilis | 34 Staurolithites laffittei? | 35 Stoverius achylosus | 36 Tranolithus gabalus | 37 Tranolithus orionatus | 38 Watznaueria barnesae | 39 Watznaueria manivitae | 40 Zeugrhabdotus compactus | 41 Zeugrhabdotus embergeri | 42 Zeugrhabdotus erectus | 43 Braarudosphaera bigelowii | 44 Broinsonia enormis | 45 Chiastozygus bifarius | 46 Cretarhabdus striatus | 47 Eprolithus apertior | 48 Gartnerago nanum | 49 Helicolithus trabeculatus | 50 Seribiscutum primitivum | 51 Watznaueria ovata | 52 Microrhabdulus decoratus | 53 Nannoconus sp. (x-section) | 54 Gartnerago obliquum | 55 Cretarhabdus conicus | 56 Tranolithus minimus | |
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| 110cm | / | / | ● | / | / | . | . | . | / | . | / | / | X | X | / | / | / | / | / | O | O | / | / | / | / | / | / | / | . | / | . | / | / | / | / | / | / | X | ■ | . | / | / | X | . | / | . | . | . | / | / | / | . | . | . | / | / | . | . | . | 110cm |
| 100cm | / | / | ■ | / | / | . | . | . | / | . | / | / | X | X | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | X | ● | / | / | . | X | X | / | / | / | . | / | / | / | . | . | . | / | / | . | . | . | 100cm |
| 90cm | / | / | ■ | / | / | . | . | . | . | . | / | X | X | X | / | / | / | / | / | / | O | / | / | / | / | / | / | / | . | / | / | / | / | / | / | / | / | X | ● | / | / | / | X | X | . | / | / | / | / | / | / | . | / | / | / | / | . | / | . | . | 90cm |
| 80cm | / | / | ■ | / | / | . | . | . | . | . | / | X | X | X | / | / | / | / | / | / | O | / | / | / | / | / | X | / | / | / | / | / | / | / | / | / | / | X | ● | / | / | . | / | / | / | / | / | / | / | / | / | . | . | . | / | / | / | / | . | . | 80cm |
| 70cm | X | / | ■ | / | / | . | . | . | . | / | / | X | / | / | / | / | / | / | / | / | / | . | / | / | / | / | / | / | . | / | . | / | / | / | / | / | / | X | O | / | / | . | X | X | . | / | . | / | . | / | / | / | . | / | . | . | . | . | . | / | 70cm |
| 60cm | / | / | ■ | / | / | . | . | . | . | . | / | O | X | X | / | / | / | / | / | / | O | / | / | / | / | / | / | / | . | . | . | / | . | / | . | / | / | X | ● | / | / | X | / | X | X | . | / | / | / | . | . | / | . | / | / | / | . | / | . | . | 60cm |
| 50cm | / | / | ● | / | / | / | . | . | / | / | / | X | X | X | / | . | / | / | / | . | O | / | . | / | / | / | / | / | . | / | . | / | / | / | / | / | / | X | ● | / | / | X | / | X | X | / | / | / | / | / | / | / | / | / | / | / | . | / | / | / | 50cm |
| 40cm | / | / | ● | / | / | . | / | . | . | . | . | X | X | X | / | . | / | / | / | . | O | . | / | / | / | / | / | / | . | / | . | / | / | / | / | / | / | X | ● | / | / | . | X | X | . | / | / | / | / | / | / | / | / | / | / | / | . | / | / | / | 40cm |
| 30cm | / | / | ● | / | / | . | . | . | / | . | / | X | X | X | / | / | / | / | / | / | O | . | / | / | / | / | / | / | . | / | . | / | / | / | / | / | / | X | ■ | / | / | . | X | X | . | / | / | / | / | / | / | / | / | / | / | / | . | / | / | / | 30cm |
| 20cm | / | / | ● | / | / | . | . | . | / | / | / | X | X | / | / | . | / | / | / | / | O | / | / | / | / | / | / | / | . | / | . | / | / | / | / | / | / | X | ● | / | / | / | X | O | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | 20cm |
| 10cm | / | X | ● | / | / | . | . | . | / | . | . | X | X | X | / | / | / | / | / | / | O | / | / | / | / | / | / | / | . | / | . | / | / | / | / | / | / | X | ● | / | / | / | X | O | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | 10cm |
| 0cm | / | / | ● | / | / | / | / | / | / | / | / | X | X | / | / | / | / | / | / | / | O | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | / | X | ● | / | / | / | / | O | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | 0cm |

# A NEW NANNOFOSSIL ZONATION SCHEME FOR THE BOREAL CAMPANIAN

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## INTRODUCTION

In 1975, the Institute of Geological Sciences (now the British Geological Survey) drilled the Trunch Borehole (located in north-eastern Norfolk, eastern England) in order to sample as complete a section of the Upper Cretaceous on the British mainland as possible, to be used as a standard section for correlation purposes in the northern English and southern North Sea area (Gallois & Morter, 1975). Approximately 220m of the borehole are Campanian in age.

As part of an extensive correlation project between macrofossil and nannofossil zonation schemes, approximately 260m of Campanian chalk from the Lagerdorf and Kronsmoor Quarries, located near Hamburg, north-western Germany, were examined for their nannofloral content.

It became apparent that the Campanian nannofloras of the two areas are comparable, both containing a number of Boreal-restricted forms, with a number of characteristically Tethyan zonal marker species being absent. The application of Sissingh's (1977, 1978) standard numbered zonation scheme, supplemented by Perch-Nielsen's nannofossil event observations (1979, 1983, summarised in Bolli et al., 1985) fails between NF Zones CC18 and CC22B, due to the non-, or very rare and stratigraphically sporadic occurrences of *Bukryaster hayii, Ceratolithoides verbeekii, Marthasterites furcatus spp., Ceratolithoides aculeus, Quadrum sissinghii, Quadrum trifidum* and *Lithastrinus grillii.* Additionally, in northern chalks, where calcitic overgrowth on nannofossil specimens tends to obscure fine detail, it is sometimes very difficult to differentiate between *Reinhardtites levis* and *R. anthophorus* when routinely dating by light-microscope, thus the identification of the bases of standard NF Zones CC22C and CC23A can be less than precise.

Correlation between the identifiable Campanian NF zones of the Trunch Borehole and the German quarries revealed a number of interstitial nannofloral events which bridge the gap in Sissingh's (1977) scheme and provide a workable alternative for the Boreal region, possibly including the North Sea area. The new zones are fitted within the framework of Sissingh's scheme (but are distinguished from his zones by the prefix B, for Boreal), in order that their relative positions, with respect to the standard cosmopolitan events, are continuous. Integrated macro- and microbiostratigraphical data on the sections involved will be published elsewhere.

## NANNOFOSSIL BIOZONATION

New NF Zones CC/B18 to CC/B22 replace Sissingh's (1977) NF Zones CC18 to CC22, whilst Sissingh's Zone CC17 is divided into Subzones CC/B17a, CC/B17b and CC/B17c, and his Subzone CC23A is subdivided into CC/B23Aa, CC/B23Ab and CC/B23Ac, herein. The zones are defined in Appendix 2.

Figure 1 shows the correlation between the English and German nannofossil events used to define the new (sub-)zones. The stage and macrofossil zonation of the Trunch Borehole is attributed to Morter (1984, unpublished B.G.S. data). Stage and macrofossil data was taken from Schulz et al. (1984) for the German material. Age definitions for the new (sub-)zones are estimated from the German scale, as this has a more refined macrofossil zonation control than has the Trunch Borehole.

Sissingh's (1977) standard nannofossil zones are correlated with the new Boreal zones and, for interest, with the Campanian part of the Sr-isotope curve of McArthur et al. (in press: based on the Trunch Borehole) in Figure 2. A high degree of age-refinement was not possible in the Trunch Borehole, with which to correlate the Sr-isotope curve. From the correlation of nannofossil data between England and Germany, more refined age-assignments can be extrapolated for the curve. A nannofossil species index is given in Appendix 1.

## DISCUSSION

A number of industry-orientated Boreal nannofossil zonation schemes have been produced for the Late Cretaceous, based on North Sea well samples. These schemes suffer from having little, or no, biostratigraphical control with which to correlate onshore material, and from the nannofloras being generally much less well preserved than in onshore material. Mortimer (1987) produced a Cenomanian to Maastrichtian scheme for the southern Norwegian and Danish North Sea area, and equated his zones to Sissingh's (1977) scheme by extrapolation. In

particular, he divided the uppermost Hod and lowermost Tor Formations (representing the Lower and Upper Campanian, respectively) into four nannofossil zones, based on the LOs (= first downhole occurrences) of *Orastrum campanensis, Helicolithus trabeculatus, Cylindralithus asymmetricus* (= *C. biarcus*?), *Broinsonia enormis* and *Phanulithus* (=*Calculites*) *obscurus*. In my study, *O. campanensis* was found not to have a correlatable LO between Germany and England, whilst *H. trabeculatus, C.biarcus* and *B. enormis* were found to range beyond the limits defined by Mortimer (probably due to preservation). Varol (1989) used Mortimer's (1987) scheme with some additional events, one of which (the LO of *Tortolithus caistorensis*) approximates to the findings of this study.

## CONCLUSIONS

It is hoped that the extensive geographical application of this new biozonation already evinced by this study is applicable to the North Sea area (although I appreciate that the new scheme uses mostly FOs, whereas LOs are of more use, industrially), where correlation of nannofloral events with macrofossil/stage data would prove useful for industrial and research purposes.

## ACKNOWLEDGEMENTS

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## APPENDIX 1: NANNOFOSSIL TAXONOMICAL INDEX

References for, and illustrations of, these species can be found in Perch-Nielsen (1985).

*Biscutum dissimilis* Wind & Wise in Wise & Wind, 1977
*B. magnum* Wind & Wise in Wise & Wind, 1977
*Broinsonia parca* (Stradner, 1963) Bukry, 1969
*Calculites obscurus* (Deflandre, 1959) Prins & Sissingh in Sissingh, 1977
*Heteromarginatus bugensis* (Gorka, 1963) Crux in Crux et al., 1982
*Monomarginatus quaternarius* Wind & Wise in Wise & Wind, 1977
*Neocrepidolithus cohenii* (Perch-Nielsen, 1968) Perch-Nielsen, 1984a
*Orastrum campanensis* (Cepek, 1970) Wind & Wise in Wise & Wind, 1977
*Prediscosphaera stoveri* (Perch-Nielsen, 1968) Shafik & Stradner, 1971
*Reinhardtites anthophorus* (Deflandre, 1959) Perch-Nielsen, 1968
*R. levis* Prins & Sissingh in Sissingh, 1977
*Staurolithites mielnicensis* (Gorka, 1957) Perch-Nielsen, 1968 *sensu* Crux in Lord, 1982

*Tortolithus caistorensis* Crux in Crux et al., 1982
*Tranolithus orionatus* (Reinhardt, 1966a) Reinhardt, 1966

## APPENDIX 2: FORMAL DESCRIPTION OF ZONES

*CALCULITES OBSCURUS* PARTIAL RANGE (P.R.) ZONE (CC17) — Sissingh (1977).
Definition: FO of *Calculites obscurus* to the FO of *Broinsonia parca.*
Age: Late Santonian to early Campanian.

*CALCULITES OBSCURUS* P.R. SUBZONE (CC/B17a) — New subzone
Definition: FO of *Calculites obscurus* to the FO of *Orastrum campanensis.*
Age: Late late Santonian to early early Campanian. Type locality: Lagerdorf Quarry.

*ORASTRUM CAMPANENSIS* P.R. SUBZONE (CC/B17b) — New subzone
Definition: FO *Orastrum campanensis* to the FO of *Biscutum magnum.*
Age: Early early Campanian. Type locality: Lagerdorf Quarry.

*BISCUTUM MAGNUM* P.R. SUBZONE (CC/B17c) — New subzone
Definition: FO of *Biscutum magnum* to the FO of *Broinsonia parca.*
Age: Early early Campanian. Type locality: Lagerdorf Quarry.

*BROINSONIA PARCA* P.R. ZONE (CC/B18) — New zone
Definition: FO of *Broinsonia parca* to the FO of *Staurolithites mielnicensis.*
Age: Early early Campanian. Type locality: Lagerdorf Quarry.

*STAUROLITHITES MIELNICENSIS* P.R. ZONE (CC/B19) — New zone
Definition: FO of *Staurolithites mielnicensis* to the FO of *Monomarginatus quaternarius.*
Age: Early to middle early Campanian.
Type locality: Lagerdorf Quarry.

*MONOMARGINATUS QUATERNARIUS* P.R. ZONE (CC/B20) — New zone
Definition: FO of *Monomarginatus quaternarius* to the FO of Reinhardtites levis.
Age: Middle early to early late Campanian. Type locality: Lagerdorf Quarry.
Remarks: *Prediscosphaera stoveri* FOs around the CC22B/CC22C boundary, probably within this zone, and may be useful in cases where the FO of *Reinhardtites levis* is difficult to distinguish.

*BISCUTUM DISSIMILIS* P.R. ZONE (CC/B21) — New zone
Definition: FO of *Reinhardtites levis* to the LO of *Biscutum dissimilis.*
Age: Early late Campanian. Type locality: Lagerdorf Quarry.

*EIFFELLITHUS EXIMIUS* P.R. ZONE (CC/B22) — New subzone
Definition: LO of *Biscutum dissimilis* to the LO of *Reinhardtites anthophorus* (or LO *E. eximius*).
Age: Early to late late Campanian. Type locality: Lagerdorf and Kronsmoor Quarries.

*TRANOLITHUS ORIONATUS* (= *PHACELOSUS*) P.R. ZONE (CC23) — Sissingh 1977
Definition: LO of *Reinhardtites anthophorus* to the LO of *Tranolithus orionatus.*
Age: Latest Campanian to early Maastrichtian.

*TRANOLITHUS ORIONATUS* P.R. SUBZONE (CC23A) — Perch-Nielsen 1985
Definition: LO *Reinhardtites anthophorus* to the LO of *Broinsonia parca.*
Author: Figured but not defined in Perch-Nielsen (in Bolli et al., 1985).
Age: Latest Campanian to earliest Maastrichtian.

*HETEROMARGINATUS BUGENSIS* P.R. SUB-SUBZONE (CC/B23Aa) — New sub-subzone
Definition: LO *Reinhardtites anthophorus* to the LO of *Heteromarginatus bugensis.*
Age: Late late Campanian. Type locality: Kronsmoor Quarry.

*TORTOLITHUS CAISTORENSIS* P.R. SUB-SUBZONE (CC/B23Ab) — New sub-subzone
Definition: LO of *Heteromarginatus bugensis* to the LO of *Tortolithus caistorensis.*
Age: Latest Campanian to earliest Maastrichtian. Type locality: Kronsmoor Quarry.

*NEOCREPIDOLITHUS COHENII* P.R. SUB-SUBZONE (CC/B23Ac) — New sub-subzone
Definition: LO of *Tortolithus caistorensis* to the LO of *Broinsonia parca.*
Age: Early early Maastrichtian. Type locality: Kronsmoor Quarry.

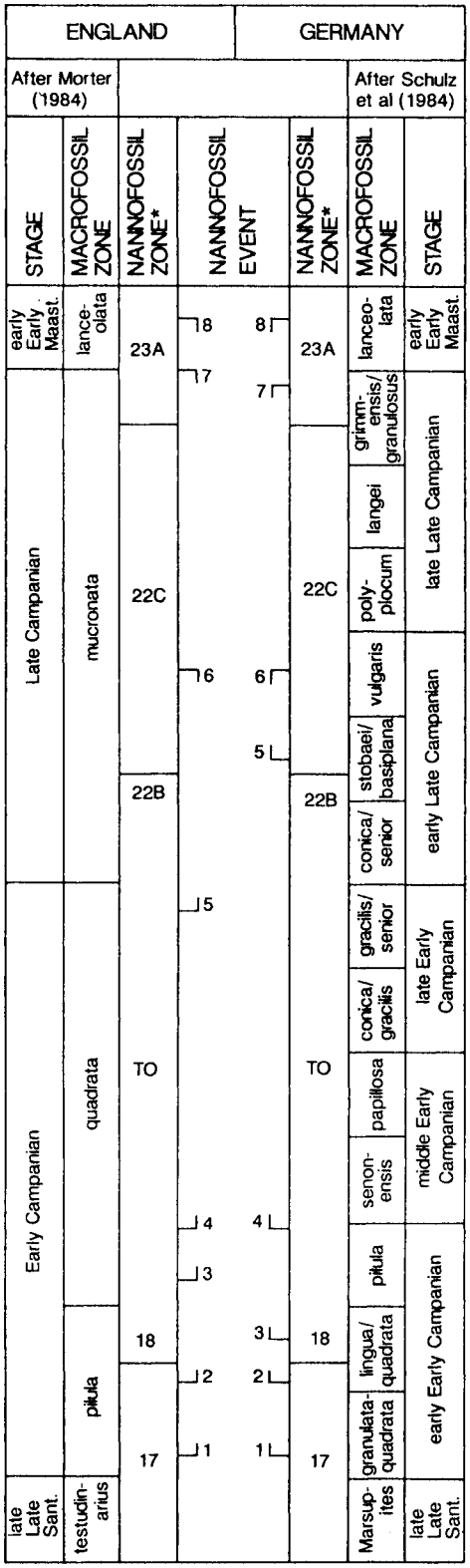


Figure 1: Correlation between English and German Boreal nannofossil events (N.B. macrofossil zones do not necessarily correlate). *After Sissingh (1977, 1978) and Perch-Nielsen (1979, 1983, 1985). Species indicated by numerals explained in Figure 2.

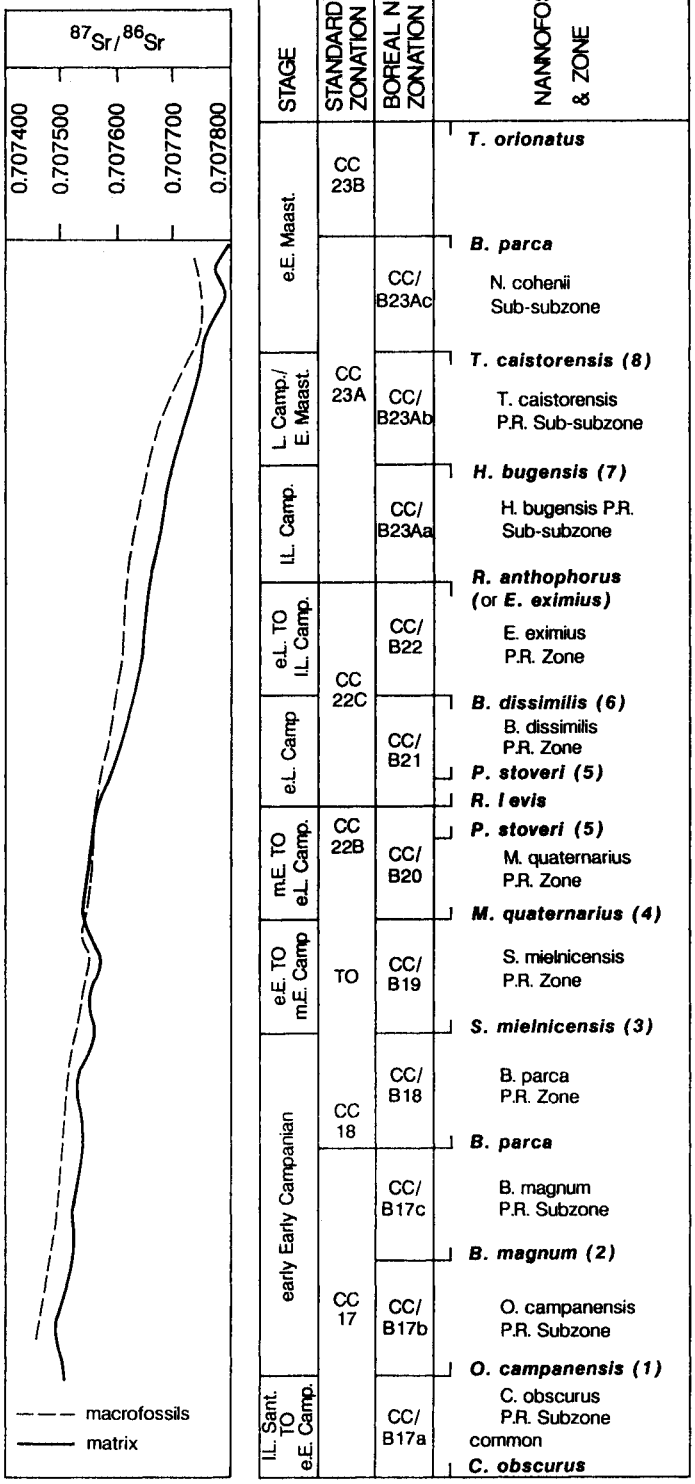


Figure 2: New Boreal zonation scheme correlated with the standard nannofossil zones of Sissingh (1977, 1978) and Perch-Nielsen (1979, 1983, 1985) and the Sr-isotope curve for the Campanian of northern England (after McArthur et al., in press).

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## NEW TAXA

### Calcareous Nannoplankton Species

*bergenii, Discoaster*
*furcatolithoides* ssp. *labradorensis, Sphenolithus*
*girgisii, Helicosphaera*
*gizoensis, Hughesius*
*jakubowskii, Helicosphaera*
*magnifica, Helicosphaera*
*mullerae, Helicosphaera*
*praeglobulata, Scyphosphaera*
*pseudorecurvata, seyphosphaera*
*solomonica, Anacanthoica*

### Calcareous Nannoplankton Genera

*Hughesius*

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## NEWSLETTER - ADVICE TO CONTRIBUTORS

### TYPES OF CONTRIBUTION

The newsletter is essentially informal and contributions of any type submitted in any form will be considered, if not necessarily accepted. The following notes are a guide to possibilities rather than a set of directions.

A. BIBLIOGRAPHIES: These are produced by the bibliographers. Any suggestions, reprints of articles, and details of omissions should be sent to them directly.

B. ARTICLES: Short articles on any aspect of nannoplankton work are welcomed. Discussion, review, synthesis, and methodology articles are particularly welcome. Any articles with scientific content may be reviewed and should be submitted at least two months before the final copy deadline. The newsletter is a valid publication for taxonomic articles.

C. REVIEWS: Reviews of books, equipment items, or computer software and conference reports are welcome. To avoid duplication the idea may be suggested to the editor in advance of submission.

D. NEWS, & NOTES: Any news items, on forthcoming conferences, research projects, new appointments are welcome.

### SUBMISSION PROCEDURE

Two copies should be sent of all submissions. Include Fax number if available, for proof checking. News items and initial drafts of articles can be sent in draft form. Other items should be sent *either* as proof ready copy *or* on computer disc.

PROOF READY COPY: Submit on A4 paper (210x297mm) with 2.5cm left, right and top margins, 3.5cm bottom margin. Single spacing, 15point (elite) text. If possible use a laser printer.

SUBMISSION ON DISC: Include print-out and details of system used. I can easily handle the following. *IBM/MS-DOS*, any format, 5.25" or 3.5", discs (ideal 5.25", 1.2 Mb). Text as WordPerfect, WordStar, Smart, DCA, Navy DIF, MultiMate, or ASCII files (ideal WordPerfect 5.0). *MacIntosh,* 3.5" discs, Ms-Word, MacWrite or ASCII files. *Amstrad,* 3"discs, Locoscript, Wordstar, Tasword or ASCII files. Any alterations to the text, other than for spelling or very minor mistakes, will be checked with the author.

DIAGRAMS: Should be submitted as very clean computer printouts, photographs or photocopies of final size, do not send large or delicate originals.

REFERENCES: Use standard (World List) abbreviations, and *format of examples below*. ODP & DSDP volumes should be treated as periodicals using the following abbreviations: IRDSDP; Proc. ODP Init. Rep.; Proc ODP Sci. Res.

Spencer S. & Dobb A. 1988: New observations on Upper Cretaceous vombatidae. *J. Wom. Res.*, **25**, 35-67.

McCarthy J.J. 1980: Nitrogen. In, Morris I. (ed.) "The Physiological Ecology of Phytoplankton", Blackwell, p.191-234.

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