



IOP NEWSLETTER 64

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PLEASE MAIL NEWS AND CORRESPONDENCE
TO YOUR REGIONAL REPRESENTATIVE OR
TO THE SECRETARY FOR THE NEXT
NEWSLETTER 65.

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EDITORIAL

Only five years ago David Dilcher and myself wrote a couple of articles for this newsletter warning that our subject was becoming too complacent, not relevant to the rapidly changing world. We tried to offer one or two suggestions of how we might look outwards to the future. How wonderfully wrong we were with our gloom and doom, for in that short time I reckon that palaeobotanists have switched to strongly interdisciplinary targets where value and meaning for others is paramount. But of course, there have been some losers, and things are not easy for everyone.

There's a lot of evidence for this sudden change. At international conferences the topics being presented are showing more and more application to the problems of other scientists. And we are being called upon to contribute to many other specialist assemblies. This year in Sydney and Kew, next in Missouri, the results of studies from fossil plants are being integrated into the work of modern botanists.

Then there is another important development. Last month in Krakow more than 200 of us gathered together from across Europe. It was the third time we had got together after the breakdown of the political divide so those of us privileged to attend all three meetings can monitor the changes. I'm in no doubt but that we are all benefiting from the new exchanges. We are all gaining from the wealth of precise systematic work that fortunately continues at centres like Berlin, Prague, Dresden, Kiev, Saint Petersburg and Moscow. Their very large databases are opening up to the rest of us and so are the interpretations. Likewise, these same groups are thinking in an outwards direction, functionally and holistically. The improvements in the standard of presentation and communication through these three meetings are astonishing.

So we can approach the next stage of development in our subject with a new-found optimism. I have a feeling that the IOP China Conference in 2000 is going to be a very open and challenging event. Dilcher and myself are delighted to have been proven wrong, at least, on this issue.

However, I fear another tendency is revealed in this very issue of the newsletter: North American isolation. The growing strength of European palaeobotany seen at Krakow, the cheaper availability of an Amsterdam journal, and the opening of interdisciplinary nomenclature from the Berlin centre, contrast with two other articles from the other side of the Atlantic. For years I've feared the European bias in this London-based newsletter and this may be one reaction in these pages. But I think there is a more serious connection, a reaction to globalisation (in our discipline of all!) and monetarism.

If only to break down this polarisation I do hope the southern hemisphere IOP members can think seriously about nominating some of their number to the forthcoming election for IOP Secretary, in China less than two years from now. Meanwhile, further discussion about applying, publishing and naming within palaeobotany will be appreciated in these ever-dwindling pages.

M.C. BOULTER, London, UK

TOWARDS AN IOP JOURNAL

H. W. Pfefferkorn writes from Philadelphia, USA:

I signed the proposal to create an IOP journal (IOP Newsletter 61) but I saw that letter only as a very preliminary first statement in a long discussion. I feel that many concrete points will have to be presented and addressed before the creation of a new journal can happen. Let me formulate a few ideas I feel are important.

- (1) A new IOP Journal can neither replace the Newsletter nor the current paleobotanical journals of record, namely "Review of Paleobotany and Palynology" and "Palaeontographica B." Each of these journals has its well-established function and creating journals of equal size would obviously require large resources.
- (2) Paleobotany is a highly interdisciplinary science. Therefore, most paleobotanists have to subscribe already to too many journals, in botany, paleobiology, taxonomy, sedimentology, and general geology.
- (3) What is needed is not another journal but a journal that nearly every paleobotanist receives.
- (4) The offer from Elsevier for a reduced price for the Review of Paleobotany and Palynology is most welcome. I would like to have this journal privately. However, I already have so many journals that I'm happy that our university library is receiving it and that's enough for me; or should I say "has to be enough for me due to economic constraints?"
- (5) A reduced cost for the Review of Paleobotany and Palynology would really be of greatest importance for those paleobotanists in developing countries or smaller institutions where the library cannot afford the "Review of Paleobotany and Palynology" and is not willing to buy it. This means that the offer from Elsevier, as welcome as it might be for some members of IOP, does not address the real problem at all.
- (6) A journal put out by IOP should not cost more than a maximum of \$40 a year. \$25 would be even better. Such a cost would insure that anybody who wanted it could afford it and would be able to add it even to

those journals one is already getting. This cost limits automatically how large such a journal can be.

- (7) There are journals that cost only \$25 or \$40 a year, even international ones, and one should not say that it is not possible.
- (8) What is missing is a journal of the size and scope of GEOLOGY which would appear either two, three, or four times a year. One could actually start with two issues. GEOLOGY has about 100 pages an issue but when it started it had much less.
- (9) The new journal would be able to publish rapidly short articles for wide circulation in the specialty. For instance, GEOLOGY publishes only articles that are four pages long. This is equivalent to 16 manuscript pages, including figures. Our journal could be the place for even shorter contributions that would insure vivid discussions. The ideal would be to do this together with the palynologists so that the entire field is covered and, at least within the specialty, we have complete transparency. Such a journal can only be created if certain technical conditions are met.
- (10) We would have to find either a small group of colleagues or one colleague who would be willing to function as editor. This will require a substantial amount of their time and would have to be done on a voluntary basis. The editors will need institutional support that these days is not given by many universities without payment. This means that their institution has to like the idea that they are putting the name of the institution on the cover and therefore allow them to use their mailing privilege and perhaps even secretarial time for the journal.
- (11) In addition, it would be important to find a significant sum, probably approximately \$10,000 to use as start-up funds to get the journal going until income from annual dues will flow on a regular basis. A first number should be produced so that everybody could see it and judge by it the necessity of such a venture.
- (12) A venture of this nature could perhaps even be done together with a well known printer of scientific journals or a scientific publisher.

I hope that the discussion will continue and lead to an improvement of communication within the profession.

NEWS OF A FORTHCOMING MEETING

THE SIXTH QUADRENNIAL CONFERENCE OF IOP (IOPC-VI). Qinhuangdao City, Hebei Province, China, 2000

All colleagues and friends of palaeobotany will be warmly appreciated.

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NEWS OF RECENT MEETINGS

THE FIFTH EUROPEAN PALAEOBOTANICAL - PALYNOLOGICAL CONFERENCE Krakow, Poland, June 26-30, 1998

The ancient city of Krakow in Poland provided an impressive setting for the fifth and largest yet European palaeobotanical-palynological conference. Scientists representing over thirty countries attended the conference's first gathering in eastern Europe. Future palaeobotanical-palynological conferences will hopefully be staged alternatively in western and eastern European countries. During four days of sessions, over eighty presentations and ninety posters were given in a social, intellectual atmosphere. The high degree of general organisation at every level allowed proceedings to run smoothly.

A warm welcome to the conference was extended by the President, Prof. Leon Stuchlik. Prof. Bill Chaloner, invited to open presentations, offered a glimpse into the evolution of our planet's carbon cycle. He paved the way for a colourful spectrum of talks accompanied by lively debate.

With the choice of Palaeozoic, Mesozoic, Tertiary, Quaternary and general palaeobotany sessions, few contributors could complain of feeling left out. Topics discussed included morphological studies and taxonomic classifications. Plant evolution and preservation were important subjects. Comparisons of modern and ancient botany formed the focus of other studies. Many speakers applied palaeobotanical and palynological information to biostratigraphical, palaeoclimatological, palaeoecological palaeogeographical and sedimentological analyses. Quaternary sessions introduced man's influence upon palaeobotany and palynology and the history of plant exploitation by man. Apparently very few parts of the world had not been visited in a quest for scientific discovery by at least one participant. Poster sessions reflected this wide variety of interests. Posters were presented during coffee breaks, giving researchers an opportunity to display and discuss their work in an informal environment.

Our appetite for food as well as science had thankfully been considered. Participants were invited to eat all they could during a buffet of grand proportion, an offer which deserved to be treated seriously.

The charm of Krakow, Poland's former capital, lured many into its central market square with each ensuing dusk. Cracow, world-renowned for its rich cultural and scientific tradition, became renowned amongst younger male conference-goers for its contemporary female attractions.

Regretfully, the consequence of such evenings was a number of sore heads the following mornings. We were all therefore refreshed by an official day off between proceedings. A cool respite from the Polish sun was found within the Wieliczka working Miocene salt mine. Our trusty guide led us safely down the extensive network of passages, proudly informing us of Poland's salt-mining history and the versatility of Polish salt. Intricate, many-coloured saline statues had been painstakingly carved and in the depths of the mine a great hall with delicate evaporitic chandeliers had been fashioned. Apparently, the ground we walked, the mine walls and roof were all composed entirely "of salt". We were comforted to learn, then, that the public conveniences at the heart of this immense evaporite body were practically the only items in our midst that were "not of salt".

A tour of Krakow including Wawel Castle, the chief residence of Polish nobility and Collegium Maius, the Jagiellonian University's oldest existing building, was fitted into our afternoon schedule. Just sufficient time remained for a final cultural experience that evening, taking in Verdi's Nabucco. The Italian Opera was given a touch of Polish flare in this production, with dynamic performances and a surprisingly imaginative wardrobe. Memories of the city's beautiful architecture and the friendly nature of its inhabitants shall be carried home by all involved.

Four fieldtrips succeeding the conference aimed to investigate the span of geological time and botanic successions within Poland's stratigraphy. Excursion number two, to the Tertiary-Pleistocene floras of Middle and south-western Poland, covered a vast stretch of scenic lowland countryside. At each site, a picture of ancient floral compositions was suggested by Polish palaeobotanists with expertise in the local fossil plant ecology. The very courteous director of the Turów open-cast brown coal mine must be thanked for providing a banquet lunch after a busy morning working up the coal measures. We also greatly appreciated the numerous gifts presented by the staff of Wrocław University during our visit. We were particularly lucky to be accompanied by Dr. Jerzy Glazec, who displayed boundless geological enthusiasm, way beyond the call of duty.

Excursion two, however, proved to be hard work for all involved. We were expected to doggedly indulge in endless courses of food. Even the most determined, dedicated eaters among us were struggling by the last evening, when we were treated to sumptuous Polish cuisine in the market square of Wrocław. Fortunately,

this meal marked the end of our fieldtrip and we were not expected to move the following day.

Both the conference and later field excursions brought scientists from very different disciplines together, while providing a meeting ground for old associates. Contributors and the audience included young researchers and well-established and respected names alike. Useful, constructive comments and direction were hopefully acquired by many. Inevitably, new collaborations were born in the cooperative atmosphere. The conference has, however, left our minds filled with as many new questions as answers. We anticipate learning about progress on these contentious issues at the next European meeting in Athens, in 2002.

The organising committee deserve a debt of gratitude for the huge workload put in by all involved and the international programme committee for their support. Participants should be acknowledged for the overall content, diversity and stimulation of presentations. Other attendants offered insightful comments and conveyed enthusiasm. Contributions will be published in a Proceedings volume, to be published later this year.

JENNY CRIPPS, London, UK

INAUGURATION OF THE INSTITUTE OF PALAEOBIOLOGY AND THE SOCIETY OF PALAEOBIOLOGISTS - A REPORT Tambaram, Chennai, India, 15th April 1998

It was a congregation of biologist, geologists and other academicians on Wednesday, 15th April, 1998, 4.00 p.m. at the conference Hall of a three-star hotel in Tambaram, Chennai-45. A collection of plant fossils from the Mesozoic sediments of Tamil Nadu and the Palaeozoic sediments of Bihar were on display at one corner of the hall which was gorgeously decorated. A few books on plant and animal fossils were also on display.

The occasion was the inauguration of the CHRISTIAN INSTITUTE OF PALAEOBIOLOGY (CHIP) and the SOCIETY OF PALAEOBIOLOGISTS. Soon after the opening prayer, Dr.P.J.Sanjeevaraj, former Professor of Zoology and presently, Professor of Ecology and Dean at the Centre for Research on New International Economic Order (CRENIEO), Chennai-6, welcomed the gathering consisting of professors, scientists, museum curators, forensic experts and students of fossil study and introduced the main speaker of the day, Dr.K.N.Prasad, former Director, Geological survey of India, Calcutta and an author of more than 200 publications in Palaeobiology who gave the inaugural address on the topic 'Biodiversity of the past'. Illustrating his talk with transparencies localities of the Indian subcontinent wherein lie buried the remains of past organisms from one celled bacteria to giant dinosaurs and

early hominids. The 'Kuthuvilakku' was lit, marking the inauguration, by some distinguished women in the audience. The vote of thanks was proposed by Dr.D.E.P.Jeyasingh, retired Professor of Botany, Madras Christian College and founder-Secretary of the inaugurated Institute and Society both of which will function, as decided in the meeting, under the guidance of an advisory committee consisting of experts.

NEWS FROM THE NATIONAL MUSEUM, PRAGUE

At the end of 1998 Marketa Strakova left the National Museum. Renata Patova is a new member of the department of palaeontology, she is working on Cretaceous palynomorphs. Jiri Kvacek finished his PhD: Cuticle analysis of gymnosperms of the Bohemian Cenomanian in May 1998. He is going to work on Cretaceous angiosperms.

Last year the museum issued a Catalogue of fossil plants described in works of Kaspar M. Sternberg (201 pages 67 plates). (The date of the issue of the first volume of *Flora der Vorwelt* is, until the botanical congress in 1957, a starting point of the palaeobotanical nomenclature). In the catalogue numerous notes on fossil plant taxonomy and nomenclature are published. The catalogue is also published in electronic form.

The museum journal *Acta Musei Nationalis Pragae*, series B - *Historia Naturalis* publishing papers on palaeobotany, where J. Kvacek is involved as an editor, has now larger (A4) size and new design. It was accredited with the International Association for Plant Taxonomy for purposes of registration of new plant names.

OBITUARIES

PROF D.I. AXELROD

Prof. Daniel Isacc Axelrod, paleobotanist in the University of California, Davis, and a Research Associate of Berkeley Museum of Paleontology, passed away yesterday of heart failure at the age of 88.

Axelrod was known for his extremely careful collection and documentation of fossil floras from throughout the western United States and his stimulating theoretical and synthetic papers on topics as diverse as angiosperm evolution, climate and evolution, dinosaur extinction, early Cambrian animal radiation, plate tectonics and paleobotany, and many, many more. His work always involved careful comparisons to modern vegetation, which he studied in many parts of the world.

He began publishing papers while a student at the University of California, Berkeley, in 1934. His publications were numerous and continued to the day he died, for he was working on several monographs on western North American floras that he collected or recollected in recent years. His work was supported largely by the Carnegie Institution and the National Science Foundation over most of his career. He collected tens of thousands of fossil plant specimens during this time, and recently donated them to the UC Museum of Paleontology, including a huge number of types. In recognition of his accomplishments in paleobotany, the Paleontological Society presented him with its highest honor, the Society's Medal, in 1990 (*Journal of Paleontology*, 65:520-523).

Axelrod received his B.A. at Berkeley, and returned to do a M.A. (1936) and Ph.D. (1938) on Tertiary floras under the guidance of Ralph Chaney. He spent two years as a post-doc at the National Museum in Washington, D. C., then joined the service and did photo interpretation for American operations in the Pacific. Axelrod began his academic career in the Geology Department at UCLA right after WW II, and moved to the Geology and Botany Departments at UC Davis in 1967. He served for a year as Chair of the Geology Department, and did a masterful job. But research was his calling and he relished it and teaching research-oriented courses in paleobotany. After his retirement in 1976, he continued his studies as if nothing had changed, going into his office/lab everyday to study and write. He never slowed down, for he considered his research "exciting and much fun"!

Once he taught ecology at Davis. Although he only gave a few lectures, the class broke into spontaneous applause each time when he finished (the only times I ever saw that happen anywhere!). The same thing happened at professional meetings with his peers. He was thorough and through a paleobotanist (and botanist and geologist) extraordinaire.

B. TIFFNEY, California, USA

SHEILA BENNETTS

Jack Douglas IOP rep for Australasia regrets to announce the death last January of Sheila Bennetts, well known community worker and IOP member, of Shepparton, Victoria, Australia. Sheila had spent many years collecting and working on pentoxylon wood.

CHANGE OF ADDRESS

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NOMENCLATURE

A coloured poster has recently been produced by R.A. Fensome, J. Jansonius, J.K. Lentin, J.E. Skog and G.L. Williams outlining the role and membership of the Committee for Fossil Plants. It also gives the authors' view on the changes in nomenclatural procedure that are being discussed by taxonomists. The following quotations from the poster may stimulate further discussion.

"Perhaps the most significant change in biological nomenclature since formal codes were established looms on the horizon. The panbiological International Code of Bionomenclature (or "BioCode") has already past through several draft stages: the present version was presented by Greuter et al. (1998 – see also Greuter and Nicolson, 1996).

"The existence of a single set of rules to govern biological nomenclature is a seductive idea. At first glance it also seems like a simple idea. However, when rules are changed, even in the existing codes, great care must be taken so that the changes do not invalidate names that were previously considered valid – lack of such care would be a sure recipe for nomenclatural chaos.

"Therefore, in order not to risk invalidating established names, the BioCode must have a retroactive limit – 1 January 2000 in the current draft. For names proposed after 1999, this retroactivity may cause few problems. However, for names published before 1 January 2000, their status up to that date would be governed by the ICBN and any change in status after that date would be governed by the BioCode. For dinoflagellate names originally published under the ICZN, three codes may be involved in establishing nomenclatural history and status.

"The problem of having to juggle up to three codes, and the fact that the BioCode is a completely original document, not an amalgamation or harmonization of existing codes, gives the authors of this poster serious concerns about the future stability of biological nomenclature, should the BioCode come into effect. This is a matter of concern to all life scientists, whether systematically inclined or not."

And then, concerning NCU (Names in Current Use) proposals:

"('deferred' at the last Botanical Congress but still strongly promoted) to establish lists of generic names that would be 'protected' against generic names not on the lists."

....."if the NCU concept is formally incorporated into the Code, names on the list would have automatic priority over names not on the list, regardless of authorship dates. Hence a listed genus, *Bubosperma* Smith 1999, would have priority over an unlisted genus, *Ballyderma* Rodriguez 1899, if the two genera are ever considered synonymous. The purpose is mainly to prevent resurrection of old forgotten names, and those published

in obscure journals or books, at the expense of well established names.

"QUESTION: I can see that if these lists are not carefully completed, chaos will result. Good names inadvertently left off the list could be scooped by obscure names. Isn't it to avoid this kind of quixotic synonymy that the NCU concept is all about? What assurance can you give palaeobotanists and palynologists that any lists will be complete and accurate?

"ANSWER: The responsible committees (fossil plants and algae in the present context) will, we hope, not recommend any lists that are not carefully formulated and widely and publicly checked and approved. Any developments with respect to fossils will be reported in *Palynos*. We should add that, although a preliminary list of fossil plants for NCU purposes was prepared under the auspices of the previous Committee for Fossil Plants, the project is definitely on the backburner as far as the present Committee is concerned. Indeed there are currently no plans to refine or update this list unless the perceived advantages of such a list becomes obvious."

[Editor's note: three of the authors of this poster are members of the Committee for Fossil Plants, RAF its chairman, JES its secretary and JJ one of 14 other members. The others are S. Archangelsky, D.J. Batten, K. Faegri, M. Fairon-Demaret, H.K. Maheshwari, D.J. Nichols, G. Playford, R.L. Ravn, F. Schaarschmidt, A. Traverse, B.S. Venkatachala, V. Wilde and Zhou Zhiyan.]

REVIEW OF PALAEOBOTANY AND PALYNOLOGY

Special Offer for IOP members - US\$ 125 for all 1998 volumes

Elsevier Science offers IOP members the possibility to take out an associated personal subscription to the *Review of Palaeobotany and Palynology* against a strongly reduced rate. For only US\$ 125.00 per year IOP members can now receive all 5 Volumes (20 issues) at their own desk.

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BOOK REVIEW

The brown algal origin of land plants and the algal origin of life on earth and in the universe.

Anthony J. Miklaussen Ragged Edge Press, ISBN 1-57249-095-0, \$60.00

There is a consensus among botanists that land plants originated within the green algae. This hypothesis is built upon the striking similarities in biochemistry and cell ultrastructure of living species 1, 2 and it has received confirmation from molecular phylogenetic studies 3, 4. Brown algae, on the other hand, are part of a very distantly related clade (Heterokontophyta) that comprises a seemingly heterogeneous assemblage of organisms, including some algae (e.g., Chrysophyceae, Xanthophyceae, Bacillariophyceae), several groups of unicellular protozoa, and multicellular or siphonous fungi (e.g., Oomycetes). Heterokonts are recognised principally on the unique structure of their flagellate cells, but new data from molecular sequences also provide strong evidence for monophyly of the group 1, 4, 5. In this book, Miklaussen offers a very different view on these and other widely held hypotheses on the evolution of land plants. For Miklaussen, green algae are irrelevant, and land plants are a highly polyphyletic assemblage with roots in the brown algae. Although the author's ideas, approach, and methods are not representative of current mainstream science, the main problem with this book is that the arguments are poorly constructed and the evidence is unconvincing.

The book begins with a lengthy (50 page) digression on the fossil lycopsid *Lepidocarpon*. Miklaussen believes that *Lepidocarpon* has been misinterpreted by generations of palaeobotanists and that this plant is a key missing link that opens the way to a new perspective on plant phylogeny. Based on new data from an assemblage of Upper Mississippian impression fossils, the root of the *Lepidocarpon* plant is reinterpreted as a flat, thalloid sheet - a kind of unzipped and ironed out stigmatic axis. This prostrate thallus bears rootlets on the lower surface, and the rootlet scars on the upper surface are interpreted as interfaces with the atmosphere. Leaf scars are completely absent from the upright stems, which bear, instead, fine longitudinal striations, and the cones are bilaterally symmetrical. This reconstruction bears little resemblance to the widely accepted model for arborescent lycopsids. Based on this new interpretation, Miklaussen argues that there are many similarities between *Lepidocarpon* and algae in the Fucales. Having identified a phylogenetic link between lycopsids and brown algae, he goes on to reconsider the relationships of other land plants, concluding that there is overwhelming evidence for the independent evolution of monocots, dicots, gymnosperms, ferns, lycopsids, sphenopsids, and bryophytes, among others, from brown algae. These ideas

are used as a framework for discussing morphological evolution within higher groups, focusing on the transformation of organ systems in the Laminariales and Fucales into structures such as the lycopsid leaf, the cone scale of conifers, and the ligule of grasses. Also discussed are geological and ecological factors that may have influenced the colonisation of the land by plants. A handful of pages at the end is devoted to the origin of life itself - on earth and elsewhere.

In this book, the author has constructed a series of hypotheses amounting to a house of cards that folds with the slightest critical scrutiny. It is a great pity that such a well-intentioned and clearly lovingly fashioned piece of work has been allowed to escape into print apparently without critical review. The reconstruction of *Lepidocarpon* is a chimera. There is little substantiating evidence, the illustrations are poor, and more straightforward interpretations of the data are evident. The prostrate "thalloid" base of the plant is more likely a compressed stigmatic axis. The interpretation of the cone as "bilaterally symmetrical" is poorly documented and contradicts better evidence from other sources. Worse, elements of different plants appear to have been mixed. The "trunk" looks suspiciously like a fragment of calamite stem or cordaite leaf! In short, Miklaussen's new interpretation of the *Lepidocarpon* plant is unconvincing.

Much of the rest of the book is devoted to developing phylogenetic hypotheses, and there are serious flaws in the author's interpretations and methodology. First, there is a highly selective reading of the comparative data. Miklaussen glosses over or ignores the large body of morphological, cytological and molecular data that contradict his ideas. In many places, citation of relevant literature is woefully inadequate. Second, most of the similarities between brown algae and various land plants listed in the text do not stand up to scrutiny. To take one example, not a single proposed similarity between *Lepidocarpon* and Fucales (p. 58) is convincing. It is difficult to see that there are any grounds for supposing, as Miklaussen does, that the lycopsid sporophyll is homologous with the fucalean conceptacle. The text is replete with similar farfetched comparisons. Miklaussen must provide plausible homologies if he is to persuade others that his ideas of relationship have some validity. This he fails to do. Third, Miklaussen applies his methods inconsistently. He acknowledges the importance of similarity in recognising relationships among various groups of brown algae and land plants, but, mysteriously, he does not apply this approach to the more striking similarities among land plants themselves, which suggest a common origin. Fourth, the author does not seem to have heard of Occam's Razor. The clearest example of this is in his treatment of angiosperms. Miklaussen believes that monocots and dicots originated independently from Laminariales and Fucales! This

hypothesis implies that all the morphological, molecular, cytological, and biochemical similarities between monocots and other angiosperms, seed plants, vascular plants, land plants, and green algae are convergent. The consequence of these errors is a series of outlandish and completely unfounded phylogenetic hypotheses, and without a credible phylogenetic framework the accompanying analysis of evolutionary patterns and processes makes little sense.

Miklaussen devotes a handful of pages towards the end to a discussion of the origin of life on earth and in the universe. These sections appear to be late additions that were probably included to broaden the book's appeal. The most extensive discussion is appended to the end of the final chapter, which has the implausible title: "Corn with a brown algal origin". Like much of the rest of the book the arguments here are confused and poorly substantiated. They appear to be little more than the author's opinions on various subjects jotted down. Miklaussen believes that the first organisms were phototrophs rather than heterotrophs, that the endosymbiotic theory of the origin of plastids is incorrect, that life evolved in cold Arctic oceans, that the NASA

Mars meteorite does not provide evidence of life on Mars, but that life elsewhere in the Universe is probable. As opinions these are fine, but in a world of sceptics opinions are no substitute for arguments.

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4. Bhattacharya, D. Origins of algae and their plastids. in *Plant Systematics and Evolution, Supplement 11* 287 (Springer, Vienna, 1997).
5. Medlin, L.K., Kooistra, W.H.C.F., Potter, D., Saunders, G.W. & Andersen, R.A. Phylogenetic relationships of the 'golden algae' (haptophytes, heterokont chromophytes) and their plastids. *Plant Systematics and Evolution, Supplement 11*, 187-219 (1997).

P. KENRICK, London, UK