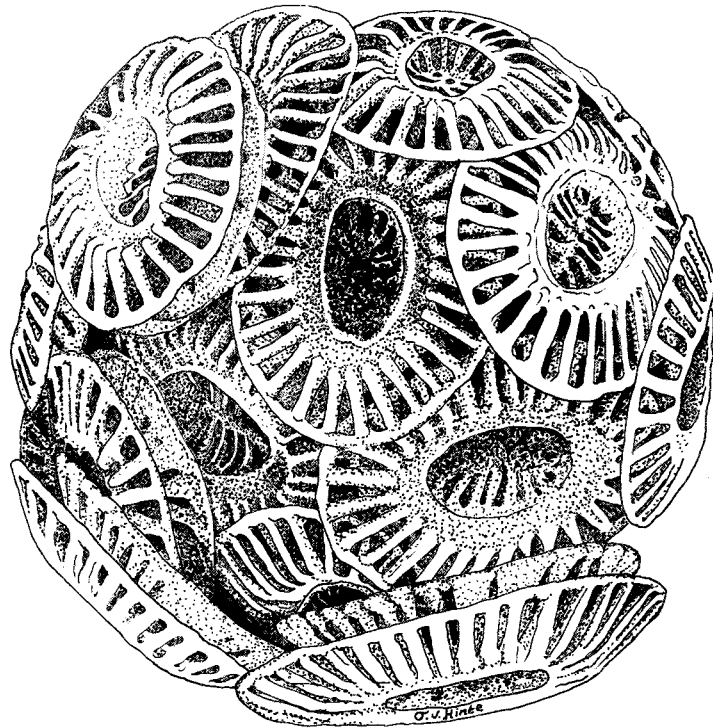


INA

NEWSLETTER



INTERNATIONAL NANNOPLANKTON ASSOCIATION

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**ADVERTISING:** Advertisements are welcome, at a rate of £40/page, £20/half page etc. Contact editor for queries.

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Proceedings of the International Nannoplankton Association

Volume 14

Number 2

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## NEWS ITEMS AND ANNOUNCEMENTS

### ELECTION OF NEW PRESIDENT

Our extended democratic experiment is nearly over. The nomination process has resulted in only two candidates; Shirley van Heck and Woody Wise. There is a voting paper included with this Newsletter, please make your vote and return the slip to Katharina von Salis. The new president will take over at the Salamanca Conference, September 1993.

### NEW AMERICAN TREASURER

Stephan A. Root enjoyed the Prague Meeting so much he has volunteered to take over as US Treasurer, from John Steinmetz. Please in future send all US\$ subscriptions to Stephan, (cheques payable to INA). This ends 9 years invaluable work by John as an INA officer, including 7 years as bibliographer. He will, nonetheless, continue working with Shirley on producing the Loeblich & Tappan and INA Bibliographies as a single database. Stephan's address is given on the inside front cover.

### EDITORIAL NOTES

**Silicoflagellate special issue:** Stacia Spaulding has completed the heroic task of compiling a Bibliography and Taxa of silicoflagellates. Since this is a substantial work we have published it as a separate special issue, mailed together with this issue of the Newsletter. The silicoflagellate bibliography is a continuing project so please check to see if your favourite silico papers are included and if not send reprints, or at least a full reference, to Stacia. Future updates should be shorter and will be published in the main Newsletter.

**Membership list:** Since I had a substantial amount of material for this issue I have held over the new INA Membership List till the next issue.

**Enclosures and advertising:** This issue includes an advertisement for Osman Varol's new consultancy, as general policy INA members are very welcome to place advertisements in the Newsletter, at a rate of £40/page. Also included is a reprint from Paul and I. A result of the curious pricing policies of Nature we were able to purchase an additional 250 copies of the paper for very little. If other members are in this position and have a paper they would like to circulate to all INA Members then please contact me.

*Jeremy Young*

### INA ACCOUNTS

The INA accounts this year are presented in a slightly more detailed way (see end of volume). This is to highlight the transactions involving the payment for the Florence Proceedings at the special prepublication price. This information was not included in the 1990-1991 accounts to save confusion. However, I have decided to give a breakdown of the transactions so that the accounts represent a true picture of our financial affairs.

The Opening Balance for '91-'92 differs from the Closing Balance of '90-'91 by the sum of £590.00. This sum was deposited into the UK INA account during April '90-'91 for the purchase of the Florence Proceedings at the special prepublication price. As all the INA accounts work together, the US account was used to make the bulk payment of \$1610.00 for 25 copies of the Florence Proceedings (at prepublication price), 8 of which are designated INA assets (the others belong to individual members).

Apart from the above, may I draw your attention to the number of members who have not paid their subscriptions to INA this year. These members will receive reminder notes in this Newsletter, but I would appreciate their settling-up as soon as possible as I don't want to waste INA monies sending reminders to individuals.

*Nicky Hine (Treasurer)*

## **2nd ASIAN/PACIFIC INA CONFERENCE, Yamagata Japan 1-3 Sept. 1992**

Convenor - Hisatake Okada

Only seven non-Japanese scientists have responded to the second circular, and we expect approximately 15 Japanese scientists to attend the conference. Despite the limited number of participants, the conference will be held as announced. All the activities will be in a very informal and friendly manner. You will enjoy our hospitality including that of our students.

### **Programme:**

**Tuesday 1st September:** Invited lectures on the biology of coccolithophores from Eiji Takahashi and Isao Inouye. Open session of oral presentations, and poster session. *Welcome Party*.

**Wednesday 2nd September:** Workshop sessions including counting methodology; Pleistocene large Reticulofenestra; new SEM and image filing technology. *Get to know you Party*.

**Thursday 3rd September:** Plenary Excursion (Miocene) & sight-seeing (rural Japan) in Yamagata region. Lunch in country restaurant famous for edible wild plants and mushrooms. Leader H. Okada.

**Friday 4th September:** Optional excursion to Boso Peninsula Plio- Pleistocene.

**Cost:** Registration 10,000yen (including Plenary Excursion, and several meals). Accommodation 6,000yen single 10,000yen double room, Ohnuma Hotel. Optional field trip 15,000yen (including train). [Editor's note 10,000yen is about US\$80 and these rates are a real bargain].

**Abstracts:** Abstracts will be publishable after the conference in the INA Newsletter, together with a general account of the meeting.

**Late registrants** are still very welcome - up to deadline of July 31, 1992.

*H. Okada, Dept. of Earth Sciences, Yamagata University, Yamagata, 990 Japan. Fax 81-236-32838.*

## **5th INA CONFERENCE SALAMANCA, SPAIN - SUMMER 1993.**

Convenor - Jose-Abel Flores

The next main INA Conference will be celebrated in Salamanca, in Summer 1993, probably the first week of September. Four days for Scientific sessions and workshops are planned, with Pre- and Post Conference excursions. Scientific sessions will be held in the University of Salamanca, probably in the historic Old Building. Workshops and microscope rooms will be available in the Department of Geology, Faculty of Sciences, close to the Old Building.

Abstracts will appear as a special issue of the INA newsletter. Proceedings will be published as a special volume of *Revista Española de Micropaleontología* or *Revista Española de Paleontología*.

Two excursions are planned: a pre-conference excursion to the Neogene of the Guadalquivir Basin (Andalusia, 4 days, likely price about 15,000pta, \$150); and a post-conference excursion to the K/T boundary and Upper Cretaceous series in the North of Spain and South of France (2 days, likely price about 30-35000pta, \$300-350). At the moment workshops on Neogene, Jurassic, K/T boundary and living coccoliths are definitely planned. Possible additional topics include "Development of nannofossil databases" and "Cretaceous nannofossils", further suggestions are welcome.

Salamanca is about 2 hours from Madrid by train or car. Accommodation will be organised by a travel agency. It is also possible to reserve some rooms in student hostels. More details will appear in the 2nd Circular. To be sure of receiving the 2nd Circular, please complete the accompanying questionnaire and return it to:

*José-Abel Flores, Dept. de Geología, Facultad de Ciencias, Universidad, 37008 Salamanca, Spain  
Phone 34-23-294497, Fax 34-23-294514*

### **Cretaceous / Tertiary Boundary Workshop.**

I will be convening this workshop in Salamanca and would be most grateful if interested members could send me their suggestions, proposals for discussion, ideas, problems, possible contributions, and special interests, so that I can organize a scheme of subjects to tackle. My idea is to organize a schedule of short contributions, slide projections and microscope observations, focused on identification of the main taxa involved, correlation of zonal schemes, and possible interpretation of events in the noteworthy sections.

*Andrea Fiorentino, c/o Farinacci, Scienze della Terra, Univ la Sapienza, Pzza A. Moro, Roma, Italy*

## **THE BIOLOGY OF THE PRYMNESIOPHYTA - Plymouth, UK, 29th March - 1st April 1993**

*A conference of the Systematics Association - Announcement and invitation.*

The aim of this international symposium is to bring together phycologists, marine and freshwater ecologists, biochemists, and all others who have an interest in this important group of organisms. Contributions on any aspect of Prymnesiophyte biology, ecology, palaeobiology, physiology or systematics will be welcomed. Sessions will include invited and volunteered contributions, and there will be poster sessions and opportunities for informal workshops. The invited contributions will be published as a Systematics Association Special Volume. For further details, and for submission of paper and poster titles and suggestions of workshops, contact one of:

*Dr. John C. Green, Plymouth Marine Laboratory, Citadel Hill, Plymouth PL1 2PB, UK.*

*Fax 0752-226865.*

*Dr. Barry S.C. Leadbeater, Biology Dept., The University, PO Box 363, Birmingham, B15 2TT, UK.*

*Fax 021-414-5924.*

## **7th INTERNATIONAL SYMPOSIUM ON BIOMINERALIZATION**

**BIOMINERALIZATION 93**, Monaco 17-20th Nov. 1993

Biom mineralization 93 is the latest in a series of multidisciplinary conferences "held every three or four years, which consider current research in the production of mineralized structures by living systems." Particular interest is concentrated on the structure and chemistry of biominerals, the interaction between organic and inorganic components and the study of all biological and analytical aspects of mineral production".

Biom mineralization 1993 includes a special session convened by Peter Westbroek on "Biominerals and Oceanography: The products of biominerals in the marine environment. Oceanographic and climatic implications. Analyses of diagenetic changes in biominerals: consequences in palaeontology and sedimentology". For further information contact:

*Prof. J.P. Cuif, Bât. 504 Paléontologie, Faculté des Sciences, 91405 Orsay, France.*

*Abstracted from First Circular*

## **PROCEEDINGS OF THE PRAGUE MEETING**

Some 25 manuscripts have been submitted to Bohumil. These have all been reviewed, in most cases by two referees, and most have now been resubmitted by the authors. The proceedings will be published in two volumes covering broadly, I - General topics and Mesozoic Biostratigraphy, II - Cenozoic Biostratigraphy and Palaeocology. Volume I is being typeset now and Volume II is being compiled.

## **PROCEEDINGS OF THE FLORENCE MEETING**

This volume is now, finally, being printed.

## **FARINACCI CATALOGUE OF CALCAREOUS NANNOFOSSILS**

The Farinacci Catalogue of Calcareous Nannofossils, like the Ellis & Messina Catalogue of Foraminifera, consists of type descriptions and illustrations reprinted in a standard format. There are 13 volumes each consisting of about 250 sheets. These cover the vast majority of taxa of living and fossil nannoplankton including calcispheres. The future of this series is somewhat uncertain, although it is hoped that it may be possible to continue the catalogue within the framework of the Nannosys project (see below). In the interim it may be noted that back issues of all 13 volumes are still available, from:

*Libreria gia Nardecchia s.r.l., Via di Tor di Nona, 39, 00186 Roma, Italy*

*Phone & Fax number 39-6-68300010. Price per volume Lit 300,000 (about US\$ 250).*

## SUBCOMMISSION ON CRETACEOUS STRATIGRAPHY

The Subcommittee On Cretaceous Stratigraphy, SCS, of the International Union of Geological Sciences (IUGS) is re-organising its structure. Instead of the previous 3 working groups, there will be a separate working group (WG) for each Cretaceous stage. The main task of these working groups will be to define the lower boundary of the stage, by establishing a Global Stratotype Section and Point (GSSP). At the end of this process every stage in the Cretaceous will be defined by its lower boundary and by the lower boundary of the succeeding stage. In this way by definition there cannot be any overlap of successive stages, and there can be no "unassigned time" between stages.

There will be 11 working groups in total; Maastrichtian, Campanian, Santonian, Coniacian, Turonian, Cenomanian, Albian, Aptian, Barremian, Hauterivian, and Valanginian. (The Berriasian is covered by the Jurassic / Cretaceous boundary WG, chaired by J. Remane). This project needs a large number of specialists of all kinds - including nanno workers.

So far, calcareous nannofossil workers have kept a low profile in the search for and definition of a modern stratigraphic scale. With this new approach of establishing a WG for each stage, I feel that several of you may be willing to serve on a WG. If you are then please contact Dr. Peter Rawson, Dept. of Geological Sciences, University College, Gower St., London, WC1E 6BT, UK.

*Katharina von Salis*

## NANNOSYS/NANNOCAT

The response to the questionnaire on Nannosys/Nannocat in the previous issue of the Newsletter was not overwhelming; only eleven members reacted! All reactions were very positive and most people offered help to fill the database. I never realized, however, that there must be a lot of Dutchmen around, because almost nobody was willing to pay!

We discussed the topic during the Terminology Meeting in London. Ton Romein reported on potential cooperation with the ETI (Expert Centre for Taxonomic Identification; PO BOX 4766, 1009 AT AMSTERDAM, Contact: Dr.P.H.Schalk); this centre could store NANNOSYS/NANNOCAT and make it available on CD-rom or other media for worldwide distribution. The system will run on a relatively simple PC (Macintosh, IBM-compatibles, UNIX).

The major problem in getting NANNOSYS/NANNOCAT started is to raise funds to pay the salary of the person(s) who will fill the database. Paul Bown offered to look into the possibilities of getting funding from NERC or the EEC.

In the meantime Katharina von Salis and Ton Romein will start loading Farinacci's Catalogue. Ton offered to continue the Catalogue (in Nannocat Format); Andrea Fiorentino will discuss the matter (especially the copyrights) with Anna Farinacci.

*Ton Romein, LPP Foundation, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands*

## ERRATUM / APOLOGY

Stefan Gartner's note on *Gephyrocapsa caribbeanica* that appeared in the last newsletter (Gartner 1991) contained some serious typographic errors, introduced by the editor. The printed version is misleading and readers are strongly recommended to alter their copies.

- |                   |   |
|-------------------|---|
| Line 8            | ... stating that the zone extends "From the last occurrence of <i>Discoaster brouweri</i> ... to the first occurrence of <i>Gephyrocapsa oceanica</i> ... |
| Line 11, 6th word | ... elsewhere ...   |
| Line 14           | ... data in that publication indicate a late Pleistocene age ...  |
| Line 20, 4th word | ... foraminifer ...   |
| Line 23           | ... criteria relating to the holotype, the early Pleistocene ...  |

## REFERENCE

Gartner S., 1991: A note on *Gephyrocapsa caribbeanica* and amphora-shaped *Scyphosphaera*. *Int. Nannoplankton Ass. Newsl.*, 13/3, 103-104.

## REPORT - TERMINOLOGY WORKING GROUP MEETING, LONDON APRIL 1992

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

As announced in the last Newsletter (13/3, p.90) the Terminology Workshop in Prague was considered a success and the meeting voted to establish a working group to revise the discussion document into a publishable set of Guidelines on Coccolith Terminology. So in April this year we had a working group meeting at the Natural History Museum to continue the work begun in Prague.

This meeting was attended by a range of experienced nanno workers covering the stratigraphic spectrum from Jurassic to Recent, complemented by post-grad students from University College London to give the opinion of less entrenched workers. The attendees were, in stratigraphic sequence;

**Living:** Berit Heimdal, Ric Jordan, Annelies Kleijne.

**Cenozoic:** Liam Gallagher, Ton Romein, Katharina von Salis, Steve Spencer, Jeremy Young.

**Mesozoic:** Paul Bown, Jackie Burnett, Andrea Fiorentino, Martin Jakubowski, Brigitta van Niel, Dave Rutledge, Dawn Windley.

In addition apologies for absence and written suggestions were received from Marie-Pierre Aubry and Jim Bergen.

The workshop lasted for two and a half days about equally divided between plenary sessions discussing general aspects and sub-groups considering the application of terminology to individual families.

Inevitably given the number of people the workshop produced some splendid arguments - not least between the living and fossil workers. However, amicable relationships were maintained and sensible compromises worked out. I now need to produce a revised version of the terminology document. This will be circulated to all members of the working group, any other INA members who have strong feelings on the subject are welcome to write to me and I will include them on the mailing. Eventual publication will probably be in the journal *Palaeontology*.

### INFORMAL NOTES ON SOME OF THE MORE CONTROVERSIAL TOPICS

Whilst most of the document is a synthesis of existing opinions in places we had to be a bit more creative and since these are likely to be the most controversial parts they are summarised here. Any comments would be very welcome.

N.B. The disjunct/conjunct division is essentially a concept of mine that I talked the others into accepting. The other topics discussed here were all the subject of free ranging debate and the opinions are the product of this.

#### RIM / CENTRAL AREA

In >90% of coccoliths there is an outer part which is somewhat higher than the inner part of the coccolith. This provides a convenient basis for starting any description of the shape and structure of coccoliths. After significant debate we decided that the terms rim and central area were most appropriate for these two parts.

#### PLACOLITH / MUROLITH / PLANOLITH

The term placolith is generally agreed to be useful since it describes a common morphotype which has evolved repeatedly, presumably because the interlocking pattern of coccolith arrangement is a good way of making coccospheres. After much debate we decided that two other morphotypes were of similar importance: bowl-shaped coccoliths (which do not overlap or interlock on the coccosphere) - e.g. *Zygodiscus*, *Pontosphaera*; and disc-shaped coccoliths (which overlap but do not interlock) - e.g. *Rhabdosphaera*, *Discoaster*. For these there unfortunately were no adequate and unambiguous terms so we coined two new ones murolith (from Latin *Murus*, a wall) and planolith (from Latin *Planus*, level).

The other -lith words caused much debate but it was agreed that most of them were no longer truly descriptive terms but rather taxo-descriptive terms, i.e. informal taxonomic names for coccoliths produced by particular taxa. As such they do not need independent definitions - examples include helicolith, sphenolith, scapholith and caneolith. The document will include clarification of the meaning of all such terms.

### COCCOLITH AND NANNOLITH

We recommend that the term nannolith is used in the sense defined by Perch-Nielsen (1985) Bown (1987), and Aubry (1989). I.e. For calcareous nannofossils of uncertain affinity to coccoliths - e.g. discoasters, sphenoliths, *Micula*, *Ceratolithoides*. By extension it can be applied to a few living taxa where the calcareous structures are not definitely homologous with heterococcoliths or holococcoliths e.g. *Braarudosphaera* (pentaliths), *Florisphaera* (plates), *Ceratolithus* (ceratoliths, not the hoop-shaped coccoliths). The nannolith / coccolith division is convenient for describing assemblages but probably does not reflect any real taxonomic division, and with further research it is quite probable that many nannoliths as currently recognised may be proven to be true coccoliths.

The term nannolith has also sometimes been used as the equivalent to nannofossil but including living specimens (e.g. Haq 1978, Flores 1989). We felt that nannofossil could almost always be used in this sense and that nannolith was better reserved for the non-coccolith nannofossils.

### DISJUNCT AND CONJUNCT CENTRAL AREA STRUCTURES

We recommend that the terms conjunct and disjunct be used to describe whether or not central area structures are formed from the rim and so appear in cross-polarised light to be in optical continuity with it. Examples of taxa with conjunct central area structures include *Kamptnerius* (plate), *Watznaueria biporta* (bar), *Gephyrocapsa* (bridge) and *Toweius* (bars). Examples of taxa with disjunct central area structures include *Arkhangelskiella* (plate), *Watznaueria britannica* (bar), *Coccolithus* (bar) and *Chiasmolithus* (cross).

The best known examples of conjunct and disjunct structures are the bars in the central area of *Helicosphaera* species. These may be either disjunct or conjunct. To explain our choice of terms it is useful to review past usage, as summarised in the table below.

AUTHOR	Term for conjunct bar	Term for disjunct bar
Bramlette & Wilcoxon (1967)	Bar in optical continuity	Bar not in optical continuity
Haq (1971, 1973)	Bridge in optical continuity	Bridge not in optical continuity
Perch-Nielsen (1985)	Continuous bridge	Distinct bridge
Theodoridis (1984)	Bar	Bridge
Aubry (1988, 1990)	Bridge	Bar
<b>Our recommendation</b>	<b>Conjunct bar</b>	<b>Disjunct bar</b>
Examples	<i>H. carteri</i>	<i>H. intermedia</i>

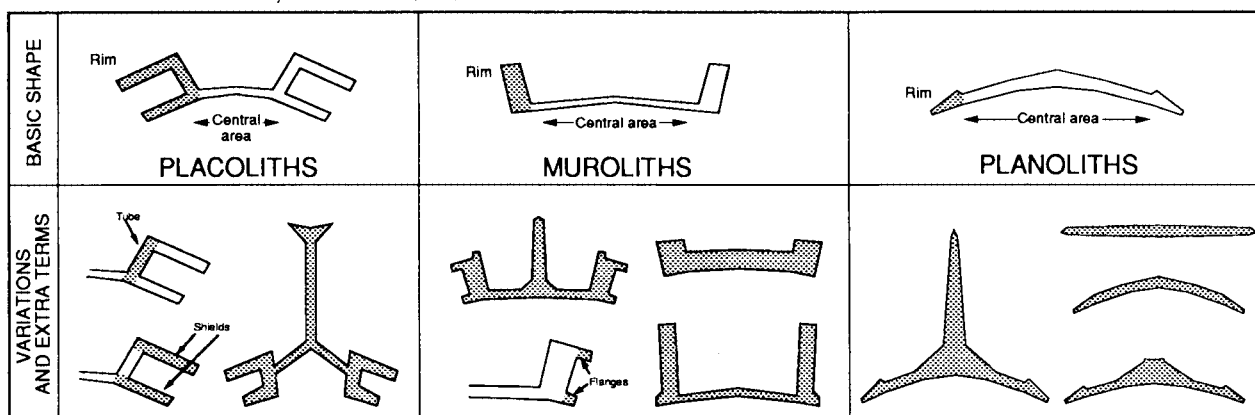
The phrases "in optical continuity" and "not in optical continuity" are viable but unwieldy. Also they place undue emphasis on the optical properties which are in fact a consequence of the structures being respectively formed from the rim crystal units or from separate crystal units confined to the central area. The bar/bridge divisions of Aubry and Theodoridis avoid these problems but introduce the new one that the special meaning ascribed to the terms bar and bridge has no logical relation to their normal meaning. This is highlighted by the fact that Aubry and Theodoridis used the terms with opposite senses. Also we prefer to use the terms bar and bridge to describe structures that are respectively flat (as in *Helicosphaera*) or arched (as in *Gephyrocapsa*).

Perch-Nielsen's continuous/distinct division is perhaps better but these two terms are not logical opposites and neither is very satisfactory since all *Helicosphaera* bars are arguably both continuous and distinct.

The recommended terms conjunct and disjunct are short, easily learned (we hope), and do not have distracting connotations.

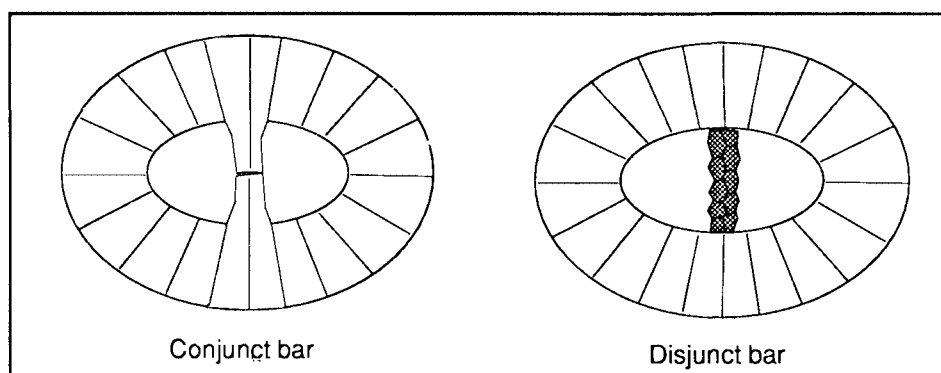
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#### Placoliths, muroliths, and planoliths.

Three basic types of coccoliths based on shape in cross-section. Intermediates between these types occur and also coccoliths not assignable to any of these types. Our objective is solely to give names to commonly recurring morphotypes, not to create a para-classification.



#### Conjunct and disjunct central area bars.

Conjunct central area structures are defined as those formed from the rim elements. Disjunct central area structures are formed from elements separate from the rim.

## BOOK REVIEW - CALCAREOUS ALGAE AND STROMATOLITES

Robert Riding (ed.), Springer Verlag, 1991

571pp., 16pls, 202 figs., Hardcover DM 228. ISBN 3-540-52373-1.

This book is a compilation of papers presented at the 4th International Symposium on Fossil Algae, held in Cardiff (Wales), in July 1987. All manner of CaCO<sub>3</sub> bioedificated structures from a wide variety of organisms (including Cyanobacteria and all major marine and fresh water calcareous algae), stratigraphic intervals (Archaean to present day) and (palaeo-) environmental interpretations are discussed. A total of 21 authors contributed 23 papers, presented in three parts.

**I. Introduction:** This deals with calcification processes and microbial carbonate classification.

**II. Major groups:** Reviews are given of the Morphology, Systematics (including some Taxonomic revision and classification), (Palaeo-)ecology, (palaeo-) geography, stratigraphic and/or geological importance (sediment production, reef formation) of: calcified cyanobacteria; Solenoporaceae; Corallinaceae; Cyclocrinitids; Dasycladales; Udotaceae; Halimedaceae; Charophyta; Calcareous nannofossils; and Calcareous dinoflagellate cysts.

**III. Algae and stromatolites through Time:** here there are discussions of Archaean, Proterozoic and Present Day Stromatolites, Cambrian Calcareous Cyanobacteria, Phanerozoic lagoonal, and marine Calcareous algae.

For nanno-workers only essays 1, 13 and 14 are closely related to their traditional research areas and so they are the only ones which are discussed in detail here.

### ALGAL CALCIFICATION OVERVIEW

Essay 1 by Alan Pentecost gives an interesting and brief description of calcification processes within several algal phyla (mainly Chlorophyta, Charophyta, Phaeophyta and Rhodophyta). He concentrates on the duality: biologically controlled (organic matrix mediated biomineralization) versus biologically induced (without direct biological control) mineralization. The importance of photosynthesis on the mineralization process and seasonal growth in Cyanobacteria are also stressed. An important conclusion may be that there are multiple, diverse calcification processes in algae and related groups. Within the section on Prymnesiophytes polysaccharide mediated intracellular versus extracellular calcification is discussed, based on data from various extant Coccolithophorids, notably, *Emiliana huxleyi*, *Pleurochrysis carterae*, and *Coccolithus (Crystallolithus) pelagicus*. The closing sentence of this section suggests that "*mechanisms supported by a rigid theoretical background are still lacking*" I would suggest the interesting models presented one month later by at the London 1987 INA Meeting by J.R. Young. The article ends with a biochemical discussion on the calcification mechanisms.

### CALCAREOUS NANNOPLANKTON

Essay 13 is entirely dedicated to calcareous nannofossils. In it Simon D. Houghton gives a fairly complete overview of nannofossils by reviewing the main biological and ecological aspects of recent coccolithophorids, calcareous nannofossil evolutionary trends and biostratigraphy, taphonomic effects on nannofossil assemblages and palaeoceanographic interpretation.

The first sections give a review of cytology and biological aspects. *Emiliana huxleyi* coccolith formation is discussed and synthetic descriptions are given of coccolith morphology and crystal structure. There are special discussions of discoasters, nannoconids, and schizosphaerellids

Reading sections 5 (Ecology of Recent Coccolithophorids) and 9 (Calcareous Nannofossils as palaeoclimatic and palaeoceanographic indicators) a possible comment, based on their separate presentation, is that there is still no Atlas with a complete equivalence between extant Coccolithophore species and their potential coccolith morphotypes, with both scanning and optical micrographs; some kind of "bridge" between biological and palaeontological terminologies and taxonomies, together with analysis of taphonomic bias (extensively discussed in section 8). This should be a task for (palaeo-)

ecologists dealing with coccolithophorids and other groups (e.g. Dinoflagellates) in order to take full advantage of water column ecological and biogeographical information in accomplishing palaeoclimatic and palaeoceanographic interpretations based upon bottom sediment contents; a first solid step before palaeoecological models [i.e. latitudinal gradient linear response; astronomic forced cyclicity; and/or chaotic turbulent dynamics (upwelling/plume convection; oceanic current gyres; climate)] may be properly demonstrated and further applied.

Still on Section 9, interesting and updated remarks are made on using calcareous nannofossil assemblages as palaeodepth and marginal sea/open ocean indicators based mainly on the author's recent works. The relative distributions and abundances of *E. huxleyi* and *G. oceanica* are extensively discussed, and variations in their dominance ratio are related to the oceanic nutrient budget.

Section 9.3 (Calcareous nannofossils used as palaeotemperature indicators) starts with McIntyre & Bé's traditional coccolithophorid climatic zones and assemblages, and continues with an interesting potential biochemical temperature indicator (ketones produced by *E. huxleyi*) followed by an extensive discussion on the discoaster group as a palaeotemperature indicator. Strict dependence of temperature is questioned against other possible explanations, particularly for extinction events (*competition for nutrients ... increased predation ...*). A good complement to this text are recent works by one of Backman's co-workers (Chepstow-Lusty et al. 1989, 1991, in press) particularly on the control of discoasters by nutrient availability. This section ends with oxygen isotope ratio analysis applied to coccolith oozes (< 25 µm fraction). The advantages and drawbacks of isotope data from coccoliths as opposed to Foraminifera are discussed, nevertheless signals retrieved by these two sources, although shifted, seem to agree extensively.

Section 6 "Evolution of Calcareous Nannofossils" reviews and documents its first representatives appearance in Tethys, in the Late Triassic, referring to K. Perch-Nielsen's suggestion that their appearance may be related to the salinity of tethyan epicontinental waters (surely it's not a coincidence that the calcification tendency of marine algae appears just before limestones become so extensively abundant during the Jurassic and Cretaceous). Major steps, diversity episodes and extinctions are also discussed, for example the K/T boundary. The late Cenozoic trends of gradual reduction in volume of calcite secreted (in *Pseudoemiliania lacunosa* and *Emiliania huxleyi* ecophenotypes) together with discoaster group evolutionary tendencies are discussed in terms of adaption of a distinct living depth or a low temperature effect.

Although biostratigraphic data is constantly being added to and checked, Section 7 (Calcareous nannofossils Biostratigraphy) provides a quick overview of the main groups of stratigraphic value and discusses their relative importance; it provides a synthetic guide for those who start in "nanno-dating" Meso-Cenozoic formations.

## CALCISPHERES

Chapter 14, entitled "Fossil Calcareous Dinoflagellate Cysts" by Helmut Keupp gives a synthesis on Dinoflagellate calcareous cysts reviewing earlier taxonomic criteria and putting some order in morphology (extensively described) and systematics of Thoracosphaera and *Pithonella*-like calcispheres.

In section 3 both the biological and potential palaeoecological meaning of these structures are specially discussed. Section 4 discusses the ecological aspects and Mesozoic palaeogeographic distributions. Short sections 5 and 6 give quick overviews of phylogeny and new research fields, respectively.

In an Appendix section further taxonomic references are made together with two new obliquipithonelloid genus descriptions: *Wallidinellum* and *Pentadinellum* n.genera.

## SUMMARY

This book as a whole may be more useful to petrographers dealing with lithified carbonates and limestone microfacies classification. Nevertheless the Nanno-reader may find it useful for three reasons:

1. It provides a general view of calcification mechanisms in Plantae and Protista Kingdoms, notably for all sorts of stromatolite-like laminae structures;
2. Although we may be tempted to add some new data (their are few bibliographic references later than 1986) or to make some comments here and there (I've made mine) according to one's speciality, Chapter 13 is a good, serious and enjoyable reading monographic work on Calcareous nannofossils;
3. A useful and I believe a welcome reference for those who work specially with calcisphere-like structures or to those who find them in their Nannofossil assemblages (Chapter 14).

*Mario Cachao, Geology Dept., University of Lisbon, Portugal*

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## THE ICBN: THINGS YOU NEED TO KNOW - 6

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In the previous articles I have discussed the formation of names. Now, before discussing important issues dealing with validity, I think it is sensible to discuss the introductory chapters of the code, which deal with general principles and definitions.

### PREAMBLE

The Code starts with a Preamble, explaining how the Code works, and containing some axioms. In this section there are a few important remarks:

9: *In the absence of a relevant rule or where the consequences of rules are doubtful, established custom is followed.*

This axiom is an important escape in a few cases where the rules do not offer a clear solution. It was for instance invoked for retaining the name *Pseudoemiliana lacunosa* (see: van Heck, 1990).

10: *This edition of the Code supersedes all previous editions.*

This is of course important, it implies that in some cases names, which were valid under a previous edition of the Code, are no longer valid. It is not relevant under which edition of the Code a name was published. A name, valid at publication, may no longer be valid under the new Code - although the code is carefully constructed to avoid capricious effects. It is therefore important always to refer to the latest edition of the Code when deciding on validity.

After the Preamble, and before starting on the Rules, Division I of the Code contains the Principles:

### PRINCIPLE I

*Botanical nomenclature is independent of zoological nomenclature. The code applies equally to names of taxonomic groups treated as plants whether or not these groups were originally so treated.*

There is, however, one rule that does have a bearing on validity under zoological rules:

45.4. *If a taxon originally assigned to a group not covered by this Code ..... If the taxon is treated as belonging to the algae, any of its names need satisfy only the requirements of the pertinent non-botanical code for status equivalent to valid publication under the botanical Code (..).*

This applies to some of our older names, to which the zoological code was applied (I intend to discuss important examples in a later article). Note, however, that this rule is not automatically reversible. A name to which the zoological code was applied, and that is valid under that code, is thereby valid under the ICBN. But if that name was not valid under the zoological code, but is in accordance with the botanical code, it may still be valid.

### PRINCIPLE II

*The application of names of taxonomic groups is determined by means of nomenclatural types.*

This is a fundamental principle, it is types (i.e. particular specimens) which form the basis for the application of names - everything else is of secondary importance, including descriptions, diagnoses and interpretations of original meaning. There are a lot of complicated rules on nomenclatural types, which shall be dealt with in a future issue.

### PRINCIPLE III

*The nomenclature of a taxonomic group is based upon priority of publication.*

### PRINCIPLE IV

*Each taxonomic group with a particular circumscription, position, and rank can bear only one correct name, the earliest that is in accordance with the Rules, except in specified cases.*

### PRINCIPLE V

*Scientific names of taxonomic groups are treated as Latin regardless of their derivation.*

### PRINCIPLE VI

*The Rules of nomenclature are retroactive unless expressly limited.*

This latter principle therefore enforces the last axiom of the Preamble.

## DIVISION II

Division II of the Code contains the rules and recommendations. Chapter I is titled: RANKS OF TAXA, AND THE TERMS DENOTING THEM.

Most of the articles in this section cause no problems, so I shall quote only a few that are of interest.

### Article 3

*3.1. The principal ranks of taxa in ascending sequence are: species (species), genus (genus), family (familia), order (ordo), class (classis), division (divisio), and kingdom (regnum). Thus, except for some fossil plants (see Art. 3.3), each species is assignable to a genus, each genus to a family, etc.*

*3.3. Because of the fragmentary nature of the specimens on which the species of some fossil plants are based, the genera to which they are assigned are not assignable to a family, although they may be referable to a taxon of higher rank. Such genera are known as form-genera (forma-genera).*

This type of form-genus is commonly used for fossil sporomorphs, and one might wonder whether the principle was applicable to nannofossils, at least to those groups of which no recent representatives are known. As, however, this principle has not been applied so far in nanoplankton literature, I would definitely not recommend starting doing so now.

### Article 4

*4.1. If a greater number of ranks of taxa is required, the terms for these are made either by adding the prefix sub- to the terms denoting the ranks or by the introduction of supplementary terms. A plant may thus 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.*

*4.2. Further supplementary ranks may be intercalated or added, provided that confusion or error is not thereby introduced.*

These are the main informative rules of Chapter I. The sections of Chapter II are lengthy and important, and will be left for future issues.

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## MESOZOIC AND CENOZOIC "CALCISPHERES" - UPDATE IN SYSTEMATICS

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### INTRODUCTION

This note outlines the systematic concept used by the working group in Berlin for their research on Mesozoic and Cenozoic "calcispheres" during the last decade. This research has been supported mainly by the "Deutsche Forschungsgemeinschaft".

Many details and problems of this concept are not discussed here but in the references. Further discussions, questions and remarks (negative and positive) are expected.

### THE NATURE OF CALCISPHERES

"Calcispheres" found in Mesozoic and Cenozoic calcareous nannofossil assemblages are mainly the skeletal remains of dinoflagellates. Dinoflagellates can produce various fossilizable remains during the different stages of their life-cycle.

In general, the life-cycle of dinoflagellates consists of a vegetative stage and a cyst stage. During the vegetative stage the motile cells are covered by a cellulosic, non fossilizable theca; the reproduction is asexual by mitosis. Before encystment, gametes are produced by mitotic division and after fusion of the gamete cells the planozygote reduces cell organelles and flagellae. Then encystment takes place by forming a thick cyst wall of acid-resistant organic material (sporopollenin ?); only a few living taxa use calcite (Dale 1983, Gao et al. 1989). These cysts are fossilizable, and fossil remains of dinoflagellates are usually assumed to be cysts. After a period of dormancy meiotic division and excystment takes place: the vegetative cells leave the cyst through the archaeopyle.

Tangen et al. (1982), Inouye & Pienaar (1983) and Bjornland (1990) found that *Thoracosphaera heimii* is an unusual dinoflagellate species with a calcareous shell during the vegetative stage. The occurrence of gametes, fusion and encystment has not been observed to date. *T. heimii* is the type species of the genus *Thoracosphaera* consequently only "calcispheres" which have the same distinctive wall structure, and which are likely to be shells of the vegetative stage can be placed in this genus. According to Tangen et al. (1982) the order Thoracosphaerales with until now only one species, *Thoracosphaera heimii*, may be a sister group of the order Peridinales Haeckel 1894 (Keupp 1991).

All other "calcispheres" known and supposed to be calcareous dinoflagellate cysts should be placed into the family Calciodinellaceae Deflandre 1947 emend. Bujak and Davies 1983.

Most of the "calcispheres" found in recent sediments have been shown in cultures to be cyst stages of dinoflagellates (Wall et al 1970, Fütterer 1976, Montresor & Zingone 1988, Akselman & Keupp 1990, Matsuoka et al. 1990, Lewis 1991). The realization of paratabulation patterns in some fossil "calcispheres" shows their cyst nature. Paratabulation patterns in calcispheres always belong to the same orthohexa-formula, which supports the interpretation of the Calciodinellaceae as a monophyletic group (Keupp 1991).

### SYSTEMATICS

Calcareous dinocysts are divided into three subfamilies based on the crystallographic orientation of the calcite crystals forming the outer layer of the cyst wall (see figure):

**Subfam. Orthopithonelloideae Keupp 1987.** C-axes of the calcite crystals perpendicular to cyst surface.

e.g.: *Sphaerodinella* ("*Thoracosphaera*") *albatrosiana* (Kamptner 1963) Keupp & Versteegh 1989

**Subfam. Obliquipithonelloideae Keupp 1987.** C-axes of the calcite crystals inclined (oblique to tangential) at various angles and directions (even in one specimen).

e.g.: *Obliquipithonella* ("*Thoracosphaera*") *operculata* (Bramlette & Martini 1964) Fütterer 1990

**Subfam. Pithonelloideae Keupp 1987.** C-axes of the calcite crystals inclined at the same angle and the same direction to cyst surface.

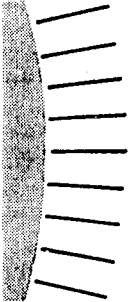
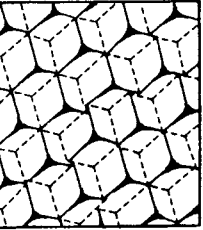
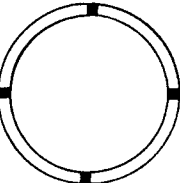

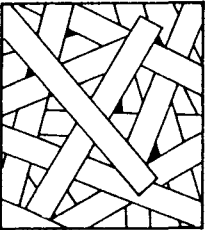
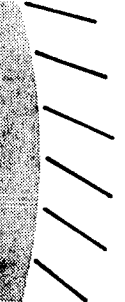
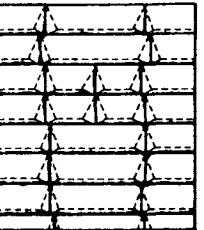
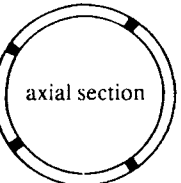
e.g.: *Pithonella sphaerica* (Kaufmann 1865) Lorenz 1902

Taxa which show paratabulation patterns are found in all three subfamilies (orthopithonelloid: *Calciodinellum operosum* Deflandre 1947, obliquipithonelloid: *Bicarinellum eulineatum* Keupp 1987, and pithonelloid: *Tetratropsis corbula* Willems 1990).

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## Wall Structures of Calcareous Dinocysts

	ARRANGEMENT OF C-AXES	EXAMPLES OF SURFACE STRUCTURES	EXTINCTION PATTERNS
<b>orthopithonelloid</b>			
<b>obliquipithonelloid</b>			<b>None</b>
<b>pithonelloid</b>			

Complete hollow 'calcspheres' normally show no extinction patterns because the interference figures of the elements overlap. The most obvious extinction patterns can be seen when specimens have a mineral core (e.g. calcite, pyrite) or in ultra-thin sections.

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## FJORD COCCOLITHS - NORWEGIAN *E.HUXLEYI* PROJECT 1992

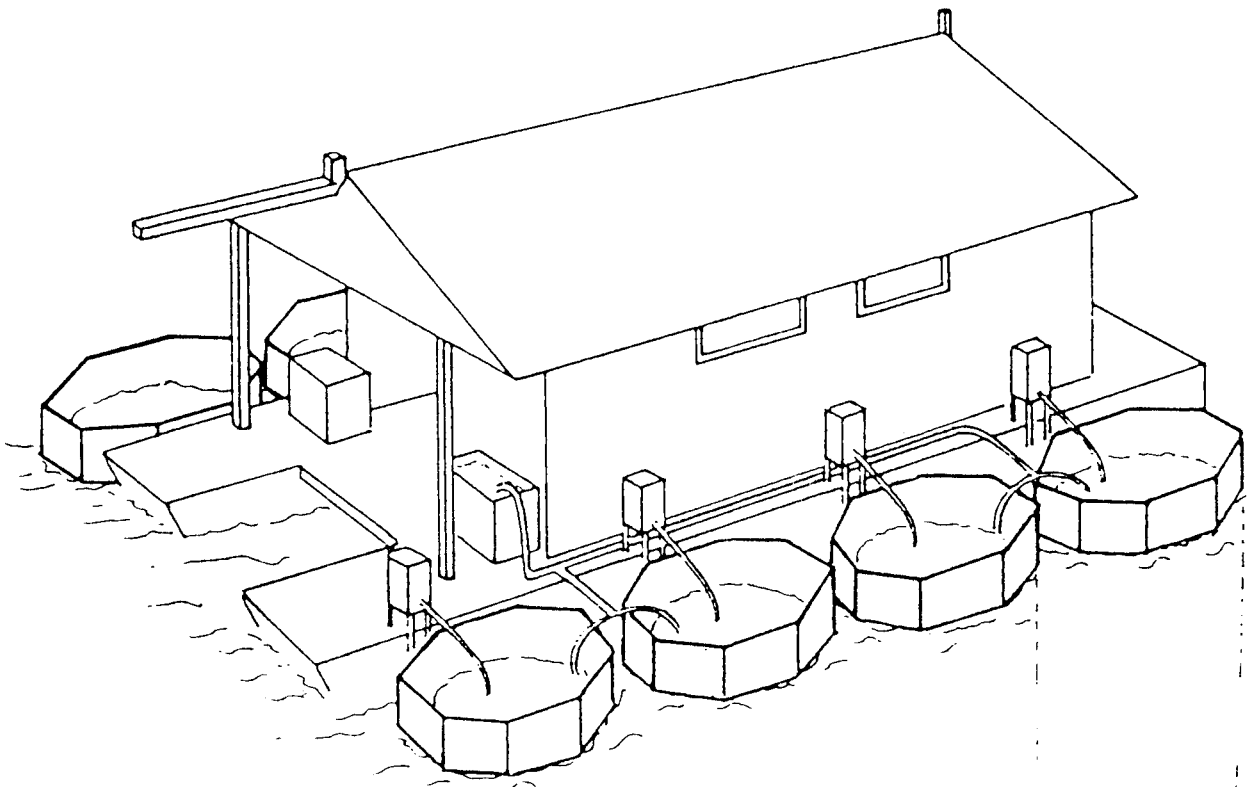
Jeremy Young, *The Natural History Museum, London*

As revealed in a couple of previous articles (Young 1990; Knappertsbusch 1991) there is now a rather substantial project underway termed "Global *Emiliana* Modelling" (or GEM) bringing together a diverse range of marine scientists to attempt an holistic study of one component of the marine ecosystem, as a key to understanding the whole ecosystem. The component in question is, of course, our friend the coccolithophore *Emiliana huxleyi*. There are now several dozen scientists involved to some degree in this project. These include a PhD student (Judith van Bleiswijk) and two Post-doctoral researchers (Paul van der Wal, Michael Knappertsbusch) working almost exclusively on the project. The Dutch component already has funding, and we are optimistic of getting a substantial EEC grant for further work. There was a special Anglo-Dutch coccolithophore research cruise last June (van der Wal 1991), and much related work has been carried out within the JGOFS program. The work has been co-ordinated via annual meetings at Blagnac in France another of which is planned for this September (organised by Michael Knappertsbusch, Geology Dept., VU, Amsterdam).

Research work for this year concentrated on the fjords, near Bergen, Norway, under the coordination of Berit Heimdal and Jorun Egge from the Bergen University Department of Fisheries and Marine Biology. The Norwegian Fjords are the site of the most famous coccolithophore blooms (Birkenes & Braarud 1952), and are a useful environment to study since they form relatively closed systems. The "Norwegian *E. huxleyi* Project" consisted of two main components - cruises by the research vessels *Pelagia* (an impressive new Dutch ship) and *Haakon Morsby* (from Bergen) in the fjords to observe natural blooms and nearshore "mesocosm" experiments. I took part in the mesocosm experiments and describe them below.

### MESOCOSM - GROWING COCCOLITHOPHORES IN PLASTIC BAGS.

For the mesocosm experiments transparent bags 2m across by 4m deep were used. The bags hang in the fjord from a platform about 200m offshore (see figure). They form medium sized ecosystems in



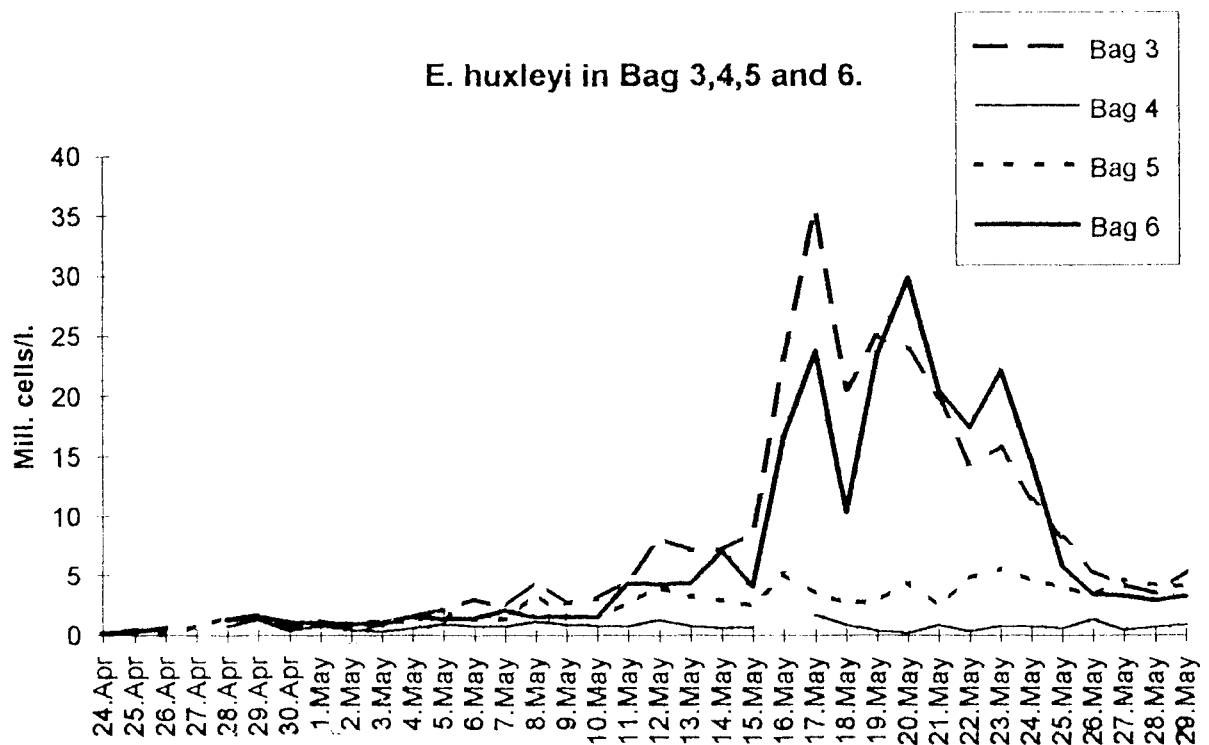
Arrangement of mesocosm bags around the raft.

which plankton can grow under conditions far more natural than those of the usual small laboratory cultures; but in which biological, chemical and physical changes can be accurately monitored. In order to encourage a coccolithophore bloom nutrients were added to the bags every day, also the water in the bags was circulated to avoid settling of the population. Nine bags were used with different nutrient regimes.

The bags were sited on a small fjord near Bergen by the old Marine Biology Station of Bergen University. Our hosts Berit and Jorun and some of their students commuted in daily from Bergen to make sure that we, and the coccolithophores, were still alive and well, and to carry out plankton counts. The visiting scientists stayed in the Marine Station made diverse observations (light transmission through the populations, dissolved CO<sub>2</sub>, etc.); isolated clones for taxonomic work; carried out experiments on for instance grazing and sinking; and filtered thousands of litres of water to collect samples for subsequent analysis of everything from DNA content to lipids to Particulate Organic Carbon. About two dozen scientists were involved in total. In addition to the Norwegians large groups came from The Netherlands and the UK and individual scientists from Estonia, Monaco, and the US. The most dedicated, lead by Judith van Bleiswijk, stayed for the full run of the experiment (20th April to 30th May), the rest of us came for shorter periods. I stayed for two weeks, during which it rained almost continuously, and the coccolithophores resolutely refused to "bloom". Afterwards apparently the weather got nice and sunny and they responded with populations of up to 35million cells/litre.

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## LIST OF PARTICIPANTS IN THE MESOCOSM EXPERIMENT

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Berit Heimdal  
G. Bratbak, Rolf Bohne  
Mikal Heldal, Jens Nejtgaard

Monitoring of phytoplankton population, light, salinity, temperature, nutrient levels (N, P, & Si), alkaline phosphatase activity. Sampling for study of viral populations and coccolith malformation.

### *NIOZ, Texel and Leiden University, The Netherlands, + Tallinn University, Estonia*

Judith van Bleiswijk  
Paul van der Wal  
Rob Kempers, Thomas Lukk  
Harry Witte, Peter Westbroek

Grazing and calcification rate experiments. Monitoring of loose coccoliths, phytoplankton and zooplankton populations, light attenuation. Sampling for, immunotaxonomy, flow cytometry, analysis of PIC, POC, PON, cell DNA content,  $^{12}\text{C}/^{13}\text{C}$  ratio, and pigments.

### *University of South Alabama, USA + Monaco Musée Océanographique*

Gesa Capers, Vicky Fabry

$^{14}\text{C}$  uptake experiments and  $\delta^{13}\text{C}$  measurements

### *University of Southampton*

Miles Finch, Duncan Purdie

Dissolved oxygen and  $\text{pCO}_2$  measurement.

### *Plymouth Marine Laboratory, UK*

John Green  
Linda Medlin

Strain isolation and bulk sampling, for genetic analysis of intraspecific variation. Sample preparation for EM work.

### *Bristol University, UK*

Maureen Conte, Geoff Eglinton  
Tony Thompson

Sampling for lipid biomarker analysis.

### *Cardiff University, UK*

Sara Bury

$^{15}\text{N}$  in situ productivity experiments.

### *The Natural History Museum, London, UK*

Jeremy Young

Monitoring of cell size and variability. Sampling for SEM study of coccolith variation.



*Emiliana huxleyi*

Compiled by William G. Siesser

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<i>Calcidiscus radiatus</i> (KAMPTNER 1955) MARTÍN-PÉREZ & AGUADO 1990, p. 343; (ex <i>Coccolithus</i> ).	A461-1
<i>Coccolithus subpertusus</i> (HAY & MOHLER 1967) WEI & POSPICHAL 1991, p. 504: (ex <i>Ericsonia</i> ).	A466-8
<i>Discoaster lingfengensis</i> WANG & HUANG 1989, pp. 220-221, pl. 97, figs. 3-4. East China Sea.	A466-5
<i>Fasciculithus lingfengensis</i> WANG & HUANG 1989, p. 224, pl. 72, figs. 1-3. East China Sea.	A466-5
<i>Neococcolithus oujiangensis</i> WANG & HUANG 1989, p. 241, pl. 84, figs. 4-5, 8. East China Sea.	A466-5
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<i>Reticulofenestra producta</i> (KAMPTNER 1963) WEI & THIERSTEIN, p. 483; (ex <i>Ellipsoplacolithus</i> ).	A466-9

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Calcispheres

<i>Bitorus</i> KEUPP 1992, p. 500. Type species: <i>Bitorus turbiformis</i> KEUPP 1992.	A467-7
<i>Bitorus turbiformis</i> KEUPP 1992, p. 500, Fig. 2; pl. 4, figs. 1-9; pl. 5, figs. 1-7.	A467-7

NEW TAXA

Calcareous Nannoplankton Species

*donghaiensis*, *Reticulofenestra*  
*lingfengensis*, *Discoaster*  
*lingfengensis*, *Fasciculithus*  
*lingfengensis*, *Reticulofenestra*  
*oujiangensis*, *Neococcolithus*

Calcisphere Genera

*Bitorus*

Calcisphere Species

*turbiformis*, *Bitorus*

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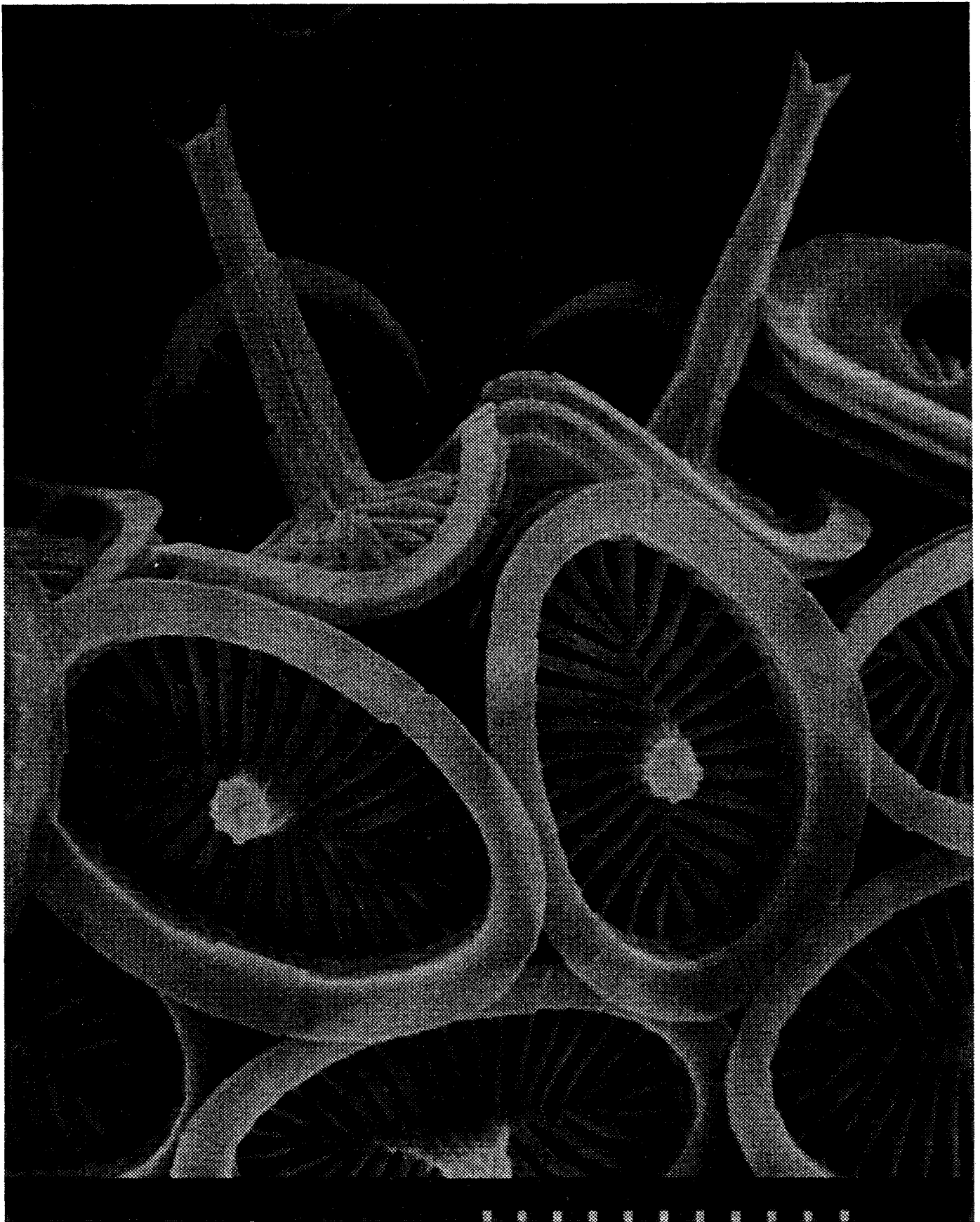
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## NEWSLETTER - ADVICE TO CONTRIBUTORS

### 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 as proof ready copy *or* on computer disc *or* by EMAIL.

PROOF READY COPY: Submit on A4 paper (210x297mm) with 2.5cm left, right and top margins, 3.5cm bottom margin. Single spacing, 10point 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 3.5", 1.44Mb). Text in any common word processor format, or ASCII files (ideal WordPerfect 5.1 or DCA-RFT). *Macintosh*, 3.5" discs, any word processor program or ASCII files. Any alterations to the text, other than for spelling or minor mistakes, will be checked with the author.

EMAIL SUBMISSION: This is a fine alternative to sending discs, and should be available in most institutions. BUT, in the museum we still only have one, unreliable, mailbox. Please use the subject field as a sub-address ("J.YOUNG, PALAEO 8996") and send a fax to alert me to check the computer. The address is: *CMAAMNT@UK.AC.IC.CC.VAXA*

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 vomatidae. *J. Wom. Res.*, 25, 35-67.

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