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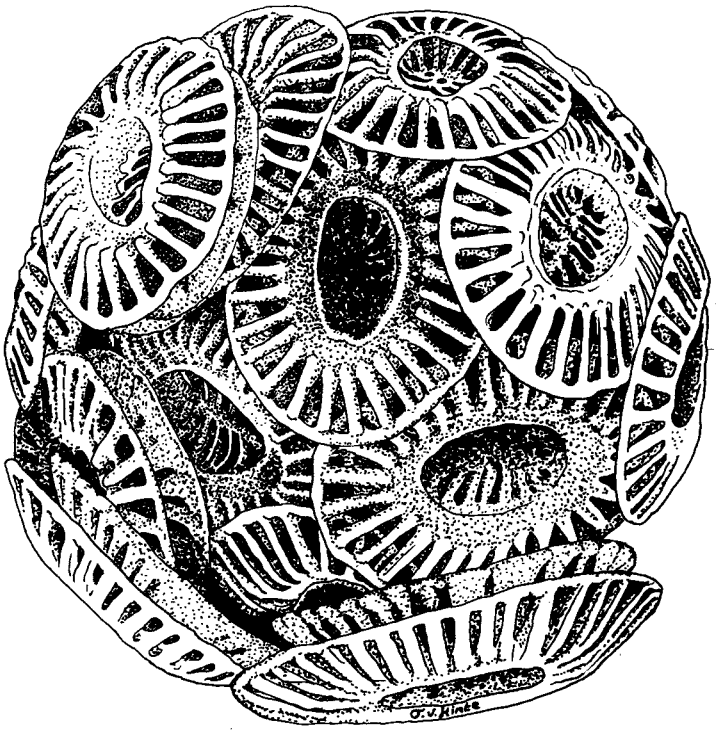
INA NEWSLETTER



INTERNATIONAL NANNOPLANKTON ASSOCIATION

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

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INA NEWSLETTER

Proceedings of the International Nannoplankton Association

Volume 12 Number 2 June 1990

EDITORIAL

I am pleased finally to include a group photograph from the Florence meeting in the "plate" opposite. The tourist I got to take the photo was evidently confused by my zoom lens, so we ended up as a small blob in the middle of the photograph. Jim Davies of University College has kindly done his best to rescue it, but it could not be enlarged any further, so I have included a photo of the Florence organizing team and of the Jurassic workshop organized by Paul Bown this Easter. There were rather less of us for that event but since we had the same fine friendship and open discussion it was again a great success. Elisabetta Erba has written a short report of the meeting and we will include scientific proceedings of the workshop in the next newsletter.

This issue contains Bill Siesser's first bibliography, with a complete listing of the codes used. A few of these have been changed for this issue, mainly to make them shorter. Also individual site reports in ODP volumes are no longer being cited. Comments and suggestions for improvements are particularly welcome at this stage while Bill is sorting out his system for doing the bibliography. Preparing the Silicoflagellate Bibliography is proving a major task, Stacia Spaulding is still working on it.

We have several scientific papers in this newsletter, which I am pleased to see. I think there is useful role for the newsletter here - for fast simple publication of short papers dealing with nannoplankton taxonomy, structure, evolution, classification, and biostratigraphy. Please continue to send them in.

Jeremy Young

INA MEMBERSHIP, SUBSCRIPTIONS AND FINANCES

Finances: 1989-90 accounts are included at the end of this issue. We are in a reasonably healthy financial state. Part of the surplus, however, is due to extraordinary items - the unpayable costs in Holland and sales of the London volume. Current income and expenditure are uncomfortably close, and unpredictable. Increased membership and payment of back dues would both help us considerably.

Subscriptions: All overdue members are being sent "bills" in this issue, please pay promptly - and write and say if you no longer wish to be a member. If it is equally convenient we would prefer payment in £UK, rather than $US. *Bank transfers - please would any members who arrange for payment of dues by direct debit of their accounts inform the secretary / treasurer since otherwise these payments are often virtually anonymous.*

Membership: An updated membership directory is included in this issue, with a geographical index - which hopefully can be used to make new contacts. We currently have about 240 members. Of these about half are in universities and other colleges, one sixth in geological surveys, museums and other government bodies, and one third in the oil industry. *N.B. The files have recently been retyped so please chack your address on the envelope label, and inform Magdy Girgis if it is not correct.*

Membership invitation: A single copy of a new membership invitation is included with this newsletter. Please photocopy these as needed and pass them on to any colleagues, students, or correspondents or libraries who might be interested. The invitation will also appear in the British Micropalaeontological Society Newsletter, and we will carry an advertisement for them in return.

Magdy Girgis and Jeremy Young

NEWS ITEMS AND ANNOUNCEMENTS

INA CONFERENCE - PRAGUE SUMMER 1991

First circular: Dear colleagues, as you probably know, at the Florence INA meeting the participants decided to entrust the Czechoslovak specialists with the organization of the next INA conference. This conference, the first one organized in Eastern Europe should help you meet your colleagues from this part of the world and to establish new contacts here. I also think that Czechoslovakia and its beautiful capital Prague could be the place you want to visit at this exciting time. We have prepared the following provisional program:

Friday - Sunday:	Arrival in Prague, accommodation.
Sunday pm:	Excursion to the Bohemian Basin (Cretaceous)
Monday:	Registration, Scientific sessions. *Evening - welcome party.*
Tuesday:	Scientific sessions. *Evening - concert or theatre performance.*
Wednesday:	Scientific sessions. Farewell evening in brewery pub.
Thursday-Friday:	Excursion to South Moravia (Jurassic, Cretaceous, Paleogene and Neogene). *Evening - dinner in wine vault, possible visit to Austerlitz.*
Weekend:	Sightseeing in Prague, departure.

At the time of Florence meeting, everything was clear and relatively easy in our country. However, the great change that has brought a freedom to our nation has also brought some difficulties to the organizers. Everything moves, things that were valid and institutions that existed for 40 years do not exist any longer. So the above mentioned preliminary plan could be changed a little.

To register your interest, please fill in and return the questionnaire enclosed as soon as possible. Also please let me know as soon as possible if you need any help from our side.

Responses to date (mid May): Since sending out the first circular 60 workers have returned positive responses the questionnaire. A final decision on date cannot be taken until September, but respondents to date have indicated preferences as follows; August - 23, September - 25 and October - 10. So October is unlikely as a time. Please could anyone who has not returned a questionnaire but is interested in the conference do so as soon as possible. This will help us with planning, and ensure your inclusion on the mailing for the second circular. The second circular will be sent out in October this year.

Bohumil Hamršmíd

BMS NANNOFOSSIL GROUP OPEN MEETING, LONDON SEPTEMBER 1990

The nannofossil group of the British Micropalaeontological Society (which is effectively the UK membership of INA) will be holding an informal one day open meeting in London in mid-late September. Any other nannofossil workers who are in the country are invited to attend. The date and venue have not been finalised yet but please contact any of us for details nearer the time.

Kevin Cooper (ECL/SSI), Paul Bown (UCL), Jeremy Young (NHM)

GLOBAL OCEAN FLUX PROJECT - NANNOPLANKTON STUDIES

There will be a planning meeting of workers involved in this work in early September 1990 (convenors Peter Westbroek - Leiden, and Patrick Holligan - Plymouth). This is not an open meeting but I will include a short report on it in the next newsletter.

Jeremy Young

OCEAN DRILLING PROJECT NEWS

The following three legs are now planned, after legs 129-135 outlined in the last newsletter.
Leg 136; Engineering legs 3A & 3B; February - May 1991.
Leg 137; Hydrothermal Processes on sedimented ridges; Juan de Fuca Ridge; May - July 1991.
Leg 138; Neogene Paleoceanography; East Equatorial Pacific; July - September 1991. This should be a significant leg for nannoplankton studies. It aims to drill a series of holes with the hydraulic piston corer in Late Miocene to Recent sediments. these will enable study of the development of Pacific circulation and the effects of the closure of the Panamanian Seaway
Leg 139; Lower crustal; September - November 1991.

LONDON MEETING, CONFERENCE PROCEEDINGS

We have now sold all our copies of this volume. BMS members can obtain discount copies through that society. Distribution of normal rate copies is through Halstead Press (John Wiley & Sons), ISBN 0-470-21203-9

MEETING REPORT: JURASSIC CALCAREOUS NANNOFOSSIL WORKSHOP

University College London - April 2-6, 1990

The first "Jurassic Calcareous Nannofossil Workshop" was held in England on April 2-6, 1990. The idea of the workshop was conceived during the Florence I.N.A. Meeting last September, and was enthusiastically accepted by quite a large group of specialists.

After his monumental thesis on Jurassic nannofossils, it was obvious to entrust Paul Bown with the organization of the workshop. Thus, the meeting took place in the Micropaleontology Unit of University College of London.

Dr. Alan Lord hosted the workshop which was attended by 21 specialists from 7 countries. The numerous English group (8 participants) was equalled by the Italian "contingent". The other participants were from U.S., France, Switzerland, Tunisia, and The Netherlands (1 participant each). It was a pleasant surprise indeed to find that such a large group is at present working on Jurassic nannofossils.

The first day of the meeting was devoted to taxonomy and evolution. Ben Prins illustrated the ultrastructure of early nannoliths and coccoliths and proposed a new terminology. Mainly based on light microscope investigations, his drawings and schemes can be considered corner-stones in the understanding of Jurassic nannofossil structure. On the other hand, Ben's 1969 paper is still one of the reference points for any nannofossil specialist working on the Jurassic.

Paul Bown presented his taxonomic subdivision of Triassic and Jurassic nannofossils comprising 15 families and 2 groups of unclassified coccoliths. The projection of nice slides and schemes illustrating ultrastructure differences stimulated the discussion and Paul closed the session by showing some evolutionary lineages.

After the two presentations, the discussion was enlarged to all the participants, and direct confrontations at the microscope continued for the entire afternoon.

During the second day attention was focused on Jurassic biostratigraphy. Kevin Cooper discussed the existing zonations pointing out that most schemes were based on boreal sections. Elisabetta Erba described the "state of the art" of Jurassic biostratigraphy for the Tethyan region, and more generally for low latitudes. As an Upper Jurassic zonation has been recently proposed (Bralower et al., 1989), efforts are currently devoted to the Lower and Middle Jurassic. To try and achieve a low latitude zonation, several sections are at present being investigated in Italy, Portugal, Switzerland, Morocco, and France. Jim Bergen and Erik De Kaenel described the detailed work they have done in respectively Portugal and Morocco. The biostratigraphy section was concluded by Kevin Cooper who presented the Jurassic zonation recently proposed for the boreal region by Bown et al. (1989).

The rest of the day was used to compile the stratigraphical ranges of Jurassic marker--species from different areas. It was a tiresome (and maybe boring) work but the resulting range-chart repaid our efforts. We could notice that only a few species show consistent ranges in different areas and can be considered as definitely cosmopolitan and isochronous. Most taxa display diachronous first and/or last occurrences. Further investigations will hopefully clarify whether Jurassic nannofossils are characterized by paleoprovincialism and to what extent; or whether apparent range differences are, at least partially, due to taxonomic problems.

On the third day of the workshop Paul Bown summarized the ideas, discussions, and problems that had emerged during the first two days and we continued our confrontations at the light microscope. The concluding remarks were highly positive: all the participants considered the indoor part of the workshop a very useful occasion for discussions and cooperations. Maybe the most evident result of the meeting was the recognition of problems that we will try to solve in the near future. This aspect was underlined also by Alan Lord who officially closed the workshop.

At the end of the meeting it was agreed that the scientific results of the workshop will be

published on the autumn issue of the I.N.A. Newsletter. Moreover, a few persons engaged themselves to co-operate in the preparation of a monograph on Jurassic nannofossils in two years time.

The workshop was followed by a two-day excursion in Dorset to sample famous Jurassic sections. The brave nannofossils workers left London under a snow storm (typical English spring weather!*) with the mirage of Jurassic nannofossil-rich outcrops in front of them. On the way to Dorset we stopped to admire Stonehenge and we were welcomed at Lyme Regis with a nice sunset.

During the field trip, guided by Paul Bown, we sampled outcrops at Seven Rock Point (Hettangian-Lower Sinemurian), Charmouth (Sinemurian), Seatown (Pliensbachian), Bridport-West Bay (Bathonian), Burton Lane-Burton Bradstock (Upper Toarcian, Aalenian, Bajocian), Osmington Mills (Oxfordian, Lower Kimmeridgian).

The field trip was a further occasion to prolong discussions but also an opportunity to deepen friendships. Despite Jurassic nannofossils are the oldest, the Jurassic nannofossil specialists most probably constitute the youngest group. We worked in great harmony, enjoyed the company, and had a lot of fun together.

Concluding this short report I wish to point out that the field trip was also the occasion for a very special confrontation, and this is the result: the English-speaking nannofossil specialists are much better in playing billiards but the non English-speaking ones are best in football.

Elisabetta Erba, Dip. di Scienza della Terra, Universitá di Milano

*Editors' note: There were only a few flakes of snow and the weather was lovely for the next two days.

THE ICBN: THINGS YOU NEED TO KNOW - 2

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

This is the second issue dealing with specific epithets. This time I discuss Art. 73., which deals with the orthography of names and epithets, or in other words: how to form a name. This article with its examples and recommendations takes up about six pages. I have omitted paragraphs that deal with rare cases and are not normally a problem. The first paragraph is:

73.1. The original spelling of a name or epithet is to be retained, except for the correction of typographic or orthographic errors and the standardization imposed by Arts. 73.8 (compounding forms), 73.9 (hyphens) and 73.10 (terminations; see also Art.32.5).

This means that you cannot change the spelling of a name according to your taste or current fashion. You may only (and sometimes must) change the spelling when the original author did not form a name according to the rules (as we will see in a moment). I discuss articles 73.9 and 73.10, but not 73.8 which is rather long and does not normally pose a problem.

73.6. Diacritical signs are not used in Latin plant names. In names (either new or old) drawn from words in which such signs appear, the signs are to be suppressed with the necessary transcription of the letters so modified; for example ä, ö, ü become respectively ae, oe, ue; é, è, ê become e, or sometimes ae; ñ becomes n; ø becomes oe; å becomes ao. The diaeresis, indicating that a vowel is to be pronounced separately from the preceding vowel (as in Noël), and the ligurates .... are permissible.

I have changed the one example here to a well-known case, and omitted the line about the ligurates because they are not relevant, and awkward to use.

73.9. The use of a hyphen in a compound epithet is treated as an error to be corrected by deletion of the hyphen, except if an epithet is formed of words that usually stand independently, when a hyphen is permitted (see Arts. 23.1 and 23.3).

As an example of a hyphen to be deleted the ICBN quotes *pseudo-planatus*; it implies that in names like *Eu-discoaster* the hyphen should be deleted. On the other hand, the hyphen in *perch-nielseniae* is allowed.

73.10. The use of a termination (for example -i, -ii, -ae, -iae, -anus, or -ianus) contrary to Rec. 73C.1 is treated as an error to be corrected (...)

This is of course a classical source of mistakes. People tend to quote names the way they were introduced, even if they are wrong. And although the spelling is indicated in a recommendation, this paragraph clearly states such terminations are to be corrected! So let's move on to that recommendation. I have replaced the names used in the examples with others known to you. The hyphens in the examples are used only to set off the appropriate termination.

Recommendation 73C

73C.1. Modern personal names may be given a Latin termination and used to form specific and infraspecific epithets as follows (but see Rec. 73C.2):

(a) If the personal name ends in a vowel or -er, substantive epithets are formed by adding the genitive inflection appropriate to the sex and number of the person(s) honoured (e.g. martini-i for Martini (m), shumenko-i for Shumenko (m), wise-i for Wise (m), stradner-i for Stradner (m), aubry-ae for Aubry (f), mueller-ae for Müller (f), except when the name ends in -a, in which case adding -e (singular) or -rum (plural) is appropriate (e.g. okada-e for Okada (m), erba-e for Erba (f)).

(b) *If the personal name ends in a consonant (except -er), substantive epithets are formed by adding -i- (stem augmentation) plus the genitive inflection appropriate to the sex and number of the person(s) honoured (e.g. young-i-i for Young (m), manivit-i-ae for Manivit (f)).*

The next two paragraphs cover formation of adjectival names. This is a mode of name formation rarely used by nannoplankton workers, but it is useful to know.

(c) *If the personal name ends in a vowel, adjectival epithets are formed by adding -an- plus the nominative singular inflection appropriate to the gender of the generic name (e.g. Corisphaera hasleana for Hasle), except when the personal name ends in -a in which case -n- plus the appropriate inflection is added.*

(d) *If the personal name ends in a consonant, adjectival epithets are formed by adding -i- (stem augmentation) plus -an- (stem of adjectival suffix) plus the nominative singular inflection appropriate to the gender of the generic name (e.g. Rhabdosphaera blackmaniana for Blackman).*

Note that since these are adjectives the termination depends on the gender of the genus, not the gender of the person the species is named after.

73C.2. Personal names already in Greek or Latin, or possessing a well-established latinized form, should be given their appropriate Latin genitive to form substantive epithets (e.g. verdenii from Verdenius). (However, modern personal names are subject to the provisions of Art. 73.10.) Treating modern names as if they were in Third Declension should be avoided (e.g. crucis from Crux).

73C.4. Prefixes and particles ought to be treated as follows:

(a) *The Scottish patronymic prefix "Mac", "Mc" or "M", meaning "son of", should be spelled "mac" and united with the rest of the name, e.g. macintyrei after MacIntyre.*
(b) *The Irish patronymic prefix "O" should be united with the rest of the name or omitted.*
(c) *A prefix consisting of an article, e.g. le, la, l', les, el, il, lo, or containing and article e.g. du, de la, des, del, della, should be united with the name.*
(d) *A prefix to a surname indicating ennoblement or canonization should be omitted, e.g. orbignyi after d'Orbigny.*
(e) *A German or Dutch prefix when it is normally treated as part of the family name, as often happens outside its country of origin, e.g. in the United States, may be included in the epithet, e.g. vancouveringii after Vancouvering, but should otherwise be omitted, e.g. hintii after van Hinte.*

Only two more recommendations should be mentioned here (the others deal with generic names or are not important for us):

Recommendation 73D

73D.1. An epithet derived from a geographical name is preferably an adjective and usually takes the termination -ensis, -(a)nus, -inus, or -icus. (e.g. Ommatolithus australiensis, Palaeomicula maltica, Conusphaera mexicana).

There is, however, no rule (yet) that you must correct the termination if it was not formed according to this recommendation.

Recommendation 73I

73I.1 The etymology of new names and epithets should be given when the meaning of these is not obvious.

Anyone who has ever juggled with dictionaries to find out just how and whether a specific epithet should change with a change of genus will appreciate the sense of this recommendation.

Much of this section has dealt with recommendations, but as I have stated before, most of them make good sense, and it is always wise to stick to recommendations as they have a habit of graduating into rules.

REFERENCE

Greuter W. 1988: International Code of Botanical Nomenclature. Koeltz Scientific Books, 328 pp.

ON THE VALIDITY OF *PSEUDOEMILIANIA LACUNOSA* KAMPTNER 1963 EX GARTNER 1967

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

Some time ago, I was asked to look into the validity of the name *Pseudoemiliania lacunosa*. As this is a rather complicated case, a fully documented account is presented here.

Kamptner (1963) introduced the genus *Ellipsoplacolithus* as follows (p. 171, translated):

Ellipsoplacolithus nov. gen. (paragen.).

Elliptical calcareous bodies, that are probably built placolithically or at least represent derivations of the placolithic type, of which, however, the generic relationship could not yet be determined. This provisional unit is primarily intended for electron micrographs. Most of the forms assigned to it may in reality belong to the genus Coccolithus.

Type species: E. lacunosus nov. spec. (paraspec.).

Because Kamptner clearly intended *Ellipsoplacolithus* to be a provisional generic name, it is invalid under ICBN Art.34.1, which reads:

34.1. A name is not validly published (a) when it is not accepted by the author in the original publication; (b) when it is merely proposed in anticipation of the future acceptance of the group concerned, or of a particular circumscription, position, or rank of the group (so-called provisional name); (c) ...

In the same publication Kamptner introduced the species *E. lacunosus* (p.172), and designated it the type species of *Ellipsoplacolithus*. No holotype was indicated but, because only one specimen was illustrated (Pl.9, Fig.50), this may be regarded as the holotype of the species following Art.7.3 of the ICBN:

7.3. A holotype is the one specimen or illustration used by the author or designated by him as the nomenclatural type. ....

However, because the name of the genus was not validly published the name of the species is not valid either, following ICBN Art. 43.1:

43.1. A name of a taxon below the rank of genus is not validly published unless the name of the genus or species to which it is assigned is validly published at the same time or was validly published previously.

Gartner (1969) introduced the genus *Pseudoemiliania*, including *P. lacunosa* as the only species. Hence *P. lacunosa* is automatically the type species of *Pseudoemiliania*. It is not clear what Gartner intended. If he regarded *Ellipsoplacolithus* and *lacunosus* as valid names, *Pseudoemiliania* would have been a junior synonym of *Ellipsoplacolithus*. If, on the other hand he was aware that *E. lacunosus* was not valid, why would he have treated it as valid, referring it to Kamptner by quoting it as *Pseudoemiliania lacunosa* (Kamptner), treating it as a new combination?

Since a name that is not valid is not available, and therefore basically treated as non-existent, this would make *Pseudoemiliania lacunosa* invalid. (Art. 12.1: A name of a taxon has no status under this Code unless it is validly published). As the genus is monospecific, the name *Pseudoemiliania* would also be invalid.

Gartner (1977) defended the validity of *Pseudoemiliania lacunosa* by referring to ICBN Art.66 (no longer existent) and Art.68:

Art. 68.1. A specific name is not illegitimate merely because its epithet was originally combined with an illegitimate generic name, but is to be taken into consideration for purposes of priority if the epithet and the corresponding combination are in other respects in accordance with the rules.

However, both articles deal with illegitimate names, rather than invalid names, as is evident even from the sections quoted in Gartner's publication (p.15). So Gartner made the common mistake of not distinguishing between illegitimacy and invalidity (Illegitimate names are those designated as such in Arts. 18.3 or 63-65, such as homonyms and names based on

holotypes of other taxa. Invalid names are ones that are not published in accordance with Arts. 32-45).

Discussion: How, then, can the familiar name *Pseudoemiliania lacunosa* be 'rescued'? The answer lies in Gartner (1969). Given that Kamptner's original name was invalid, one might consider whether Gartner in effect introduced a new name. While introducing the, monospecific, genus *Pseudoemiliania* Gartner gives a full description and diagnosis, thereby fulfilling part of the requirements. The only thing apparently lacking, is the designation of a holotype. But according to Art.7.3 (quoted above) the holotype is the one specimen or illustration used by the author. One may argue that by assigning the name *lacunosa* to Kamptner, Gartner uses the one illustration given by Kamptner (Pl.9, Fig.50), which therefore automatically becomes the holotype.

Even if this argumentation seems tenuous, a final argument to preserve the name *Pseudoemiliania lacunosa* is provided by one of the Preambles of the Code, which states:

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

So the correct full citation for the species is *Pseudoemiliania lacunosa* Kamptner 1963 ex Gartner 1969. For an abbreviated citation *P. lacunosa* Gartner 1969 is also correct.

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PROPOSED CHANGES TO THE CLASSIFICATION SYSTEM OF LIVING COCCOLITHOPHORIDS. II.

Annalies Kleijne, Earth Sciences, Amsterdam Free University, NL
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Since the Florence INA meeting of 1989 and the publication of the workshop recommendations (Jordan & Young, 1990), two additional problems have been noted. This note deals with them.

NEW COMBINATIONS

Rhabdosphaera clavigera var. *stylifera* comb.nov. (1)
Basionym: *R. stylifera* Lohmann, 1902, p. 143, pl.5, fig.65.

Syracolithus ponticuliferus comb. nov. (2)
Basionym: *Corisphaera ponticulifera* Kamptner, 1941, p.90, pl.11, figs. 117-118.

TAXONOMIC NOTES

1) ***Rhabdosphaera clavigera:*** Murray & Blackman (1898) studied coccolithophores from net haul samples and reported living rhabdospheres for the first time, from which they described the genus and species *Rhabdosphaera clavigera.* Lohmann (1902) described a second species, *R. stylifera,* from the Mediterranean, differing from *R. clavigera* in its appendix shape. The former possesses a thin stem composed of fine elements, whereas the latter has a thicker, coarser stem. In recent taxonomic works (Okada & McIntyre, 1977; Hallegraeff, 1984) the two species have been regarded as conspecific, with *R. clavigera* having priority. Intermediate forms have been seen (Borsetti & Cati, 1972; Hallegraeff, 1984; Norris,1984) but we believe that the stem types are distinct enough to be separated as varieties so that future distribution studies may provide useful information on their individual biogeographies.

2) ***Corisphaera ponticulifera.*** Kamptner (1941) described *Corisphaera ponticulifera* as a coccosphere consisting of zygoliths (i.e holococcoliths consisting of a tube, with the distal end spanned by a bridge). Although no stomatal coccoliths were observed, he placed it in the dimorphic genus *Corisphaera.* Deflandre (1952) created the genus *Homozygosphaera,* for zygolith-bearing monomorphic species, and Kamptner (1954) transferred *C. ponticulifera* to this genus. Modern illustrations (Okada & McIntyre, 1977, pl. 12, figs. 8-9) show that the coccoliths of this species are laminated discs, perforated by two large holes, with a pointed protrusion on the distal surface. These are laminoliths rather than zygoliths, so the species is transferred here to the genus *Syracolithus.*

ACKNOWLEDGEMENTS

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CLARIFICATION OF *RETICULOFENESTRA PERPLEXA* (BURNS) WISE, 1983

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Backman (in Heck, 1981) first pointed out that *Dictyococcites antarcticus* Haq (1976) is a junior synonym of *Dictyococcites perplexa* Burns (1975). Based on the well known size of *Isthmolithus recurvus,* which was figured along with the holotype and isotypes of *D. perplexa* in Burns (1975), Wise (1983) concluded that "all of Burns' magnifications are overstated by a factor of about 2.5. The dimensions he attributed to the holotype of *D. perplexa* are also overstated by the same factor; thus the holotype measures about 5 to 6 µm along the length of the distal surface rather than 18-20 µm as originally stated. The revised measurements are similar to those given by Haq (1976) for *D. antarcticus."* Wise (1983) transferred *D. perplexa* to *Reticulofenestra* because *Dictyococcites* is an ill-defined genus, and it is difficult and of little value to differentiate *Dictyococcites* from *Reticulofenestra.* In spite of all this, there is still confusion in the literature concerning the size of *R. perplexa.* Perch-Nielsen (1985) included *D. antarcticus* but not *R. perplexa* in her comprehensive compilation of nannofossil taxa. More recently, Driever (1988) argued that *R. perplexa* is a large-sized coccolith species (19-20 µm) based on written communication with Burns, thus he considered *R. perplexa* different from *D. antarcticus. Dictyococcites antarcticus* is still used in some of the most recent publications (e.g., Rodriguez--Pindado & Flores, 1990). Because *R. perplexa* (=*D. antarcticus*) is a dominant nannofossil species in the Miocene calcareous sediments from the Southern Ocean and has biostratigraphic and paleoceanographic utility (Haq, 1980; Wise, 1983; Wei & Wise, in press; Wei & Thierstein press; Wei and Wise, in prep), it is important to resolve the taxonomic problem. This has been done by re-examining the topotypic material of *D. perplexa,* as suggested by Dr. J.R. Young (written comm., 1989).

Two samples (265-16-6, 28-29 cm and 265-16-6, 35-36 cm) were examined from the same core section that the holotype of *R. perplexa* was described (265-16-6, 25-26 cm). One sample (329-3-3, 30-32 cm) from the interval that Haq (1980) reported abundant *D. antarcticus* was also examined. Smear slides were made from unprocessed samples and examined using a Zeiss Photomicroscope III. The first 60 or more well preserved specimens of *R. perplexa* (=*D. antarcticus*) encountered along random traverses of each slide were measured on a Panasonic monitor screen connected to a Panasonic TV camera mounted on the microscope. Calibration of the magnification of the screen images was determined by measuring several specimens both on the screen and in the microscope. The measurement error is estimated to be less than 0.3 µm.

Size (length) distribution patterns of *R. perplexa* (=*D. antarcticus*) for Samples 265-16-6, 28-29 cm, 265-16-6, 35-36 cm, and 329-3-3, 30-32 cm are presented in Figures 1 through 3. The mean sizes are 7.47, 7.62, and 7.40 µm for the three samples respectively. Most specimens range from 6 to 9 µm in all the samples. No specimens larger than 13 µm were found while scanning the slides. In fact, no specimens larger than 13 µm were observed during our studies of Miocene sediments from the Falkland Plateau (South Atlantic), Maud Rise (Weddell Sea), or the southern Indian Ocean. Detailed biometric study of *R. perplexa* from these regions is presented in Wei and Wise (in prep.).

In conclusion, re-examination of the topotypic material reveals that *R. perplexa* is a medium-sized placolith, commonly 6-9 µm instead of 18-20 µm as Burns (1975) stated. Consequently, *R. perplexa* is a senior synonym of *D. antarcticus,* as suggested previously by Backman (in Heck, 1981) and Wise (1983).

SYSTEMATIC PALAEONTOLOGY

Genus *RETICULOFENESTRA* Hay, Mohler & Wade, 1966

Reticulofenestra perplexa (Burns) Wise, 1983

(Pl. 1, Figs. 1-4)

Dictyococcites perplexa Burns, 1975, p.594, figs.13, 19-20.
Dictyococcites antarcticus Haq, 1976, p.567, figs.1-5, 7-8; Backman, 1980, pl.4, figs.4-5, 8.
Reticulofenestra perplexa (Burns) Wise, Wei & Wise, in press, pl.3, figs.1-3; Wei & Thierstein, in press, pl. 1, figs.5-10.

Remarks: *Reticulofenestra perplexa* has about 60 elements in each shield and has a closed central area. Its size commonly ranges from 6 to 9 µm and it grades into a smaller form, *Reticulofenestra producta,* near the Miocene/Pliocene boundary (Backman, 1980). The first occurrence of *R. perplexa* is time transgressive across latitudes, with an age ranging from ca.14.3 Ma at 65°S to ca.10.4 Ma at 50°S latitude (Wei and Wise, in prep).

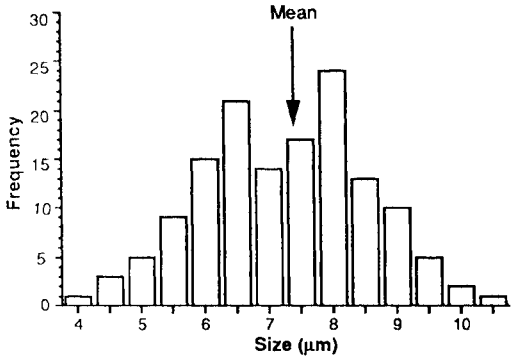

Figure 1. Histogram of size distribution of *Reticulofenestra perplexa*, Sample 265-16-6, 28-29 cm.

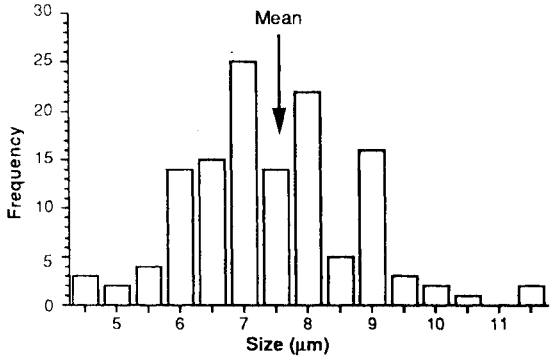

Figure 2. Histogram of size distribution of *Reticulofenestra perplexa*, Sample 265-16-6, 35-36 cm.

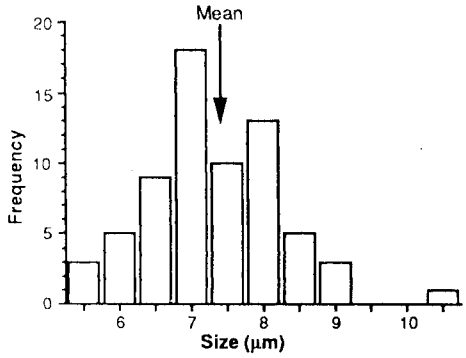

Figure 3. Histogram of size distribution of *Reticulofenestra perplexa*, Sample 329-3-3, 30-32 cm.

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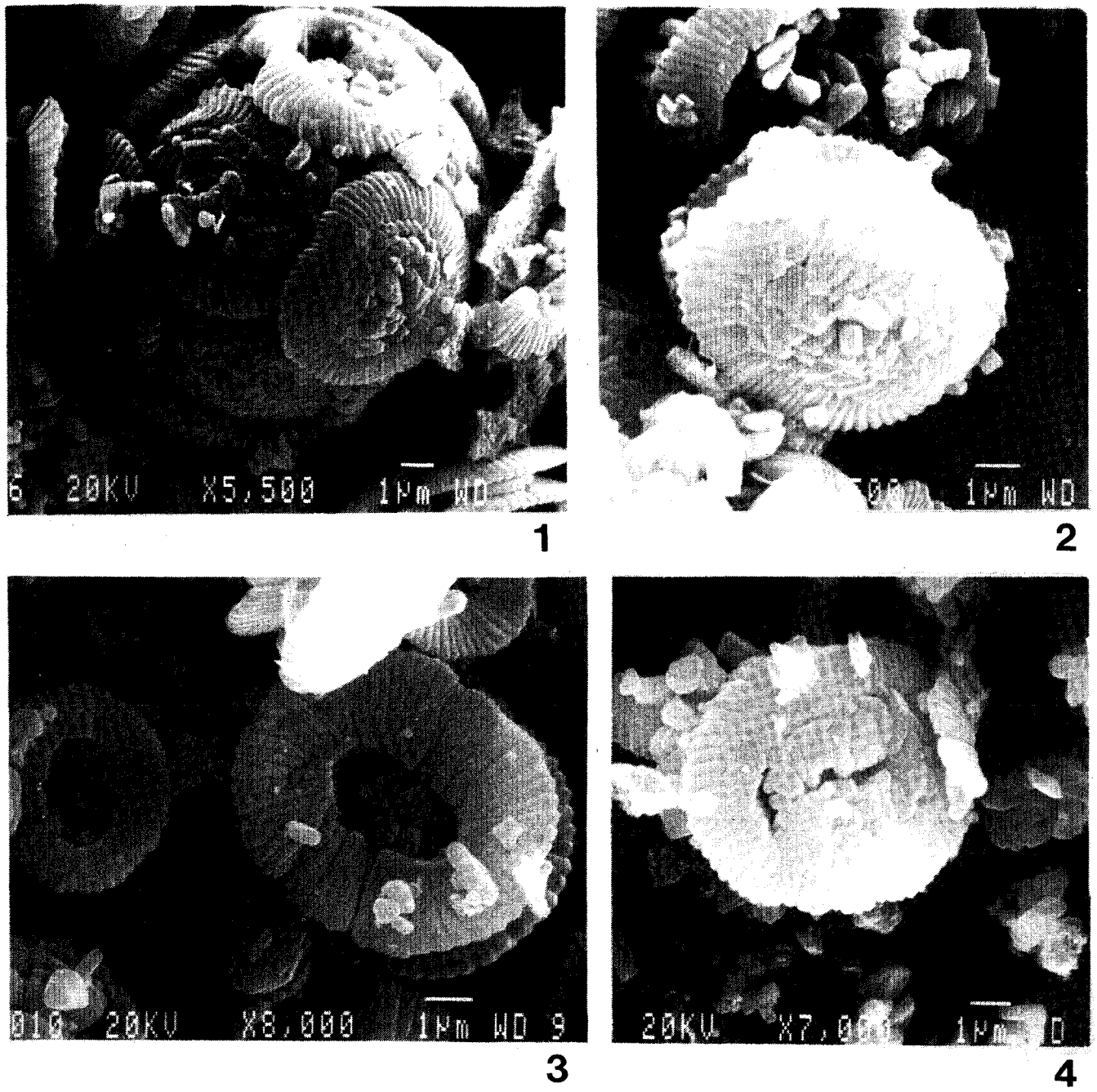

Plate 1. 1-4. *Reticulofenestra perplexa* (Burns) Wise; (1) coccosphere, Sample 265-16-6, 28-29 cm; note that specimen on top has been strongly dissolved which resembles those illustrated in fig. 12 of Burns (1975) where *Reticulofenestra pseudoumbilica* was recorded; (2) distal view, Sample 265-16-6, 28-29 cm; (3) proximal view, Sample 265-16-6, 35-36 cm; note size variation of *R. perplexa* (left specimen, 4.3 μm; right specimen, 7.3 μm); (4) distal view, Sample 265-16-6, 35-36 cm. Magnifications are indicated by numbers and micron bars in the pictures.

A REVISION OF THE STRATIGRAPHIC HISTORY OF THE GENUS *STEPHANOLITHION*

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INTRODUCTION

The genus *Stephanolithion* is elliptical in shape with a modified protolith rim possessing lateral spines or protuberances. The central area has two to eight arms arranged, typically, symmetrically around a small central vertical spine. The genus was first designated by Deflandre in 1939 and is one of the oldest establish nannofossils genera. Because of their morphology species are easily identified and have an uncluttered taxonomy and synonymy. This has also led them being widely used as biostratigraphic marker species. One or more species of this genus have appeared in all the published zonation schemes for the Jurassic. In the most recent scheme (Bown, Cooper and Lord 1988) a total of six species of this genus were used in defining zones or subzones.

As a result of new species being defined and the adjustment of ranges of established species, it has become necessary to revise the stratigraphic history and evolutionary lineage of the genus *Stephanolithion*.

This paper is a result of research carried out to establish an early to mid Mesozoic biozonation (Bown et al. 1988) and also as part of the author's Ph.D studies.

HISTORY OF STUDY

The first detailed study of the genus *Stephanolithion* was undertaken by Rood and Barnard (1972). Even though they examined most of the Jurassic their study was selective and incomplete with some ammonite zones remaining unexamined. In that paper, the subspecies *S. speciosum octum* and the species *S.hexum* were described. The study explained the evolution of *S. speciosum* into *S. speciosum octum* and *S. hexum* but did not suggest any evolutionary link to *S. bigotii*. Additionally, although showing *Stephanolithion* as continuing into the Early Cretaceous with the species *S. laffittei*, the authors questioned the validity of the generic assignment of this species.

The next publication involving this genus was Medd (1979) on the Haddenham and Gamlingay boreholes in Cambridgeshire. Medd mainly covered the Late Jurassic and recognised one new species and two new subspecies; *Stephanolithion carinatum*, *S. speciosum elongatum* and *S. bigotii maximum*. No discussion of the evolutionary history of the genus was attempted although the range of *S. bigotii* was extended upward into the Kimmeridgian.

Perch-Nielsen (1985), updated the evolutionary history of *Stephanolithion* to include the new data from Medd (1979). Furthermore, she suggested that the ancestor of *Stephanolithion* was *Stradnerlithus comptus*, which may have given rise to *S.speciosum* in the Early Bajocian. She also considered that *S.speciosum* was the ancestor of *S. speciosum octum* and possibly *S. hexum*, as well as Medd's *S. speciosum elongatum* and *S. carinatum*. She placed the Cretaceous species *S. laffittei* into a separate genus *Rotelapillus*, thus restricting the genus *Stephanolithion* to the Jurassic.

Cooper (1987) studied material from the type Volgian and from these samples one new species of *Stephanolithion* was described, *S. atmetros*, and a new combination was proposed; *S. helotatus* (basionym *Corollithion helotatus* Wise & Wind 1977). Additionally, the last occurrence of *S. bigotii* was extended from the Kimmeridgian up to the Middle Volgian.

EVOLUTIONARY LINEAGE

The first occurrence of the oldest species in this genus, *S. speciosum*, is considered to be at the top of the Early Bajocian (see Fig.) The most likely ancestor for this species is *Stradnerlithus asymmetricus* (Rood *et al.* 1971), Medd (1979). This species occurs in the same samples as *S. speciosum* and is morphologically similar, having eight bars in the central area but lacking the lateral spines of *S. speciosum*. In the Late Bajocian, *S. speciosum* gave rise to *S. speciosum octum* by an increase in the length of the lateral spines. The next evolutionary change occurred in the Bathonian with the first occurrence of *S. hexum*; this species has only six bars in the central area and long lateral spines. The probable ancestor for this species is *S. speciosum*

octum which, although it has eight bars, does possess long lateral spines.

S. speciosum speciosum also gave rise to a number of other forms during the later part of the Middle Jurassic. At the top of the Bathonian, *S. elongatum* first appeared. This species is similar to *S. speciosum speciosum* in that it has short lateral spines and eight arms in the central area. However, its shape is considerably more elliptical than *S. speciosum speciosum*. Also first recorded at this level is a large form of *S. speciosum speciosum* very similar in size to the forms of *S.bigotii* seen in the Early Oxfordian that have been assigned to the subspecies *S. bigotii maximum*. Due to a lack of adequate photographs this form has not yet been formally described. Another species with *S. speciosum speciosum* as its possible ancestor is *S. carinatum* which appeared first in the Oxfordian. This latter species has short lateral spines and seven or eight arms randomly arranged in the central area, in contrast to *S. speciosum speciosum* which has symmetrically arranged arms.

The next significant event in the evolutionary history of the genus *Stephanolithion* was the first occurrence of *S. bigotii bigotii* in the lower part of the Callovian. This species appears to have evolved from *S. hexum* by the loss of a pair of central area arms. Subsequent subspeciation appears to be evidenced by the occurrence of the short-ranging *S. bigotii maximum* (topmost Callovian to early Oxfordian). This subspecies is very similar in form to *S. bigotii bigotii* but is much larger (*S. bigotii bigotii* has an average size with spines of 4.3 X 3.5 m whereas *S. bigotii maximum* is defined as being over 6.0 X 3.0 m). Also probably related to *S. bigotii bigotii* is *S. helotatus*. It has four arms in the central area but its lateral spines are very short, and can be absent on etched specimens. *S. helotatus* first appears in the Kimmeridgian and ranges up into the Middle Volgian. In the Middle Volgian, the last true species of *Stephanolithion*, *S. atmetros* appears. It has an elliptical shape, small or no lateral spines and a single pair of arms in the central area forming a crossbar parallel to the small axis of the ellipse. It is likely that *S. atmetros* evolved from *S. helotatus* by the loss of, or merging of, a pair of arms. The highest occurrence of this species in the Jurassic is basal Portlandian and no true species of *Stephanolithion* are known from the Cretaceous.

The Cretaceous species *S. laffittei*, is now regarded as belonging to the genus *Rotelapillus*, not *Stephanolithion*, and this species can be shown to have evolved from *R. radians* during the terminal Jurassic stage. The species *R. radians*, the ancestral form of the *Rotelapillus*, probably evolved from the species *Stradnerlithus fragilis* an eight armed form of this genus. Both of these species have been recorded from the Middle Volgian and, even though *S. fragilis* is elliptical rather than round like *R. radians*, in these Middle Volgian samples, many of the specimens of *S. fragilis* have very low elipticity.

ACKNOWLEDGEMENTS

I would like to acknowledge the research support of E.C.L. Stratigraphic Services in particular Dr. J. Weston for grammatical advice.

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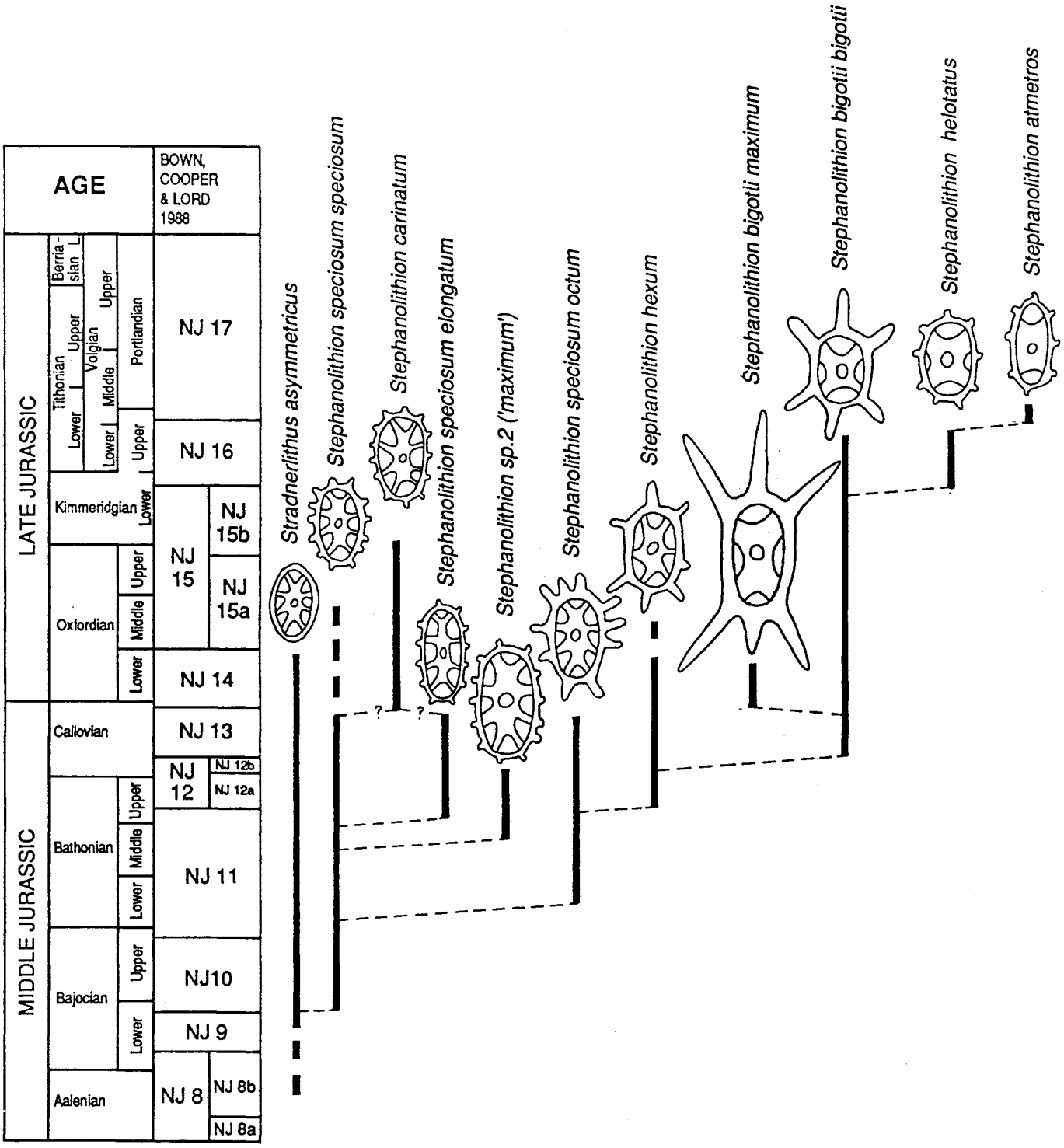

Development of the *Stephanolithion* lineage during the Jurassic

LIST OF CODES USED IN THE "BIBLIOGRAPHY AND TAXA OF CALCAREOUS NANNOPLANKTON"

Some new abbreviation codes have been added and others modified since this list was last published in its entirety in INA Newsl. Vol. 1, Number 1, November, 1979. The following codes are currently being used. Suggestions for improvement are welcomed.

PUBLICATIONS

Abst.	= Abstract only.
Bibl.	= Bibliography.
Overview	= Paper contains data on many subjects, being an introduction to calcareous nannoplankton or giving an overview.
Review	= Reviews of other publications.

TOPICS

Strat.	= General stratigraphy.
Strat.	= Introduction/re-definition of new zones or subzones.
(Strat.)	= Correlation between nannofossil zonations and subdivisions based on other techniques.
Syst.	= Systematics (taxonomy and nomenclature).
Syst.	= Systematics, with new taxa or new combinations.
(Syst.)	= Pictures of nannoplankton, without descriptions.
Biol.	= Biology; data on anatomy, biochemistry, coccolith formation, culture experiments, life history.
Diag.	= Diagenesis.
Ecol.	= Ecology; data on climate; global, regional and vertical distribution; light dependence; temperature preference; water chemistry, etc.
Evol.	= Data on evolution of nannoplankton.
Isot.	= Isotopic studies involving nannoplankton.
Living	= Specimens collected from the water column.
Morph.	= Morphology and terminology of the mineralized skeletal parts.
Sedim.	= Sedimentation, processes acting on the skeletal elements before burial; nannofossils as sedimentary components only.
Tech.	= Techniques.
Tech. prep.	= Preparation techniques of samples or slides.
Tech. obs.	= Observation methods.
Tech. count.	= Counting methods.

CHRONOSTRATIGRAPHY

QUAT.	= Quaternary
TERT.	= Tertiary
TERT.U.	= Upper Tertiary (Miocene-Pliocene)
TERT.L.	= Lower Tertiary (Paleocene-Oligocene)
K/T BDY	= Cretaceous-Tertiary boundary
CRET.	= Cretaceous
CRET.U.	= Upper Cretaceous (Cenomanian-Maastrichitian)
CRET.L.	= Lower Cretaceous (Berriasian-Albian)
JURA.	= Jurassic
JURA.U.	= Upper Jurassic (Oxfordian-Tithonian)
JURA.M.	= Middle Jurassic (Aalenian-Callovian)
JURA.L.	= Lower Jurassic (Hettangian-Toarcian)

TRIAS.	= Triassic
TRIAS.U.	= Upper Triassic (Carnian-Rhaetian)
TRIAS.M.	= Middle Triassic (Anisian-Ladinian)
TRIAS.L.	= Lower Triassic (Scythian)
PRETRIAS.	= Pre-Triassic

GEOGRAPHICAL LOCATIONS

Africa N.	= African countries bordering the Mediterranean Sea.
Africa C-S.	= Other African countries; Canary Islands, Cape Verde Islands, and Malagasy Republic included.
America N.	= North America; Canada, USA, Greenland
America C.	= Central America; countries between Colombia and the USA, and those situated in the Caribbean and the Gulf of Mexico; Bahamas included, Trinidad excluded.
America S.	= South America; Falkland Plateau, Galapagos Islands and Trinidad included.
Asia SW.	= Southwest Asia; all countries of Asia south of the Soviet Union and west of Pakistan; Cyprus included.
Asia S.	= Pakistan, India, Bangladesh, Sri Lanka.
Asia E.	= East Asia; other countries of Asia except USSR.
Antarctic	= Continent of Antarctica.
Australasia	= Australia, Melanesian Archipelago, New Zealand and Papua-New Guinea.
Europe E.	= Eastern Europe; Albania, Bulgaria, Czechoslovakia, Finland, Greece, Hungary, Poland, Romania, Yugoslavia; Crete included, Russia excluded.
Europe W.	= Western Europe; all European countries west of those mentioned before; Balearic Islands, Corsica, Ibiza, Sardinia, and Malta included.
USSR	= European and Asian states of the Soviet Union
Arctic	= Arctic Ocean; area generally north of 70° N. lat.
Atlantic N.	= Northern Atlantic Ocean; area noth of 30° N; Baffin Bay, Norwegian Sea, Baltic Sea and North Sea included.
Atlantic C.	= Central Atlantic Ocean; area between 30° N and 20° S; Caribbean and Gulf of Mexico included.
Atlantic S.	= Southern Atlantic Ocean; area from 20° S. to Antarctica.
Indian	= Indian Ocean, south to Antarctica; Persian/Arabian Gulf, Red Sea included.
Mediterr.	= Mediterranean Sea; Black Sea included.
Pacific N.	= Northern Pacific Ocean; area generally north of 20° N; Bering Sea, Sea of Japan, Sea of Okhotsk; Yellow Sea included.
Pacific C.	= Central Pacific Ocean; area between 20° N and 20° S; Banda Sea, Celebes Sea, South China Sea, and Java Sea included.
Pacific S.	= Southern Pacific Ocean; area from 20° S to Antarctica; Coral Sea and Tasman Sea included.
N. Hemisph.	= Northern Hemisphere; localities distributed over several continents and/or oceans north of the Equator.
S. Hemisph.	= Southern Hemisphere; localities distributed over several continents and/or oceans south of the Equator.
Worldwide	= localities distributed over several continents and/or oceans north and south of the Equator.

Note: Data based on sea-floor samples from continental shelves receive the code of the country adjacent to the continental shelf.

BIBLIOGRAPHY AND TAXA OF CALCAREOUS NANNOPLANKTON - 15

Compiled by William G. Siesser

A418

1	**AUBRY, M.-P.**	**1989**	Abst.
	Paleogene evolution in the calcareous nannoplankton.		Evol.
	Geol. Soc. Amer. Abstracts with Programs, St. Louis, 1989, p. A87.		TERT.L.
2	**AUBRY, M.-P. & BERGGREN, W.A.**	**1989**	Strat.
	Age of the upper volcaniclastic debris flow at Site 747: a special study.		TERT.L.
	In: Schlich, R., Wise, S. W. Jr., et al., 1989, Proc. ODP Init. Repts., 120: 57-69.		Indian
3	**BARRON, J. A., LARSEN, B., BALDAUF, J. G. & ODP 119 SCIENTIFIC STAFF**	**1989**	Abst.
	Proximal and distal evidence of the history of the East Antarctic Ice Sheet: results from ODP Leg 119.		Strat.;Ecol. TERT.
	Third Internat. Conf. Palaeo-Oceanog., Cambridge, Abstract volume, p. 3.		Antarctica; Indian
	BAUMANN, K.-H., MATTHIESSEN, J. & MUDIE, P.	**1989**	Abst.
4	Holocene calcareous nannofossil and dinoflagellate cyst assemblages from the Norwegian-Greenland Sea.		Living; Ecol. Atlantic, N.
	Third Internat. Conf. Palaeo-Oceanog., Cambridge, Abstract volume, p. 25.		
5	**BIEKART, J. W.**	**1989**	Strat.; Syst.
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Alveosphaera JORDAN & YOUNG 1990; p. 16. Type species: *Alveosphaera bimurata* (OKADA & MCINTYRE 1977) JORDAN & YOUNG 1990	A421-4
Alveosphaera bimurata (OKADA & McINTYRE 1977) JORDAN & YOUNG 1990; p. 16; (ex *Calciosolenia?*).	A421-4
Bussonius fecheri KRISTAN-TOLLMANN, 1988; p. 76, pl. 3, figs. 4-9; Central Timor; Pliensbachian.	A421-6
Ceratolithus cristatus var. *telesmus* (NORRIS 1985) JORDAN & YOUNG 1990; p. 15; (ex *Ceratolithus telesmus*).	A421-4
Dictyococcites sessilis (LOHMANN 1912) BIEKART 1989; p. 122; (ex *Pontosphaera).*	A418-5
Emiliania huxleyi var. *corona* (OKADA & McINTYRE 1977); JORDAN & YOUNG 1990; p. 15; (ex *Emiliania huxleyi* subsp. *corona*).	A421-4
Eoconusphaeraceae KRISTAN-TOLLMANN, 1988; p. 76. New family. Type genus is *Eoconusphaera* JAFAR 1983.	A421-6
Eoconusphaera jansae (WIEGAND 1984) KRISTAN-TOLLMANN, 1988; p. 77-78, fig. 2. (ex *Calcivascularis*).	A421-6
Gruenilithaceae KRISTAN-TOLLMANN, 1988; p. 75. New family. Type genus is *Gruenilithus* KRISTAN-TOLLMANN, 1988.	A421-6
Gruenilithus KRISTAN-TOLLMANN 1988; p. 75. Type species: *Gruenilithus* tufari KRISTAN-TOLLMANN 1988.	A421-6
Gruenilithus tufari KRISTAN-TOLLMANN, 1988, pp. 75-76; pl. 3, figs. 1-3. Type species of *Gruenilithus* KRISTAN-TOLLMANN 1988; Central Timor; Pliensbachian	A421-6
Helicosphaera carteri var. *hyalina* (GAARDER 1970) JORDAN & YOUNG 1990); p. 15; (ex *Helicosphaera hyalina*).	A421-4
Oolithotus fragilis var. *cavum* (OKADA & McNTYRE 1977) JORDAN & YOUNG 1990; p. 15; (ex *Oolithotus fragilis* subsp. *cavum*).	A421-4
Papposphaeraceae JORDAN & YOUNG 1990; p. 16; Typus: *Papposphaera* TANGEN 1972.	A421-4
Reticulofenestra parvula (OKADA & McINTYRE 1977) BIEKART 1989; p. 127; (ex *Crenalithus*).	A418-5
Reticulofenestra parvula (OKADA & McINTYRE 1977) JORDAN & YOUNG 1990; p. 15; (ex *crenalithus*). See "Comments".	A421-4
Reticulofenestra parvula var. *tecticentrum* (OKADA & McINTYRE 1977) JORDAN & YOUNG 1990; p. 15; (ex *Crenalithus parvulus* subsp. *tecticentrum*).	A421-4

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Reticulofenestra punctata (OKADA & McINTYRE 1977) JORDAN & YOUNG 1990; p. 15; (ex *Crenalithus*).	A421-4
Reticulofenestra sessilis (LOHMANN 1912) JORDAN & YOUNG 1990; p. 15; (ex *Pontosphaera*).	A421-4
Syracosphaera anthos (LOHMANN 1912) JORDAN & YOUNG 1990; p. 15; (ex *Deutschlandia*).	A421-4
Syracosphaera halldalii f. *dialata* (HEIMDAL 1981) JORDAN & YOUNG 1990; p. 15-16. (ex *Caneosphaera*).	A421-4
Timorhabdus KRISTAN-TOLLMANN 1988; p. 74. Type species: *Timorhabdus timorensis* KRISTAN-TOLLMANN 1988.	A421-6
Timorhabdus timorensis KRISTAN-TOLLMANN 1988; pp. 74-75, pl. 1, fig. 6; pl. 2, figs. 1-6. Type species of *Timorhabdus* KRISTAN-TOLLMANN 1988. Central Timor; Sinemurian.	A421-6
Triquetrorhabdulus rioensis OLAFSSON 1989; pp. 19-21; pl. 1, figs. 9-10. Equatorial Atlantic and Pacific Oceans; lower middle Miocene.	A422-9
Triquetrorhabdulus serratus (BRAMLETTE & WILCOXON 1967) OLAFSSON 1989; p. 20; (ex *Orthorhabdus*).	A422-9
Tubirhabdus patulus PRINS 1969 ex ROOD, HAY & BARNARD 1973, subsp. *patulus* KRISTAN-TOLLMANN 1988; pp. 116-117, pl. 3, figs. 5,6. Timor; Sinemurian.	A421-7
Tubirhabdus patulus PRINS 1969 ex ROOD, HAY & BARNARD 1973, subsp., *tubaformis* KRISTAN-TOLLMANN 1988; pp. 117-118, pl. 3, fig. 2-4, pl. 5, fig. 8; Timor; Pliensbachian.	A421-7

CALCISPHERES

Bonetocardiella lenticularis DALI-RESSOT 1989; pp. 186-189, 192; pl. 1. Tunisia; lower Cenomanian.	A426-4

NEW TAXA

Calcareous Nannoplankton Species Names in Alphabetical Order

anthos, Syracosphaera
bimurata, Alveosphaera
carteri var. *hyalina, Helicosphaera*
cristatus var. *telesmus, Ceratolithus*
fecheri, Bussonius
fragilis, var. *cavum, Oolithotus*
halldalii, f. *dialata, Syracosphaera*
huxleyi var. *corona, Emiliania*
jansae, Eoconusphaera
parvula, Reticulofenestra
parvula var. *tecticentrum, Reticulofenestra*
patulus ssp. *patulus, Tubirhabdus*
patulus ssp. *tubaformis, Tubirhabdus*
punctata, Reticulofenestra
rioensis, Triquetrorhabdulus
serratus, Triquetrorhabdulus
sessilis, Dictyococcites
sessilis, Reticulofenestra
timorensis, Timorhabdus
tufari, Gruenilithus

New Calcareous Nannoplankton Genera

Alveosphaera
Gruenilithus
Timorhabdus

New Calcareous Nannoplankton Families

Eoconusphaeraceae
Gruenilithaceae
Papposphaeraceae

Calcisphere Species Names in Alphabetical Order

lenticularis, ***Bonetocardiella***

COMMENTS

Reticulofenestra parvula (OKADA & McINTYRE 1977) BIEKART 1989 was published before *Reticulofenestra parvula* (OKADA & McINTYRE 1977) JORDAN & YOUNG 1990 and therefore has priority.

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