INTERNATIONAL UNION OF BIOLOGICAL SCIENCES SECTION FOR PALAEOBOTANY


# IOP NEWSLETTER 46

**FEBRUARY 1992**

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The views expressed in the newsletter are those of its correspondents and do not necessarily reflect the policy of IOP.

# IOP NEWS

## IOP PRESIDENT

Professor Charles Beck, University of Michigan, USA has resigned as President "after considerable thought".

Many great thanks are due to him for his four years of service to the organisation. He has given confident support to the Secretary and has helped influence some new directions for the Executive Committee such as the Plant Fossil Record project and newsletter distribution.

According to our Constitution the vacancy on the Executive Committee must be assumed by one of the Vice Presidents. In response to Charles Beck's nomination Dr Jean Galtier, Montpellier, has kindly agreed to assume that office until the 1993 International Botanical Congress in Tokyo.

## THE BIRBAL SAHNI - IOP MEDAL

On Tuesday November 12th there was a meeting in Lucknow of Prof D.L. Dilcher (Vice-President of IOP), Dr S.C. Srivastava (Secretary of the Birbal-Savitri Sahni Foundation) and Prof M.C. Boulter (Secretary of IOP). The President of IOP was not present and had given power of consent to the Vice President.

The aim of the meeting was to agree a procedure for the selection of a recipient of the medal at each IOP Conference. The next of these is to be held in Paris 1992 and an award is to be made.

It was agreed that the selection should be made by correspondence between the IOP President, the three IOP Vice Presidents, and the IOP Secretary. The Secretary of the Foundation should be an ex-officio member of this selection committee.

After the meeting Professor V.A. Krassilov, Moscow, was nominated for the award at Paris in 1992.

# REPORTS OF A RECENT MEETING

## THIRD INTERNATIONAL WORKSHOP ON PLANT TAPHONOMY

### UTRECHT, THE NETHERLANDS, NOVEMBER 12TH 1991

It was a cold foggy morning outside the Botanical Institute in Utrecht, (the stillness was not split by the cry of a lone wolf in the distance). Inside over 50 palaeobotanists warmed themselves with coffee before the first of two interesting keynote lectures were delivered. Previous meetings have had an informal atmosphere and the speakers attempted to retain this trend by inviting "synlectural" interruption. Bob Gastaldo may have deterred the audience by waving the pointer in a very menacing "schoolmaster" fashion. It is worth noting that the first questions were asked by those out of pointer range.

In the first hour Dr Bob Gastaldo (Auburn University, USA) reviewed the origins of several fossil log assemblages by comparison with modern analogues. In doing so he attempted to explain how careful study of wood assemblages could give useful sedimentological and palaeoclimatical information. Modern examples included cyclonic blowdowns in Alabama, Red River log jams and *Nypa* swamps in Indonesia. Fossil examples were taken from the Carboniferous, Triassic and Eocene. Bob also presented results from a study of log infilling similar to those by Gill Rex in the early eighties. His work, however, was undertaken in a field situation because he "couldn't find a flume that was big enough".

Dr Andrew Scott (Royal Holloway and Bedford New College, UK) gave the second keynote lecture. Here the emphasis was on experimental work. Andrew spoke on the burial and diagenesis of plant material, emphasising the need to know the complete history of the specimen if we are to interpret the fossil record correctly. After reviewing the experimental charcoalification work of Dr Tim Jones he went on to look at the origins of coal balls. Using evidence from the crystallisation history and isotopic studies of the carbonates he concluded that no single model could be invoked to explain the production of all coal balls.

The last speaker before lunch, Dr Hans Kerp (Westfalish Wilhelms-Universitat, BRD), described a collection of uncompressed conifers from a small fault-bounded basin in the Italian Alps. These fossils, of Permian age, acted as the nuclei for stromatolite growth.

Following lunch Dr H. Leereveld (Utrecht, Netherlands) explained the major factors affecting the distribution of dinoflagellate cysts. He concentrated on marine taxa emphasising the effects of water temperature, depth and salinity. The distribution of fossil cysts is dependent as much on its living stage as on influences occurring after its death. Taphonomy, it was felt, should therefore start before the death of the organism. This thought was shared by many in the audience. The paper by Dr J. de Leeuw (TU Delft, The Netherlands) attracted the most discussion from the audience. The Delft group have been working on the identification of biomacromolecules of leaf cuticles. They used pyrolysis and spectrometry to identify some of these macromolecules. In their study they investigated a material which they have named "cutan". This substance is more resistant to decay than cutin. It therefore follows that plants with a high proportion of cutan to cutin are more likely to survive in the fossil record. This provides a taphonomic bias against plants with little or no cutan in their cuticle (eg *Lycopersicon*). Much of the discussion centered on what factors may control the distribution of cutan within the plant kingdom (ie why do some plants have it whilst others do not?). Dr J. de Leeuw emphasised that the relatively small number of specimens so far studied meant that it was not yet possible to say what these factors were.

Prof. Dave Ferguson (Rijksuniversiteit Centrum Antwerpen, Belgium) brought the lectures to a close with an example of the use of taphonomic principles in the interpretation of an interglacial fossil assemblage. By considering the dispersal capabilities of the plant organs

found at the site he reconstructed the spatial distribution of seven plant communities.

The organisation of the meeting was such that there was plenty of time for open discussion of the topics presented. A marvellous lunch was organised and the workshop ended with a farewell party.

P.L. HOLMES, London, UK.

Lovely old Utrecht was the site for a meeting for a relatively new branch of paleobotany, namely that of plant taphonomy. The Third International Workshop on Plant Taphonomy brought together around 55 paleobotanists and palynologists from the Netherlands, Belgium, Great Britain, France, Germany, Austria, and even as far away as the U.S.A. (via Germany) to discuss various problems in Plant taphonomy.

What was striking at this one-day workshop were the many different directions into which plant taphonomy is expanding. Questions about diagenesis as well as about biostratinomy are now being posed, and the taphonomic study "organisms" range from organic molecules to massive logs. Efficiently organized and graciously run by Johan van der Burgh and his colleagues at the famous Laboratory of Palaeobotany and Palynology in Utrecht, this meeting featured speakers who provided us with much new food for taphonomic thought, while our generous Dutch hosts provided us simply with much good food.

The workshop began with two keynote lectures. The first one by R.A. Gastaldo discussed the genesis and utilization of wood assemblages as it applies to the taphonomy of the Petrified Forest in Arizona (it was not a Triassic log jam, that's for sure). The second keynote lecture by A.C. Scott was on the burial and diagenesis of fossil plants and focused in on the information gleamed from calcitic cements in coal balls. To maintain the informal nature cultivated at past workshops, the number of the following, shorter oral contributions was kept to just a few. These lectures ranged from Permian conifer twigs entombed in stromatolites (J.H.F. Kerp) to the reconstruction of an interglacial site in Belgium (D.K. Ferguson) to the spatial distribution of living dinoflagellates (H. Leereveld). Posters were presented on a new Cretaceous bryophyte species (H. van Amerom), characteristics and distribution of palynofacies in (sub) Recent sediments in Angola (N. Janssen), and provincialism in the distribution of probable crustacean eggs in Indonesia (I. van Waveren).

One especially interesting paper presented in the afternoon was the one by J. de Leeuw on the bias of the fossil record due to the presence or absence of resistent biomacromolecules in precursor organisms. The title is intimidating, but the take-home message is straightforward: all plant cuticles are <u>not</u> created equal. Some biomacromolecules (such as the newly discovered cutan) are more resistent to degradation than others (such as cutin, cellulose and waxes). Because some plants naturally have cutan, cutin, or a combination of both, the fossilization of plant cuticles is not a random process, but depends on what sort of organic compounds the cuticle once contained. This creates a bias in the preservation of leaves and other plant parts in the fossil record which in turn may bode ill for any paleoenvironmental reconstructions based exclusively on microscopic investigations.

Following the temporal and geographic tradition set by past workshops, the next workshop is scheduled to be held sometime in the autumn of 1992 in this corner of Europe, probably in Munster. Contact Prof. Dr. J.H.F.Kerp, Forschungsstelle fur Palaobotanik, Westalische Wilhelms-Universitat, Hindenburgplatz 57-59, D-4400 Munster, Germany, for more details.

C.T. GEE, Bonn, Germany.

# NEWS OF FORTHCOMING MEETINGS

## PALAEOFLORISTIC AND PALAEOCLIMATIC CHANGES IN CRETACEOUS AND TERTIARY TIMES

**- AIX-EN-PROVENCE, FRANCE, SEPTEMBER 6-12TH 1992**

**- BRATISLAVA, CZECHOSLOVAKIA, SEPTEMBER 14-20TH 1992**

The first of these aims to summarise our present knowledge of the development of flora and palaeoclimate from the Cretaceous to the Tertiary on the basis of spores and pollen.

The second meeting in Bratislava has similar aims and also expects to consider plant megafossils.

Write to: Dr Eva Planderova, Dionyz Stur Intitute of Geology, Mlynska dolina 1, 817 04 Bratislava, Czechoslovakia.

## XV INTERNATIONAL BOTANICAL CONGRESS

**TOKYO, 1993**

The latest information from the organisers is that the Division of Systematics and Evolution will have the following palaeobotanical sessions among its many other topics:

S 1.7.1 Evolution of Pteridophytes and Gymnosperms - organised by G.W. Rothwell & H. Nishida

S 1.7.2 Early evolution of flowers - E.M. Friis & H. Nishida

S 1.7.3 The impact of environmental change on angiosperm evolution - J.A. Wolfe & K. Uemura

S 1.7.4 Morphology and systematic relationships of Mesozoic Gymnosperms - R.A. Stockey & J. Horiuchi

S 1.8.2 Palynological evidence of major events in the development of terrestrial floras - P.R. Crane & P.G. Gensel

The Division of Ecology and Environmental Biology has a palaeobotanical session organised by C.

Schwegar & C. Yonebayashi: Late Quaternary Vegetation History and Community Dynamics

# BIRBAL SAHNI BIRTH CENTENARY CELEBRATIONS

**INDIA, NOVEMBER 1991**

Professor Birbal Sahni was born on November 14th 1891 at Bhera, a small town in the Shahpur district, now in Pakistan.

He was the first Indian to specialise in palaeobotany research and became one of the foremost scientists in his country. One of his closest friends, and a near contemporary at Cambridge, was Jawaharial Nehru who, in 1949, laid a foundation stone to what was to become the Birbal Sahni Institute of Palaeobotany.

For such a great man, Indian scientists organised many grand celebrations for the centenary of his birth. There were ceremonies and scientific meetings at Allahabad and Lucknow, articles about fossil plants appeared in newspapers and magazines, souvenir books were published and a special exhibition of palaeobotany, aimed at children, was opened in Lucknow. At a civic ceremony in Allahabad medals were presented by the IOP Secretary to some of Sahni's students: Professors D.D. Pant, B.S. Trivedi, K.R. Surange and M.N. Bose.

At the Birbal Sahni Institute of Palaeobotany in Lucknow, a large number of programmes had been arranged.

The Birth Centenary Celebrations began on 14 November 1991 with Pushpanjali at the Samadhi of Birbal Sahni, followed by the planting of a sapling of the Scholar's tree, *Alstonia scholaris*, in the campus of the Birbal Sahni Institute. This was followed by the unveiling of a tablet commemorating the foundation of the Institute of Palaeobotany in the Department of Botany, University of Lucknow, by Professor T. S. Sadasivan. An exhibition on 'Birbal Sahni, and the Past of the Green World' was inaugurated by the eminent scientist Dr. A. P. Mitra, in the Regional Science Centre, Lucknow. The Centenary Celebrations were formally inaugurated by Professor S. Z. Qasim, Member of the Planning Commission. His Excellency Sri Satyanarayan Reddy, Governor of Uttar Pradesh was the Chief Guest. Professor T. S. Sadasivan, one of the oldest students of Birbal Sahni, delivered a memorial lecture on "Professor Birbal Sahni's contribution to Indian Botany and its impact on the scientific scenario". Tributes to Birbal Sahni were paid by Dr. A. P. Mitra, President of National Academy of Sciences, and Dr. B. P. Radhakrishna, Editor at the Geological Society of India.

On 15 November 1991 there was a group discussion on **"The Relevance of Palaeobotany in a modern context"**. C. P. Vohra, Director-General of the Geological Survey of India presided over the discussion which was moderated by Professor H. Y. Mohan Ram. In the afternoon, Professor David Leonard Dilcher, University of Florida, delivered the 21st Professor Birbal Sahni Memorial Lecture on **"The importance of plant/animal interactions in the origin and subsequent evolution of flowering plants"**. Mr. C. P. Vohra released two special publications, one of **"Extinct plants, evolution and earth's history"** published by the Current Science Association, and the other **"Catalogue of plant fossils from India"** published in 11 fascicules by the Birbal Sahni Institute of Palaeobotany.

The scientific programmes that took place during the following week included

- Symposium on **"Evolutionary Plant** Traverse of the Pensylvania State University
- Symposium on **"Four Decades of Indian Palaeobotany,** 18-19 November 1991, inaugurated by Professor C.G.K. Ramanujam of Osmania University
- **Birbal Sahni Birth Centenary Palaeobotanical Conference,** 20-22 November 1991, inaugurated by Professor D. L. Dilcher.

During the week four special lectures were also delivered. - 36th Sir A. C. Seward Memorial Lecture - **"History of Internal Co-operation in Palynology"** by Professor James E. Canright of Arizona State University which was presided by Professor R. N. Kapil

- 37th Sir A. C. Seward Memorial Lecture - **"Links with the past in the plant world: cuticles as recorders of Diversity, Kerogen formation and palaeoatmospheric $CO_2$ level"** by Professor Henk Visscher of University of Utrecht which was presided by Dr. B. D . Sharma
- The Palaeobotanical Society International Medal Award Lecture for 1989 - **"The early history of land plants - revisited"** by Professor Harlan P. Banks of Cornell University (read by Professor Alfred Traverse)
- The Palaeobotanical Society International Award Lecture for 1991 - **"Sporopollenin and chitin--'non-biodegradable plastics' trace major biochemical events of the geological past"** by Professor Alfred Traverse of The Pennsylvania State University, USA.

At the University of Allahabad the Departments of Botany and Earth & Planetary Sciences organised an international conference from November 13 - 16th. There were 143 presentations over these four days to large and diverse audiences. The conference was opened by Prof R.C. Mehrotra Vice-Chancellor of the University of Allahabad and there were other speeches from Prof D.D. Pant, Prof T.N. Tandon President of the Indian National Science Academy and others. There were several invited lectures each day and many shorter papers. The discussion was enthusiastic and at times long and argumentative, though the good humour was entertaining. There were large numbers of young scientists and many are hoping to become professional palaeobotanists.

This very ambitious yet relaxed conference involved many hundreds of people. It was magnificently organised by Professor D.D. Nautiyal whose quiet determination directed the complex details with precision. Its great success is largely due to him.

# THE ROLE OF PALAEOBOTANY THROUGH THE 1990's

Recently, both in India and elsewhere, palaeobotanists have been contemplating their role in the near future. A new generation of leaders is beginning to present the subject within an environmentally concious world. The items that follow report debate at Lucknow, summaries of recent discussions between Boulter and Dilcher, and an account of a group of American palaeobotanists.

## A GROUP DISCUSSION AT LUCKNOW: THE RELEVANCE OF PALAEOBOTANY IN THE MODERN CONTEXT

Presiding over the discussion, Mr. C. P. Vohra, Director-General of the Geological Survey of India highlighted the usefulness of palaeobotanical researches in search for coal and hydrocarbons, palaeogeographical modelling and configuration of the continents including plate boundaries. Earlier, introducing the theme, B. S. Venkatachala said that palaeobotany has entered an interpretative phase, wherein increased emphasis is being laid on synergy. Relevant data from the study of modern plants, geochemistry, etc. are being usefully employed to make the science more useful.

Initiating the discussion, David Dilcher pointed out that science is expensive and that palaeobotany thus must demonstrate its potential for new discoveries but happenstances need be avoided. Researches only on major themes need be taken up. A close link should be maintained with molecular biologists and use of latest technology such as the SEM, TEM, Fluorescence Microscopy, Spectrophotometry, etc.

C.G.K. Ramanujam exhorted the palaeobotanists to avoid a defeatist view and to be more articulate and create a rapport between the laboratory, the classroom and the lay public. B. D. Sharma wanted percolation of knowledge about usefulness of plant fossils down to the masses. Henk Visscher suggested that a concerted effort be made to train young girls and boys in modern botany and give them a detailed insight into geology and chemistry to enable them to undertake palaeobotanical researches in a comprehensive mode. Al Traverse suggested that besides convincing the "powers that be" of the usefulness of paleobotany, a media blitz and displays of exhibits on the lines of Missouri Botanical Gardens will be great propoganda tolls to popularize paleobotany. M. Bonardi laid emphasis on collaborative researches. Other active participants included K. P. Jain, H. K. Maheswari. A. Sedowska, H. P. Singh and R. S. Tiwari.

The general opinion that evolved through this group discussion, that was moderated by Professor H. Y. Mohan Ram, was that palaeobotany continues to remain relevant. Most participants wanted to widen its horizons, to make it more purposeful.

## THE RELEVANCE OF PALEOBOTANY IN THE MODERN CONTEXT

This is a time in the world when all branches of science are asked to explain their purpose, evaluate their directions and justify their needs. Both industry and government agencies that support basic science, expect scientists to explain the relevance of their areas of science to questions that industry or government are willing to address and to explain where the focus of their science should be. Government and industry are also searching to learn what questions should be addressed and which areas of science should be supported. They are looking both for areas in which new initiatives should be made, areas worthy of continued support and areas which can be reduced or eliminated because they are no longer relevant to what people want to know.

Science is expensive. If we as scientists expect to continue investing tax payer or industry money into our research we must be ready and willing to demonstrate the benefits that can be expected from our work that was made possible by their investments in us. We need to develop a sense of accountability to those who are providing the funding for our research work. With this in mind it is time to focus our attention specifically upon the field of paleobotany. We need to assess where we are and provide guidance for the directions we think this field of science should go.

Paleobotany builds upon past knowledge, develops new hypotheses, provides a basis to understand past evolutionary events, past climate, past environments and basic geophysical and geochemical histories that have shaped the earth and the life on it. We stand now at a point in paleobotany that has tremendous potential for exciting new discoveries and important contributions to be made in understanding our world. Because of the number of new research tools and techniques available, the increased amount of information known now, the increased potential to find new fossil plants and examine known collections of fossil plants and new theories about the evolution of life and world history, paleobotany should have a lot of interesting new information to share with many who would find the information useful and interesting.

However rather than being a growth area of science, paleobotany has been under challenge recently. In several government labs, industry labs and university labs, many of which have long histories in paleobotanical research, we learn that they are phasing out their paleobotany programs or reducing its staff. The question, in each case, should be asked why paleobotany served that it no longer serves? What are relevant questions that need to be addressed for which paleobotany has the data, techniques and ability to provide answers. If there are no relevant questions, if paleobotany no longer provides interesting data or new answers to basic questions then it should become extinct. However we do not believe that this is the case.

We need to consider some concept driven initiatives that involve fossil plants in order to find out the

answers to the questions addressed. We must approach our science from this perspective. Our questions addressed today should not be based upon happenstance collections of a few fossils or something interesting that you happened to find by accident. Today our science must be guided by ideas of major projects with major themes of common interest to many areas of science and to human needs.

Basic questions of evolution are often animal dominated today but plants have a great deal to contribute - rates of evolution, reproduction evolution, mosaic evolution, world climate, climate history and the response of vegetation to these changes.

While we don't want to be "band wagon" driven or technologically driven - we must be well advised of the potential to our field by available technology. To earlier microcopy including light, SEM and TEM we can add image analysis. Geochemistry is important and now biochemistry and Rbcl chloroplast-DNA analysis is possible to at least 17 million years (mid-Miocene). New parameters for understanding paleoclimate are possible with new statistical analysis and the study of plant anatomy as a sensitive index to climate. Evolutionary trends often become clearer when viewed by means of careful character analysis typical of cladistic analysis. The physics of deposition combined with the ecology and diversity of plants and their postdepositional chemistry can help us understand both coal and oil formation.

In January 1948 Ghandi said after he concluded the last fast of his life - "Let peace return to all India ...If we remember that all life is one, there is no reason why we should treat one another like enemies." This same message is very true today in the field of palaeobotany. Too often one laboratory or individual in the field will be unfairly critical of the work of others. Perhaps the person or laboratory thinks this makes them superior to those they refuse to support. Quite to the contrary this lack of support tends to pull down the field of palaeobotany where ever it is expressed. Such tactics in any field of science destroys public confidence as well as government, industry and university or other public funding of the work done in our field. Therefore it should be clear that we need to pull together and work as a group to solve our own problems within palaeobotany. We need to always build up our field and those in it in a positive way rather than tear them or what they do down. At the same time we must practice our science honestly, openly and always deal with data and ideas rather than personalities.

Some more senior researchers may sometimes be intrigued by an esoteric question and encourage a student to undertake a PhD thesis on that topic. Or a research advisor may be able to attract money for a project that once complete, adds little of interest to what we know or has no potential to be continued once the PhD thesis is completed. These studies probably should not be done as theses for students because they lead nowhere once the thesis is complete and they do a disservice to the student who has no future in an esoteric area of palaeobotany in which they are trained. But these judgements can only be made by those involved. The field of paleobotany gains little by training this way or by training new students to be copies of those already in the field. Palaeobotany must evolve as a scientific discipline and that evolution should take place mainly through its students.

We must keep in mind: are we asking relevant questions and are these questions people want to know the answers to?

D. L. DILCHER, Florida, USA & M. C. BOULTER, London, UK

## THE ROLE OF PALAEOBOTANY THROUGH THE 1990's

Though the shape of global politics and power centres has changed dramatically over the last year the "End of History" postulated by some American thinkers is not to be taken seriously. Religious struggles and the destruction of the planet's natural environment are two persistent sets of problems that must be attended to urgently. It is this latter set of issues, the effects of man on the earth's environment, which palaeobotany can help. Perhaps more than any other, our subject can help understand environmental problems. For it is the study of the natural environment, before man had an effect, that yields useful data. This concerns the formation and structure of fossil fuels, soils and plant growth, extinction from overpopulation, migrations and climatic change. Such complex and enormous problems can be helped by the very modest and small number of palaeobotanists in the world in cooperation with other scientists, economists, sociologists and politicians.

Classical palaeobotany involves precise collection, examination, observation, description and interpretation. These data are the necessary components of all applications of the plant fossil record and of course must continue especially in areas of particular value. For example, palms cannot grow in regions with regular frost and studies of their distribution give important climatic information: we need to know a lot about classical palm palaeobotany.

Our knowledge of palaeobotany is contained in the scientific literature, in numerous specialised and general publications. Many are obscure, very old and very difficult to find. Much is hidden and unknown for very many specialists and most is difficult for others such as geologists and botanists to use on their own. So very large descriptive computer databases which include all necessary details are increasingly important.

Most interpretations of qualitative and quantitative scientific data relate to the original objectives of the investigation. Modern methods of age determination, microscopy and statistical analysis can easily direct the fossil plant evidence to the problems of others. The scientific approach to environmental problems must be multidisciplinary.

Palaeobotanical methods are constantly changing as new technology develops. Nucleotide base sequencing is one of the latest ways to look at some fossil

material and there are many other new techniques waiting to help test environmental and palaeobiological theories.

Expenditure on research and development by both private industries and public states has been falling now for some years. The major employers of palaeobotanists (palynologists) for many decades, the oil and coal industries, have fewer and fewer such specialists because new technologies replace classical biostratigraphic methods. Several of the world's traditional centres of palaeobotany, including famous museums, are actively reducing the numbers employed. Even as this piece is being edited in early February news comes in that several palaeontologists from British Petroleum are being made redundant.

There has been much criticism from other scientists in many countries about the quality and benefit of palaeontological work. Some palaeontologists have been accused of being "stamp collectors" and others are shown to disregard the world outside their specialism. That some governments appoint official enquiries into these allegations shows that they are based on serious evidence with serious implications.

This tragic situation is partly due to the complacency of some members of the present senior generation of palaeontologists. There is an inward attitude to the subject; psychologically, introversion and inferiority have prevented vivid applications of the subject being undertaken. It is this change in attitudes and activities that comprise the revolution that we are seeking. There is far too high a proportion of palaeobotanists today who are working with only the first of the methodologies outlined above, those of the classical subject.

So, in 1992, we are in a curious situation. At the very time that the help of palaeobotanists is needed more urgently than ever before, employment is decreasing, fewer graduates specialise in the subject and our scientific reputation and morale are at all-time lows. As well as philately (albeit involving highly skilled powers of observation, description and interpretation), we need to attach an envelope, write a letter and mail it to a real outside reader. To the real people with the real problem, the postage stamp, the envelope, the paper and the writing are all equally important to receive the message and work out the real solution.

Birbal Sahni has been described as a 'versatile' scientist and it is that quality which needs to be resurrected before the end of the century. We need to access palaeobotanical data and theories for other users within the environmental sciences. Geologists, philosophers, or whoever, must be able to understand our information and be able to use it themselves. We need to access palaeobotanical data and theories at other users within the environmental sciences. We have to tell people about what we are doing. We have to market our products to users such as school teachers, polluters, birth controllers, flood preventers, farmers, etc.. The list is endless and the tasks are important. We need to ensure the relevance of all our new research projects. They should either concern real problems outside our central subject or be of pertinent use to many others within it. And the students qualifying within the projects should be able to get a job using the skills it trained them to do.

To many it may appear to be sacrilegious, especially to some of the older generation, but we have a revolution to deal with: so let us stop calling ourselves "palaeobotanists". Instead, let us give ourselves different explicit titles according to our scientific and social aims.

If we don't accept these necessary changes very soon, ourselves, our entire group may become extinct.

M.C. BOULTER, London, UK & D.L. DILCHER, Florida, USA

## RESEARCH PRIORITIES IN PALEOBOTANY

Paleobotany, the study of fossil plants, is an interdisciplinary field contributing to both the biological and earth sciences. Research on plant fossils has emphasized systematics, comparative and functional morphology and anatomy, evolutionary biology, ecology, biodiversity and floristics, and biostratigraphy. The purpose of this document is to discuss the role of paleobotany in the nation's research agenda. The intent is to highlight principal areas of outstanding potential where continuing and increased funding can yield substantial rewards during the next decade. Since our work is, by its very nature, interdisciplinary, the long-term future of paleobotany depends upon our ability to relate our discipline to other areas of science.

There are several aspects of peleobotany that serve to distinguish it from other biological and geological disciplines. These attributes relate to aspects of the time depth, biodiversity of fossil/living floras, ecology/paleoecology, paleoclimate and what can best be described as alternatives to uniformitarianism.

Studies of fossil organisms and communities give us access to time on a range of scales that cannot be approached by even the most long-term neontological studies. With these resources, we are able to study patterns in the extended history of terrestrial systems, and examine the processes controlling those patterns, over periods of time that modern biology cannot approach. This broadened scope allows for testing rates of change and comparison. Because of the interdisciplinary nature of our discipline, paleobotanists are well-situated to examine a number of important research questions in both biology and geology, and to provide meaningful answers. In many ways. we are focusing our energies not only on enumerating the past, but on illuminating its clear relevance to the issues and problems of the day.

P. CRANE, A. KNOLL, W. CREPET, G. MAPES, W. DIMICHELE, G. ROTHWELL & E. TAYLOR (compiler).

## BIBLIOGRAPHY

New arrangements are now active to produce a Report on European Palaeobotany and Palynology for 1990 and 1991. A format and system of publication has been developed and representatives have been appointed for all countries in Europe. The bibliography is being edited in Cardiff, the capital of one of the smallest of these countries, Wales, which has yet to fight for its independence. Rumours that the bibliography will be published in the Welsh language are not true.

Write to Dr B.A. Thomas, National Museum of Wales, Cathays Park, Cardiff CF1 3NP, UK.

## NEWS OF INDIVIDUALS

**PHILLIP L. HOLMES**

left his two year post as Research Assistant at the Polytechnic of East London at Christmas 1991. As well as his specialist interests in taphonomy he was the first manager of the IOP Plant Fossil Record project and helped produce the newly designed newsletters. He begins a new career as a teacher of pc software applications.

**JOHN ANDERSON**

from Pretoria has been touring Europe to plan two palaeobotanical debates for France next year. These concern 'the elusive fossil species , as he calls them, and promise to be more constructive than previous discussions in Calgary and Berlin.

**JO PAIS AND PAULO TRINCAO**

had a wet visit to London before Christmas and were troubled by IRA bombs and forgotten aircraft. They visited Phillip Holmes on a Treaty of Windsor Exchange and together the three of them prepared IOP Circular 11: The Plant Fossil Record of Portugal. This is a set of complete Records of all the 33 plant fossil genera which are based on type species from Portugal. It serves as a model for other nations' palaeobotanists.

**H.-J. SCHWEITZER**

identified white tiger and bison from his elephant in the Bandhavgarh reserve, Madhya Pradesh, India: more comfortably than the *Eschericia coli* roaming his intestine some days earlier.

**SVEIN B. MANUM**

has been seen in some strange and distant places in November and December 1991. In central India he was photographed walking from Nagpur to Bombay. He was next reported from a village outside Dar es Salaam in Tanzania (Was the walk followed by a swim?) and finally he struggled through the dark fog at Newcastle-upon-Tyne near Scotland, trying to find his way home in Oslo. But then, Norway is where Santa Claus comes from, and perhaps he was starting work early.

**ANDREW KNOLL**

became a member of the United States National Academy of Sciences in April 1991. This institution was formed under the presidency of Abraham Lincoln to advise the government on scientific matters. It consists of about 1,500 members in science, engineering and medecine, and up to 66 new members are elected each year. There are now five palaeobotanists in the Academy: Andrews, Banks, Leopold, Dilcher and Knoll: an all-time high.

**SURESH BANDE**

specialises on fossil palms, and works at the Maharashtra Association for the Cultivation of Science, Law College Road,Poona, India. He has a collection of many unpublished theses about living palms and wants to exchange ideas and data with other palaeobotanists. Contact him quickly because he hopes to visit France for the conferences this summer and can bring along details.

## BOOK REVIEW
## WHAT'S NEW IN CLADISTICS?

**THE COMPLEAT CLADIST: A PRIMER OF PHYLOGENETIC PROCEDURES.**
**E. O. WILEY, D. SIEGEL-CAUSEY, D. R. BROOKS & V. A. FUNK. 1991. UNIVERSITY OF KANSAS MUSEUM OF NATURAL HISTORY SPECIAL PUBLICATION 19 158PP. ISBN 0-89338-035-0. US$14.95.**

If cladistics is essentially paradoxical then the discipline is well represented by this strongly recommended but far from flawless 'teach yourself cladistics' manual.

First the bad news. The title is, as the authors concede in the preface, highly misleading. The book is by no means "compleat"; such a description would better fit earlier cladistic texts unfettered by recent advances, such as Eldredge & Cracraft (1980) and Wiley (1981). Cladistics has outgrown a modestly-sized single volume Rather, Wiley et al.'s "primer" is a relatively specialised tome, devoted to the how's rather than the why's and wherefore's of cladistics. It assumes in the reader a pre-existing desire to learn.

Even within the confines of cladistic procedures, the information presented is often highly selective. This decision has simplified and clarified the text, but means that major controversies are generally relegated to footnotes (for example, transformed cladistics is acknowledged in only two sentences (p. 6) and in a passing reference to Nelson & Platnick's (1981) challenging benchmark). Such streamlining might encourage the uninitiated into believing the rather startling statement that "disagreements [among cladists] are data based, not opinion based" (p. 2). The following (equally uncompromising) sentence, "Phylogenetics, to put it crudely, is a put-up or shut-up scientific discipline", promotes per-

haps the greatest strength of cladistics -- methodological explicitness -- while simultaneously making the highly contentious assertion that cladistics is phylogenetics.

So what exactly is the book? Well, in terms of production quality, it is a good advertisement for recent advances in desk-top publishing, marred only by the bland and insubstantial cover -- presumably a concession to facilitate the commendably low price. The book is well illustrated; 95 figures and 35 tables occur in the text and a further 23 of each in answers to a series of test exercises. Self-examination is a major feature of the book, with two levels of problem-solving: 25 "quick-questions" are answered at the end of each chapter and 43 quantitative "exercises" at the end of the book. The former are underexploited beyond the first chapter; whereas the latter are valuable teaching aids; all are intended to be solved by synapse rather than microchip. Nevertheless, the book assumes (reasonably) that the reader will routinely analyse cladistic data by computer. Repeated references to PAUP 3 (Swofford 1990) and MacClade (Maddison & Maddison in press) suggest a preference for broad-based, user-friendly Macintosh software rather than the (literally) fiendishly clever IBM-based Hennig86 (Farris 1989), though this preference is not explicitly stated. A more overt link to a specific software package would have freed the authors to recommend specific commands in specific situations.

Few of the case-studies (including the self-examinations) are taken from real life; most matrices are hypothetical and uniformly binary. This could cause readers to underestimate the complexity of cladistic matrix analysis, while also providing an implicit (if unintentional) advocacy for bistate rather than multistate characters.

Most of the text is clearly written. A progressive feature is a female hypothetical investigator (eventually revealed as "Ms. Smith") who encounters other cameo performers such as the dastardly "Dr. Fenetico" (p. 117). Enboldening of many keywords in the text is helpful, though it is a poor substitute for the non-existent index; the book is evidently intended to be read from cover to cover rather than dipped into periodically.

The seven chapters are logically delimited and ordered. The first two pages of Chapter 1 ("Introduction, Terms and Concepts") are the low point of the book. The inevitable homage to Hennig (1966) in the second sentence is followed by single-paragraph dismissals of "traditional systematics" as mere inexplicit intuitive character weighting and of phenetics as "no better than traditional systematics" due to its focus on "total [more correctly 'overall'] similarity" rather than on nested sets of shared derived character states (apomorphies). Thus, the authors climb the revered Tree of Systematics, settle on the most fruit-laden branch, and then express their desire to sever it from the trunk! Fortunately, the text soon moves on to more constructive topics. Fundamental cladistic terms and concepts are defined clearly and logically throughout the book, thereby refuting accusations of terminological impenetrability that are frequently raised by anti-cladists as a smoke-screen to cover their reluctance to learn. My only quibble here is with the authors preference for describing a single attribute as a "transformation series" and a condition of that attribute as a "character" (p. 9), rather than using 'character' for the former concept and 'character state' for the latter.

Chapter 2 ("Basic Phylogenetic Techniques") cogently argues the case for seeking the "one true phylogeny" (the cladistic holy grail) using the powerful combination of parsimony and apomorphy; sadly, other phylogenetic approaches are relegated to footnotes.

Similar selectivity is evident in Chapter 3 ("Character Argumentation and Coding"), where the outgroup method of character polarisation is discussed in helpful detail but the alternatives -- the use of hypothetical ancestors, ontogenetic criteria, and relative timing of appearance in the fossil record – are given short shrift. Pros and cons of complex transformation series are well covered, but the problems of unfixed (polymorphic) and continuously variable characters in basic analytical entities (terminal taxa) are glossed over, as are the questions of whether infraspecific and supraspecific taxa should be used as terminal taxa. I would argue a conservative position that, in most cases, only (1) species and (2) fixed discontinuous characters are acceptable; this viewpoint on the benefits of using species contradicts the authors subsequent argument that 'splitting' and 'lumping' are irrelevant to cladistics (p. 91).

Chapter 4 ("Tree Building and Optimization") includes excellent summaries of different algorithms for constructing and identifying most-parsimonious trees. Coverage of character conflicts is less thorough. Two logically extreme optimisation algorithms are discussed in valuable detail but others (including user-imposed solutions) are ignored. Character compatibilty approaches are relegated to an unreferenced footnote, and the often overlooked but equally important problems posed by missing values in matrices (a topic particularly relevant to palaeontology) are discussed only in terms of vicariance biogeography (in Chapter 7).

Chapter 5 ("Tree Comparisons") covers a wide range of statistical measures designed to allow comparison of cladograms by length and/or character state distributions. Also thorough is the account of consensus techniques for summarising groups of trees, though again some of the most profound comments are confined to the footnotes (for example, frequent abuses of consensus techniques are skilfully laid bare). Sadly, trees of greater length than the most parsimonious solution(s) are not discussed; although slashed by Occam's Razor, they can still encompass interesting hypotheses of relationship and character change.

Chapter 6 ("Classification") acknowledges that many workers broadly sympathetic to the aims of cladistics balk at the required abandonment of groups that are paraphyletic (have a single ancestor but are known to exclude some of its descendants); these include palaeobotanically pivotal taxa such as the Bryophyta, Pteridophyta, Rhyniopsida, Zosterophyllopsida, Trimerophytopsida, Pteropsida, Progymnospermopsida, Gymnospermopsida, and Pteridospermales. The authors demonstrate conclusively that classifications containing para-

phyletic groups cannot be used to reconstruct the "one true phylogeny", harkening back to their introductory statement that "all monophyletic taxa [groups with a single ancestor that are believed to include all of its descendants] are equally important and paraphyletic and polyphyletic taxa are equally misleading" (p. 8). But how much does this suboptimal interchangeability between phylogeny and classification really matter? If it is dislike of paraphyletic groups that generates in many cladists prejudice against extinct taxa (e.g. Patterson 1981; Loconte & Stevenson 1990) and prompts suggestions that they should be treated as second-class citizens of the cladistic world (plesions and/or stem-species: p. 106), then it is dislike of paraphyletic groups by cladists that in turn generates dislike of cladistics by many palaeontologists (e.g. Stein & Beck 1987). One problem is that paraphyly can be defined only in terms of the present. Viewed from a historical perspective, we see that all paraphyletic groups were once monophyletic (for example, the Gymnospermopsida was monophyletic for perhaps 230 my until one particular gymnosperm gave rise to the first angiosperm). Compared with the wholesale systematic reorganisation required if paraphyletic taxa are to be eliminated from classifications, the authors debatable plea that we "make every effort to retain well known taxon names at their traditional ranks" (p. 104) seems relatively trivial.

Chapter 7 ("Coevolutionary Studies") could be retitled 'Vicariance Biogeography'. Although we are assured in a footnote that "biogeographic and coevolutionary [analytical] techniques are virtually identical" (p. 127), their biological implications are of course very different. The text ends abruptly without conclusions, instead passing directly into a bibliography of 139 references, generally well chosen but revealing a few surprising omissions.

To summarise, this excellent "primer" offers good coverage of the topics selected by the authors, but leaves the novice ignorant of the wider biological context of phylogenetics. I have already raised several of the crucial topical issues that are either omitted or relegated to footnotes. Other important areas inadequately covered include the relative merits and treatment of morphological and molecular data (e.g. Hillis & Moritz 1990) and the ethics of recoding characters following initial analysis. Little advice is given regarding the best method of collecting data prior to analysis, or to the biological and evolutionary interpretation of the "one true tree" once it has been sifted out from among the false idols. Overall, it will be interesting to compare the breadth of coverage and software specificity of Wiley et al. (1991) with those of two competing cladistic primers currently in press (by Lipscomb and Humphries et al.), and to see which changes are made in the promised future editions of Wiley et al. Ideally, Wiley et al.'s primer should be read in conjunction with other recent texts; a thematic (broadly neo-Hennigian) set would include Ridley (1986) to place cladistics in context, Funk & Brooks (1990) for an overview of the biological interpretation of cladograms, Brooks & McLennan (1991) for ecologists, Harvey & Pagel (1991) for neo-Darwinian adaptationists, and lastly Hull (1988) to explain why no practising cladist, however "compleat", can expect to lead a peaceful existence.

**Who** should read Wiley et al.? Well, anyone seriously interested in evolutionary systematics (which should mean anyone reading this newsletter). Cladistic devotees will inevitably be irritated by some of the necessarily subjective decisions made by the authors, but will prescribe this book to their students anyway. Critics of cladistics in particular would benefit from inwardly digesting the contents of the book (preferably beginning on p. 3 for the sake of their blood pressure). Although enhanced comprehension may not always lead to fervent converts, it **should** successfully eliminate some the less informed but persistent criticisms. Cladists in turn could shed a little of their collective paranoia. If your star burns brightest in the sky, why strive so hard to extinguish all other heavenly bodies?

**References**


Brooks, D. R. & McLennan, D. A. 1991. Phylogeny, ecology, and behavior: A research program in comparative biology. Chicago University Press.

Eldredge, N. & Cracraft, J. 1980. Phylogenetic patterns and the evolutionary process: Methods and theory in comparative biology. Columbia Univ. Press, N.Y.

Farris, J. S. 1989. Hennig86, version 1.6. Port Jefferson Station, New York.

Funk, V. A. & Brooks, D. R. 1990. Phylogenetic systematics as the basis of comparative biology. Smithsonian Institution Press, Washington DC.

Harvey, P. H. & Pagel, M. D. 1991. The comparative method in evolutionary biology. Oxford University Press.

Hennig, W. 1966. Phylogenetic systematics. University of Illinois Press, Urbana.

Hillis, D. M. & Moritz, C. 1990. Molecular systematics. Sinauer, Sunderland, MA.

Hull, D. L. 1988. Science as a process. Chicago University Press.

Loconte, H. & Stevenson, D. W. 1990. Cladistics of the Spermatophyta. Brittonia 42: 197-211.

Maddison, W. P. & Maddison, D. R. In press. MacClade, version 3.0. Sinauer, Sunderland, MA.

Nelson, G. & Platnick, N. I. 1981. Systematics and biogeography, cladistics and vicariance. Columbia University Press, New York.

Patterson, C. 1981. Significance of fossils in determining evolutionary relationships. Ann. Rev. Ecol. Syst. 12: 195-223.

Ridley, M. 1986. Evolution and classification: The reformation of cladism. Longman, London. Stein, W. E. & Beck, C. B. 1987. Paraphyletic groups in phylogenetic analysis: Progymnospermopsida and Prephanerogames in alternative views of seed-plant relationships. Bull. Soc. Bot. Fr. 134: 107-119.

Swofford, D. L. 1990. Phylogenetic analysis using parsimony (PAUP), v. 3.0. Ill. Nat. Hist. Surv., Urbana.

Wiley, E. O. 1981. Phylogenetics: The theory and practice of phylogenetic systematics. Wiley, New York.



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