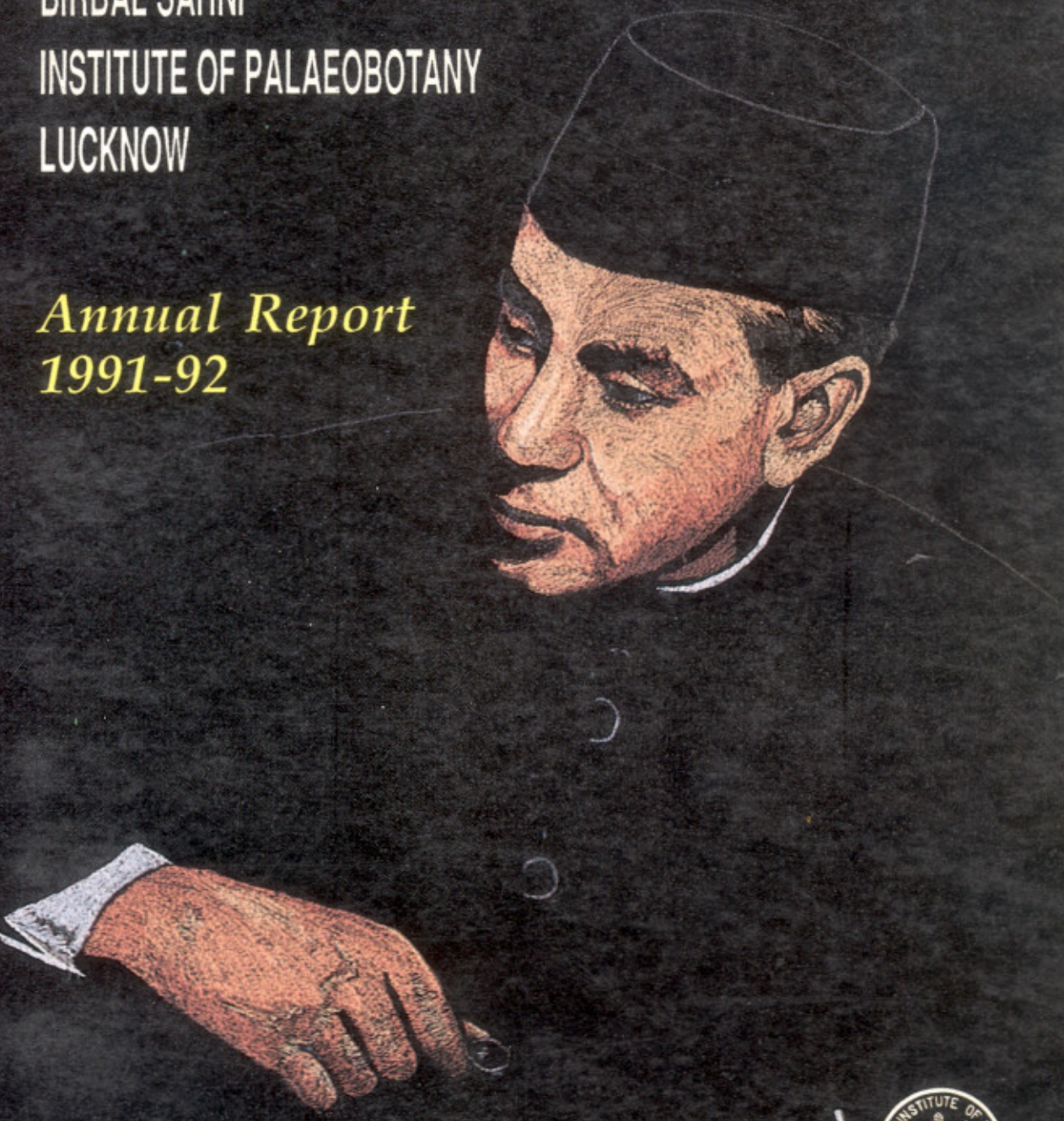
BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY LUCKNOW

Annual Report
1991-92



BIRBAL SAHNI BIRTH CENTENARY YEAR

Birbal Sahni (1891-1949)

ANNUAL REPORT
1991-92

Cover portrait : Embroidered portrait of Birbal Sahni.

Back cover photo: *Pentoxylon sahnii* Srivastava. Transverse section of a fossil gymnospermous stem showing five vascular bundles; Pentoxyleae, Early Cretaceous; Rajmahal Formation, Nipania, Santhal Parganas District, Bihar (original size of specimen, 0.66 x 0.65 cm).

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Acknowledgement

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Contents

Foreword

The Birbal Sahni Institute of Palaeobotany, a nodal centre for palaeobotanial studies, witnessed a memorable and an eventful year as it embarked on a year-long Birbal Sahni Birth Centenary Programmes. These programmes were held amidst a galaxy of distinguished scientists, and guests both from India and overseas. Several other symposia and conferences, dedicated to the memory of Professor Birbal Sahni, were held at different centres of the country.

The important academic activities held at the Institute were : a group discussion on the relevance of palaeobotany in the modern context, two symposia, viz., (i) Evolutionary Plant Biology, (ii) Four Decades of Indian Palaeobotany, and a conference--Birbal Sahni Birth Centenary Palaeobotanical Conference. During these functions several publications from the institute dedicated to Professor Sahni were released. To popularize palaeobotany in the minds of young students and general public an exhibition--Past of the Green World was organized at the Regional Science Centre, Lucknow by the Birbal Sahni Institute of Palaeobotany and National Council of Science Museums, New Delhi.

The centenary programmes provided an opportunity to have a renewed look on the life and work of Professor Birbal Sahni. He was a gifted botanist and a geologist. Professor Sahni was also blessed with an acute sense of perfection and quest for excellence. Both these qualities, amongst several others, made him to excel himself as a leader amongst the leaders. He was a great visionary. Professor Sahni's inimmitable style of work is legendary. His ideals continue to inspire his academic successors at the institute. Embodying this spirit of excitement, enthusiasm and perfection, the Birbal Sahni Institute of Palaeobotany is committed not only to uphold these values, but also to carry them forward through posterity.

Professor Sahni envisaged the development of palaeobotany in all its aspects. He felt that "...the study of fossil plants pursued with modern techniques and with due regards to its repercusions upon all the bordering sciences, already occupies a respectable place among the sciences and fully deserves the support that it is now receiving all over the world. It not only allows us glimpses into the evolutionary history of plants, but helps us more and more accurately to tell the ages of strata and thereby to explore the mineral wealth of the earth, particularly coal and oil". Professor Sahni's own research contributions are diverse like morphology, anatomy, taxonomy, phytogeography, evolutionary biology, plate tectonics, numismatics and related aspects. He worked with a single minded devotion to build an excellent school of botany. He did not live long to see the sapling he had planted to flower and bear fruit.

The main objectives of the Institute are :

— To develop palaeobotany, including palaeopalynology, in all its botanical and geological aspects;

— To constantly update the data for interaction with allied disciplines;

— To coordinate with other knowledge centres in areas of mutual interest, such as early life, exploration of fossil fuels, vegetation dynamics, climatic modelling, conservation of forests, etc; and

— Dssemination of palaeobotanical knowledge.

During the early phase the research activities of the Institute laid emphasis on composition of the Indian fossil floras, the form and structure of different taxa, and their distribution in time and space. Gradually, the research activities diversified toencompass palynological and biopetrological studies for building past history of vegetation and also to understand the genesis and palaeoecology of coal basins. Attention was also paid to phylogeny and evolution. Biostratigraphic dating of sediments, correlation of surface and subsurface sections and location of favourable areas for oil prospecting assumed added importance. Ultrastructural studies for morphotaxonomy have recently been introduced with the availability of a scanning electron microscope. Investigations on biodiagenesis have been given due importance to understand factors responsible for the degradation of dispersed organic matter. Keeping in view the importance of absolute dating of palaeobotanical and archaeological samples geochronological studies also have been taken up.

In order to attain wider interaction among scientists at the Institute as well as to increase inter-institutional collaboration, increasingly more emphasis has been laid on multidisciplinary approaches. It has also been made a guideline for future planning. The application of this concept has substantially increased the precision and accuracy of results.

Current research activities are organised under the following projects with many programmes under each projects :

1. Antiquity, radiation and evolutionary patterns of early biota
2. Gondwana coal and associated sediments : genesis, floral evolution and biostratigraphy
3. Cenozoic plant biogeography of peninsular India
4. Phytoplankton biostratigraphy of marine sedimentaries of India
5. Palaeofloristic diversification in the Himalayan region
6. Biostratigraphy and palynofacies of petroliferous basins of east India
7. Reconstruction of Quaternary vegetational patterns
8. Geochronometry of Indian rocks
9. Annotated atlases, catalogues, monographs, and books

Close interaction with other centres of learning in the country helped to achieve tangible results. Some of the research findings during the year 1991-1992 include :

Early to Middle Riphean stromatolite morphotypes *Conophyton, Stratifera undosa, Gymnosolen, Stratifera undata, Kussiella, Jacutophyton, Tungussia,* etc. have

been recorded from the Cudapah Basin. Digitate stromatolites show varied types of microstructures from filamentous to rugged nature indicating the role of coccoid and filamentous cyanobacteria in development of the respective microstructure.

The ginkgopsid and glossopterid association in the flora from the Datum fireclay quarry of Auranga Coalfield suggests similarity with the ginkgopsid rich assemblage of the Lower Permian sediments of Rajmahal Hills, Bihar. Studies on evolutionary lineages in various leaf forms and fructifications of glossopterid indicate development of glossopterid group of plants along two different lineages. A new tripinnately branched fern-like foliage *Maheshwariopteris digitata* is reported from shales associated with Lalmatia coal seam in the Hura Coalfield, Rajmahal Basin. Megafloristic investigation of Khutnashi assemblage has revealed that it is older than Gilamari and Chunakhal floras. It resembles the flora of 2nd intertrappean bed at Bhutahapahar, Rajmahal Hills. The Mamal Formation, of the Panjal Group in Kashmir has been redefined.

Palynological analysis of bore-hole SPB-18 from Middle Pali sequence near Burhar area, Sohagpur Coalfield shows a Late Permian palynoassemblage which reveals a closer relation with the assemblage from Raniganj Formation. Presence of *Leiosphaeridia* in few samples indicates a probable marine influence in this area. The palynological analysis of samples from 450 m deep bore-hole TCW-25 in the northern part of the Talcher Coalfield has revealed the presence of three distinct palynoassemblages based on FADs, LADs and pattern of species distribution. They are comparable to the marker Assemblage zones identified in Damodar-Rajmahal area. The lowermost assemblage - *Parasaccites korbaensis* Assemblage Zone represents the Upper Talchir, and *Scheuringipollenites barakarensis* Assemblage Zone and *Faunipollenites varius* Assemblage Zone represent Lower and Upper Barakar, respectively. Based on evolutionary changes in the morphology of the pollen groups, their FADs and LADs, eleven Biohorizons and ten Inverval zones have been identified through the span of Gondwana sequence. Analysis of data on Permo-Triassic boundary has revealed that there had been no mass extinction at this boundary. It was an episode of high turnover. The climatic changes and alteration in geomorphology due to new tectonic-setup at the boundary were responsible for a major shift in evolution of palynomorphs. Eight palynoevents have been identified along the latest Permian-earliest Triassic transition and they have been tagged with comparable palynoevents in various basins of the peninsula. Palynofloral patterns studied in bore-holes GS-1,2,3 and 4 from Sattupalli area have shown the presence of Late Permian palynoassemblages. The assemblage is characterised by the presence of striate disaccates.

Microconstituents of the coals from Lalmatia colliery have been estimated to understand the ratios between various reactive and non- reactive contents. It has been observed that the coals are rich in trimacerite and of (mixed) type, indicating inferior quality for selective utilization. A detailed megascopic study of various coal bands indicates that the Talchir coals are mostly composed of hard dull bands. They also soil the finger due to the presence of fusion at various levels, suggesting fluctuating hydrological conditions in the basin. First authentic record of *Botryococcus* alga (alginite) from Singrauli coals has been made. A scheme for indexing spontaneous combustion susceptibility of Indian coals and lignites has been pro-

posed, which incorporates most of physical, chemical and petrological factors recognized to have induced spontaneous heating process.

A rich assemblage of leaf-impressions from Arjun Khola were identified and assigned to the genera, viz., *Aglaia, Alstonia, Alsodeia, Anacolosa, Artocarpus, Bridelia, Diospyros, Dracontomelum, Euphoria, Evodea, Filicium, Garcinia, Grewia, Gynocardia, Lagerstroemia, Lepionurus, Miliusa, Millettia, Phyllanthus, Unona, Vitis*, etc. of the dicotyledonous families. Two fabaceous fruits have been identified with those of *Butea superba* and *Sindora velutina*. Fossil woods of *Dipterocarpus* (Dipterocarpaceae), *Canarium* (Burseraceae), *Euphoria*, (Sapindaceae), *Julbernardia*, (Fabaceae), *Barringtonia* (Lecythidaceae), *Madhuca* and *Manilkara* (Sapotaceae) have been identified from Namsang beds near Deomali, Arunachal Pradesh. Of these, *Julbernardia* is an African genus and suggests phytogeographical linkage of Africa with the Indian subcontinent during Neogene. A leaf of *Mangifera* recovered from the Upper Palaeocene sediments near Laitryngew, Khasi Hills supports the view that the genus *Mangifera* appeared first in the Upper Palaeocene in the Indian subcontinent. A fossil wood similar to *Grewia* (Tiliaceae) with tile cells and radial gum canals has been identified. Woods similar to African genera *Trichilia* (Meliaceae), *Blighia* (Sapindaceae) and *Erythroxylon* (Erythroxylaceae) were also identified from Nawargaon. The genus *Chlorophora* of the family Moraceae, a typical African genus, has been recorded for the first time in the Indian Neogene flora of western India.

Morphotaxonomic study of the palynoflora obtained from the Neyveli Mine-I has been partly done. The assemblage is correlatable to the upper zone of the Neyveli Formation, viz., *Trilatiporites sellingii* Cenozone of Jayamkondacholapuram area. Latest Maastrichtian, low latitude calcareous nannoplankton marker species *Micula prinsii* has been reported in this section, terminating in stratigraphic order at the base of the clay layer. An integrated scheme, incorporating dinoflagellate cyst, calcareous nannoplankton, planktonic foraminifera and geochemical data, is proposed from the Langpar Formation exposed along the western bank of the Um Sohrengkew River, on the southern slope of Cherrapunji Plateau, Khasi Hills. Three new species of the genus *Trichodinium*, viz., *T. minutum, T. brevispinosum, T. jainii* and a new combination *Acanthaulax magnum* (Jain) are described from the Grey Shale Member of Dalmiapuram Formation (Lower Albian) together with a new genus *Ectodinium* and a new species, *Callaiosphaeridium tapeum* from Trichinopoly Formation (Turonian-Santonian) of Cauvery Basin. A rich dinoflagellate cyst and acritarch assemblage has been recovered from selected core and cutting samples of a 764.9 meter deep bore hole drilled in Puduvoyal, Chingleput District, Palar Basin, southern India and assigned an Early Cretaceous (Hauterivian-Barremian) age. Middle Miocene diatoms from the 75 meter thick South Coast Cliff Section of Kamorta Island have been detailed out. Palynoassemblages of four measured sections, viz., Dali, Khargala, Sair and Kalakot of Jammu depict their close similarity with those recorded from Kalka-Simla and Banethi-Bagthan areas of Himachal Pradesh. Based on this observation a possible sea-link between these two widely separated areas is envisaged during Eocene time. Palynological investigation on the Cretaceous-Tertiary transition in the bore hole core no. CM5 drilled in the Atlantic ocean off Senegal Coast, West Africa suggests a major change in floral composition marking K/T boundary, characterized by the disappearance of

Maastrichtian marker taxa and presence of a fern spike.

Pollen analytical investigation of 12 glacier dust samples from Dunagiri Glacier, Garhwal Himalaya revealed presence of broad-leaved *Quercus, Betula, Alnus, Carpinus, Ulmus* and *Celtis, Pinus, Abies, Picea* and *Cedrus* in low values. Poaceae, alongwith Cheno/Ams, Ranunculaceae, Asteraceae, Rosaceae, etc. are the prominent herbaceous elements. Palynology of 4.30 meter deep profile dated 3800 years B.P. from Rambha on south east flank of Chilka Lake enabled to divide whole time span into two phases, between 3,800 - 2,000 yrs. B.P. records the existence of well developed core-mangrove forest and from 2,000 yrs. B.P. till date records the overall degradation of core- mangrove vis-a-vis uprise in the values of hinterland taxa. Tree samples of *Cedrus deodara* from Harshil in Uttarkashi have been dated and a 745 yrs long (1243-1987) chronology has been prepared. Another chronology of *Pinus wallichiana* growing in sub-alpine mesic site in Gangotri ranges from 1694 - 1988 AD. The occurrence of hemp/bhang (*Cannabis sativa*) charcoals from Neolithic-Chalcolithic site at Senuwar, Rohtas, Bihar (Ca 2000-600 B.C.) suggests the exploitation of narcotic properties of this plant. The occurrence of pomegranate (*Punica granatum*) from Rohira, Punjab (ca. 2000 - 1700 B.C.) suggests the cultivation of pomegranate in the orchard husbandry of Harappans.

A core of lake deposit from Orissa relating to the study on the evolution of mangrove vegetation was dated to 3470 ± 170 yrs at a depth of 3.5 m. A carbonaceous ocean-sediment core from Andaman Sea was dated using the organic fraction of the sediment. The C-14 age at a depth of 33 cm is 11850 yrs and at 1.0 m it is 21000 yrs. Charcoal samples relating to archaeological studies from Mesolithic culture of Kerala has been dated for the first time at 2850 ± 80 yrs B.P. Petrified wood samples collected from Deccan Intertrappean beds have been dated using the Auto Scan system; the F-T ages of petrified woods from different localities near Shahpura in Mandla district, Madhya Pradesh are Ghghua: 57 ± 8 ma, Umaria: 56± 7 ma, Silther: 53 ± 9 ma, Parapani: 54 ± 7 ma and Mehdwani: 58 ± 8 ma.

The Research Programming and Planning Group consisting of Drs H.P. Singh, K.P. Jain, H.K. Maheshwari and R.S. Tiwari helped to prepare this document. Dr A Rajanikanth rendered considerable help in bringing out this report. The printing of this report has been looked after by Dr J.S. Antal.

(B.S. VENKATACHALA)

Director

1991-92
BIRBAL SAHNI
BIRTH CENTENARY

Birbal Sahni Birth Centenary Celebrations

The inaugural function was held at the Sahni Institute on November 14, 1991 amidst a galaxy of distinguished guests and scientists, both from India and overseas. His Excellency Sri B. Satyanarayan Reddy, Governor of Uttar Pradesh was the Chief Guest. Sri Reddy reminded us that Birbal Sahni belonged to that generation of individuals who lived for ideals and worked with intense passion and devotion to realize them. Professor H.Y. Mohan Ram, in his welcome speech, pointed out that Professor Birbal Sahni's interests were wide and interdisciplinary. He left behind a rich legacy of a scientific fervor which should ever remain a matter of pride for the nation. Inaugurating the birth centenary programmes, Professor S.Z. Qasim, Member Planning Commission said that in remembering Professor Birbal Sahni we were honouring science and a great visionary of science. Dr B.P. Radhakrishna, Chief Editor, Geological Society and Dr A.P. Mitra, former Director-General of the CSIR paid glowing tributes to Professor Sahni. Delivering the Birth Centenary Lecture, Professor T.S. Sadasivan, a former Chairman, Governing Body, Birbal Sahni Institute of Palaeobotany, who had the honour to be a student of Professor Sahni, said that the futuristic vision and interdisciplinary direction envisioned by Professor Sahni had a great bearing on the present day science. Dr Harsh K. Gupta, Adviser, Department of Science and Technology released "Indian Gondwana", a Volume dedicated to Professor Birbal Sahni, published by the Geological Society of India.

Floral tributes *(Pushpanjali)* to Professor Sahni at his "*Samadhi*".

Dr B. S. Venkatachala welcoming the Chief Guest, Shri B. Satyanarayan Reddy, Governor of Uttar Pradesh.

To commemorate this event, a commemorative Plaque was unveiled by Professor T.S. Sadasivan in the Botany Department, Lucknow University, the birth place of the Institute of Palaeobotany. A sapling of a legendary scholars tree—*Alstonia scholaris* R. Br., was also planted in the campus of the Institute.

Professor T.S. Sadasivan delivering the Memorial Lecture.

A tablet commemorating the foundation of Birbal Sahni Institute of Palaeobotany at the Department of Botany, University of Lucknow.

The focal points of academic activities include :

Exhibition — Past of the Green World — A tribute to Birbal Sahni

The exhibition was installed by Regional Science Centre, Lucknow. Research for the exhibition was done by the Sahni Institute. We also provided material and logistic support.

Professor S. Z. Qasim planting a sapling of *Alstonia scholaris* in the Institute campus.

Dr A. P. Mitra opening the Exhibition, Past of the Green World — A tribute to Birbal Sahni at the Regional Science Centre, Lucknow.

Dr A.P. Mitra, Chairman of National Council of Science Museums, New Delhi inaugurated the exhibition. The object of the exhibition has been to create an awareness about the importance of Palaeobotany amongst the lay public, specially

Visitors at the exhibition —,Past of the Green World.

Professor Birbal Sahni's Room — recreated.

the young ones. In the section devoted to the life and works of Professor Birbal Sahni, Professor Sahni's office has been recreated with his original belongings . The main section has seventeen panels and a central display. The panels exhibit origin and evolution of life, early land plants, coal-forming vegetation, gymnosperm and angiosperm diversification, Himalayan orogeny, coastal vegetation, desertification, palaeobotany in relation to coal and oil, radiometric dating of rocks, geological clock, etc.

Group discussion on Relevance of Palaeobotany in modern contex

A Group Discussion on "Relevance of Palaeobotany in modern context" was held on 15 November, 1991. Sri C.P. Vohra, Director- General of the Geological Survey of India presided over the discussion which was moderated by Professor H.Y. Mohan Ram. The main conclusions derived through this Group Discussion were (i) science is expensive and hence palaeobotanists must demonstrate and prove benefits that accrue through the study of fossil plants, (ii) palaeobotany has tremendous potential for new discoveries but happenstances need be avoided and researches only on major themes need be taken up, (iii) a close link should be maintained with molecular biologists and use of latest technology such as, the SEM, TEM, Fluorescence Microscopy, Spectrophotometry, etc. can and should be made, (iv) a rapport should be established between the laboratory, the classroom and the lay public, (v) 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 undertake palProfessor Birbal Sahni's Room — recreated.aeobotanical researches in a comprehensive mode, (vi) a Media Blitz and displays of exhibits on the lines of the exhibition and displays put up by the

Delegates of the Symposium — Evolutionary Plant Biology.

Missouri Botanical Gardens will greatly help to popularize palaeobotany.

The general opinion that evolved through this group discussion was that palaeobotany continues to remain relevant, only its horizons need be widened to make it more purposeful.

Symposium on Evolutionary Plant Biology

A symposium on Evolutionary Plant Biology was held on November 16- 17, 1991. The Symposium inaugurated by Professor Alfred Traverse of Pennsylvania State University, had an International participation. Professor Traverse remarked that pal- aeobotanists are sort of historians. Study of plant fossils in co-ordination with other sciences, such as organic geochemistry, animal/plant interaction, etc., can give us a new insight into evolutionary biology. Twenty- three oral presentations were made at this symposium. As of today, typescripts of 19 papers have already been received. Nine more are promised, that include papers that were invited but could not be presented. Editing of the papers is in progress. We hope to release the volume on 14 November 1992.

Symposium on Four Decades of Indian Palaeobotany

The Symposium was organized with the objective to critically analyse and evaluate palaeobotanical and palynological data generated during the period 1950-1990 and to prepare state-of-the-art reports. These reports may help in designing future plans of research at the Institute.

Delegates of the Symposium — Four Decades of Indian Palaeobotany.

The two-day Symposium was inaugurated on 18 November 1991 by Professor C.G.K. Ramanujam of Osmania University, Hyderabad. Of the 33 invited papers, 27 were presented and discussed. Manuscripts of most papers have already been turned in. These will be gone through by the resource-persons. It is hoped that the Proceeding Volume of this Symposium, too, will be released on 14 November, 1992.

Birbal Sahni Birth Centenary Palaeobotanical Conference

A three-day Palaeobotanical Conference jointly convened by the Palaeobotanical Society and the Birbal Sahni Institute of Palaeobotany was inaugurated by Professor David L. Dilcher on 20 November, 1992.

154 research papers were contributed. Over 200 delegates representing U.S.A., Argentina, Italy, U.K., Hungary, Poland, France, Madagascar, China, Japan and Australia and 35 institutions in India participated in the conference.

During the Birth Centennial week, a number of memorial and special lectures were delivered. A special issue containing selected papers will be published soon.

Memorial and Special Lectures

36th Sir A.C. Seward Memorial Lecture — "History of International Co-operation in Palynology" by Professor James E. Canright of Arizona State University.

37th Sir A.C. Seward Memorial Lecture — "Link with the past in the plant world : cuticles as recorders of diversity, kerogen formation and palaeo-atmospheric CO_2" by Professor Henk Visscher of University of Utrecht.

The Palaeobotanical Society International Medal Award Lecture for 1989 — "The early history of land plants —revisited" by Professor Harlan P. Banks of Cornell University, U.S.A.

The Palaeobotanical Society International Medal Award Lecture 1991 — "Sporopollenin and chitin—'non-biodegradable plastics' trace major biochemical events of the geological past" by Professor Alfred Traverse of the Pennsylvania State University.

21st Professor Birbal Sahni Memorial Lecture on "The importance of plant/animal interactions in the origin and subsequent evolution of flowering plants" by Professor David L. Dilcher.

Publications released during the Celebrations

Indian Gondwana : Birbal Sahni Volume — Edited by B.S. Venkatachala & H. K. Maheshwari; Memoir 21, Geological Society of India, Bangalore. Includes selected bench-mark papers on the Indian Gondwana.

Extinct Plants Evolution and Earth's History — Edited by B.S Venkatachala, C.V. Subramanian & S. Ramaseshan , published by the Current Science Association, Indian Academy of Sciences, Bangalore.

A Catalogue of Fossil Plants from India in 11 fascicules, covering data for the period 1971-1989.

Part-1	:	*Archaean & Proterozoic Palaeobiology* — Manoj Shukla & Rajendra Bansal
Part-2	:	*Palaeozoic & Mesozoic Megafossils* — Shaila Chandra & Rajni Tewari
Part-3	:	*A. Palaeozoic & Mesozoic spores & pollen* —Suresh C. Srivastava
	:	*B. Palaeozoic & Mesozoic megaspores* — Rajni Tewari
Part-4	:	*Cenozoic (Tertiary) Megafossils* — Rashmi Srivastava
Part-5	:	*Cenozoic (Tertiary) A Spores & Pollen B.Fungi* — R.K. Saxena
Part-6	:	*Cenozoic(Quaternary) Palynology & Palaeobotany* — *M.S. Chauhan*
Part-7	:	*Dinoflagellates* — Khowaja-Ateequzzaman
Part-8	:	*Diatoms and Silicoflagellates* — Anil Chandra
Part-9	:	*Nannoplankton* — Jyotsana Rai
Part-10	:	*Calcareous Algae* — A. Rajanikanth
Part-11	:	*Archaeobotany* — Chanchala

BSIP family at Sahni Centenary Celebrations.

Research papers of Birbal Sahni and of Birbal Sahni Institute of Palaeobotany : a catalogue — J.S. Guleria

Type and Figured specimens at the Repository : an inventory: Part- 1, 1991 — G.P. Srivastava

Birbal Sahni Institute of Palaeobotany, Lucknow —a Brochure

Workshop on Major Stratigraphic Boundaries

A workshop on "Major Stratigraphic Boundaries" was held from November 27-29, 1991, at the Post-Graduate Department of Geology, Jammu University. This workshop was sponsored by the Department of Science and Technology, Government of India. Professor S.K. Shah of Jammu University and Professor Ashok Sahni of Panjab University paid rich tributes to Professor Birbal Sahni for his contribution to Geology, Botany and Palaeobotany.

The participants included a large number of scientists from various organizations of the country — such as, I.I.T., Bombay; GSI, Bangalore, Hyderabad, Nagpur and Calcutta; Wadia Institute of Himalayan Geology, Dehradun; Birbal Sahni Institute of Palaeobotany, Lucknow; D.S.T., New Delhi and Universities of Udhampur, Lucknow, Punjab and Jammu. Publications released during Birbal Sahni Centenary Celebrations in November, 1991 at BSIP were also displayed.

Birbal Sahni Birth Centenary Symposium on the Siwalik Basin

A symposium on the Siwalik Basin was organised by Wadia Institute of Himalayan Geology, Dehradun from December 5-6, 1991. Mr C.P. Vohra, Director-

General, Geological Survey of India inaugurated the symposium which was attended by delegates from India and overseas.

During the two days technical sessions, research papers dealing with various aspects of Siwalik sediments occurring in India, Nepal and Pakistan were discussed. An exhibition on life and work of Professor Birbal Sahni was mounted. Publications released during Birbal Sahni Centenary Celebrations in November 1991 at BSIP were displayed.

Botanical Conference dedicated to the memory of Birbal Sahni

The 14th All India Botanical Conference hosted by the Department of Botany, Lucknow University was dedicated to Professor Birbal Sahni. The three-day Conference was inaugurated at the Birbal Sahni Institute by Professor H.K. Awasthi, Vice-Chancellor of Lucknow University on 28 December, 1991. The conference was attended by a large number of botanists of the country.

Research

Projects and Programmes

PROJECT 1 : ANTIQUITY, RADIATION AND EVOLUTIONARY PATTERNS OF EARLY LIFE

Programme 1.1 : **Palaeobiology of Vindhyan Basin**

Objective : *To identify metaphyte and metazoan body fossils, ichnofossils and their relics from the Proterozoic succession and their evolution and diversification*

: *To identify organosedimentary structures found in association of metaphytes and metazoans and to decipher environmental conditions*

: *To determine the significance of metaphytes and metazoans in biostratigraphy*

Observations on the organic-walled microfossils comprising acritarchs, algae and cf. vendotaenid in the Ganurgarh Shale exposed near Mid-Ghat railway station have been completed. The O.W.M. compare with the known Vendian assemblages due to the presence of large sized acritarchs, viz., *Leiosphaeridia*, *Orygmatosphaeridium*, *Vavososphaeridium*, *Nucellosphaeridium* and *Cymatiosphaeroides*; tubular cyanobacterial forms, viz., *Eomycetopsis, Polythrichoides, Tubulosa* and cf. *Vendotaenid*.

Studied organic-walled microfossils both in thin section and macerated residue preparations from the Bijawar Group and Vindhyan Supergroup, viz., Ganurgarh Shale, Nagod Limestone, Sirbu Shale and Maihar Sandstone formations exposed around Damoh-Narsingarh. Interesting organic-walled microfossils dominated by the Vendian marker *Bavlinella* are recorded from the Nagod Limestone Formation. The Sirbu Shale shows the presence of acritarch with decomposed walls and tubular filaments.

Studied macroscopic biota, in the Rohtas Formation. A branched filamentous form possibly ?alga is recorded. Besides, further observations are made on *Amjohrea* indicating its affinity with ?Chlorophycean remain.

P.K. Maithy and R. Babu

Prepared samples of Suket Shale to study the metaphyte and metazoan evidences.

K.L. Meena

Programme 1.2 : **Palaeobiology of the Proterozoic sediments in Cuddapah, Kaladgi and Bhima- basins**

Objective : *To record distribution of Precambrian microfossils*

in Proterozoic succession of Cuddapah, Kaladgi and Bhima basins

Serial sectioning of stromatolites and thin sectioning of associated chert from Cuddapah Basin was completed. Preliminary identification of stromatolite morphotypes - morphogeneric and morphospecific - based on three dimensional reconstruction revealed the presence of *Conophyton*, *Stratifera undosa, Gymnosolen, Stratifera undata, Kussiella, Jacutophyton, Tungussia*, etc. Most of these forms are characteristic of Early to Middle Riphean age. Thin section study of associated cherts revealed low diversity of microbial assemblage, which is mainly dominated by unicellular coccoides with still low frequency of filamentous hollow sheaths comparable to *Eomycetopsis* sp. It has also been noted that most of stromatolites are silicified which is a secondary phenomenon. Microstructures are typical tussocky in nature. Digitate stromatolites show varied types of microstructures from filamentous to rugged nature indicating the role of coccoid and filamentous cyanobacteria in development of the respective microstructure.

Samples of Kaladgi stromatolites were also sectioned. The silicified stromatolites are mostly digitate in nature and may be termed microstromatolites. Their microstructure studies indicate that they were mainly formed by filamentous forms.

Manoj Shukla and Mukund Sharma

PROJECT 2 : GONDWANA COAL AND ASSOCIATED SEDMENTS : GENESIS, FLORAL EVOLUTION AND BIOSTRATIGRAPHY

Programme 2.1 : **Morphotaxonomy, floristics, evolution and stratigraphic significance of plant fossils in Koel Valley and Jharia Coalfields**

Objective : *To collect plant fossils from different localities*

: *To study morphotaxonomy, evolution, stratigraphical distribution of the flora and its significance*

: *To decipher ecological and climatological regimes*

Investigation of plant fossils from Datum fireclay quarry of Auranga Coalfield was carried out. The assemblage is represented by species of *Glossopteris, Noeggerathiopsis, Neomariopteris, Psygmophyllum, Ginkgoites* and *Saportaea*. The ginkgopsid and glossopterid association in the flora suggests similarity with the ginkgopsid rich assemblage of the Lower Permian sediments of Rajmahal Hills, Bihar. Plant fossils of Daltonganj and Hutar coalfields available in the museum were studied. The fossils are represented by species of *Gangamopteris, Glossopteris, Noeggerathiopsis* and *Vertebraria*. The assemblages are comparable with the flora of Karharbari Formation.

A. K. Srivastava

Evolutionary lineages in various leaf forms and fructifications of glossopterid were critically examined. The study indicates development of glossopterid group

of plants along two different lineages.

H.K. Maheshwari and A.K. Srivastava

Morphographical description and studies of various *Glossopteris* species, viz., *G. angustifolia, G. formosa, G. shailae, G. retusa, G. browniana, G. communis* and *G. gondwanensis* from the Raniganj Formation of Bhatdih Colliery of Jharia Coalfield were completed. Cuticles of some fructifications which apparently looked like the genus *Plumsteadiostrobus* were prepared by transfer technique and studied under SEM. These showed apart from cellular structures regular circular pits on which the seeds might have been attached, some seed-like structures (which could not be observed under low power binoculars), show active bacterial degradation and a crystalline mass. Cuticular pulls of *Glossopteris gondwanensis* found closely associated with the fructifications, were studied under SEM.

Rajni Tewari

Programme 2.2 : **Comparative morphology, floristics, biostratigraphy and palaeoecology of Permian Gondwana**

Buriadia heterophylla (Feistmantel) Seward & Sahni from Talchir Coalfield, Orissa.

Euryphyllum whittianum Feistmantel from Talchir Coalfield, Orissa.

plants in Son-Mahanadi Graben

Objective : *To study morphotaxonomy, floristics, biostratigraphy and palaeoclimate of the Permian Gondwana formations in the area*

: *To study fructifications in order to understand the evolutionary aspect of Pteridophytes and Gymnosperms*

: *To establish palaeobotanical succession in the Singrauli Coalfield area*

A plant fossil assemblage from Gopal Prasad locality in Talcher Coalfield was studied. The assemblage includes *Glossopteris karanpuraensis, G. communis, G. subtili, G. indica, G. retifera, G. gigas, G. leptoneura, G. arberi, G.tenuifolia, G.*

conspicua, G. nimishea, G. vulgaris, G. browniana, Dichotomopteris sp., *Neomariopteris hughesii* and *Schizoneura gondwanensis*. Plant fossils indicate Late Permian age.

Shaila Chandra and K. J. Singh

Programme 2.3 : **Evolutionary perspective of megafloral diversification in the Nidpur plant bed**

Objective : *To carry out fine resolution morphotaxonomical investigations and decipher affinities and interrelation of different plant organs*

: *To attempt whole plant reconstructions*

Two genera, viz., *Pterophyllum* and *Pseudoctenis* have been studied for their morphographic characters. The specimens of *Rhabdotaenia* are also being studied in order to find out its precise affiliations.

Fertile organs have also been studied and among these the finding of the megasporophyll is quite significant because it shows its affinity with the Cycadales.

Shyam C. Srivastava and S.R. Manik

Programme 2.4 : **Palynostratigraphy of Gondwana Sequence in Son-Mahanadi Graben**

Objective : *To systematically collect samples and to analyse palynoassemblages with a view to interpret floral changes, boundary transitions and age determination at a finer level in the intraformational succession of Johilla Coalfield*

: *To identify Talcher/Athgarh relationship in the Talcher Coalfield and Athgarh Basin*

Palynological analysis of bore-hole SPB-18 from Middle Pali sequence near Burhar area, Sohagpur Coalfield shows a Late Permian palynoassemblage which reveals a closer relation with the assemblage from Raniganj Formation. Presence of *Leiosphaeridia* in few samples indicates a probable marine influence in this area. So far, the samples from Lower Pali proved to be barren. Processing of the samples from bore-hole SPB-14 has been completed.

Ram-Awatar

The palynological analysis of samples from 450 m deep bore-hole TCW-25 in the northern part of the Talcher Coalfield has revealed the presence of three distinct palynoassemblages based on FADs, LADs and pattern of species distribution. They are comparable to the Marker Assemblage-Zones identified in Damodar-Rajmahal area. The lowermost assemblage —*Parasaccites korbaensis* Assemblage-Zone represents the Upper Talchir, and *Scheuringipollenites barakarensis* Assemblage-Zone and *Faunipollenites varius* Assemblage-Zone represent Lower and Upper Barakar, respectively. The palynological observations for climatically sensitive morphological characters reveal a relatively cooler climate

in Mahanadi Valley in comparison to Damodar Valley during Upper Barakar.

Archana Tripathi

Processing of 25 samples of bore hole TCC-20 of Talcher Coalfield, Orissa was done and slides of productive samples were prepared.

Studies of the palynological assemblage from bore hole TCW-24 of Talcher Coalfield, Orissa have revealed the presence of Barakar, Barren Measure and Raniganj sequence in this bore hole. The assemblage equivalent to Barakar assemblage of Damuda Series contains genera like *Faunipollenites, Striatites, Scheuringipollenites, Paravesicaspora, Striatopodocarpites*, etc. with a prominence of the genus *Scheuringipollenites*. This assemblage was encountered at 265.45 m depth onwards upto its last depth (532.30 m). The Barren Measure type of assemblage was found at 223 m depth with a prominence of *Scheuringipollenites-Striatopodocarpites*. The palynological assemblage found upto 200.80 m depth is characterized by *Striatites, Hindipollenites, Verticipollenites, Striatopodocarpites* along with trilete genera like *Cyclogranisporites, Lophotriletes, Horriditriletes* and plicate forms. This assemblage has resemblance with Raniganj type of assemblage of Damuda Series.

B.N. Jana

Palynological analysis of samples from bore-hole IBH-6 from Ib- River Coalfield has suggested the presence of assemblages equitable to Barakar , Kulti and Raniganj formations of the Damodar Graben. Similar studies in bore-hole RGP-7 from Raigarh Coalfield have revealed the presence of Kulti and Raniganj palynofloras in this area.

K.L. Meena

Programme 2.5 : **Cuticles of Gondwana gymnosperms and ultrastructure of megaspores, seeds and in-situ pollen/spores**

Objective : *To make extensive and exhaustive collections of leaf specimens of Gondwana gymnosperms, study their morphology, make cuticular preparations, establish relationship between morphography and epidermal features. Objectively identify each species, based on cuticles of extant gymnosperms, ultrastructure of in-situ pollen/spores for fine resolution taxonomy and affinities*

A new tripinnately branched fern-like foliage is reported from shales associated with Lalmatia Coal seam in the Hura Coalfield, Rajmahal Basin. The foliar shoot is thick and articulate. The ramification of foliage into flabelliform pinnules of unequal size is seen at the nodes. The foliage is unlike any one known so far from the Gondwana. It, however, does superficially resemble *Dactylophyllum*

Maheshwariopteris digitata gen. et sp. nov. from Early Permian of Rajmahal Hills.

digitata fronds reported from Australia. In the absence of knowledge about fertile structures, its exact affinities remain uncertain. The taxon is named as *Maheshwariopteris digitata* gen. et sp. nov.

Usha Bajpai

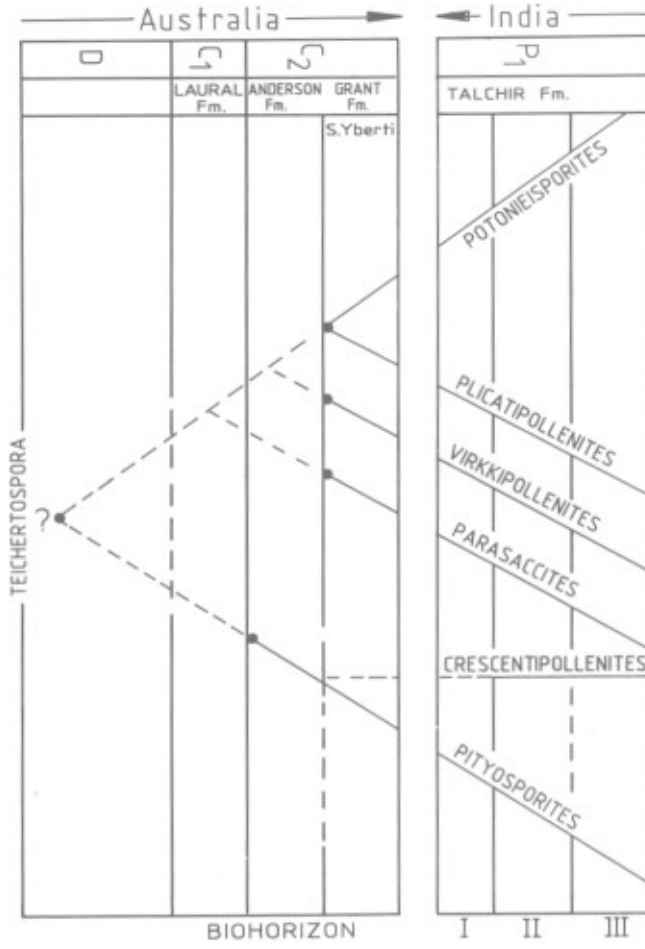
Programme 2.6 : **Pattern of evolving palynofloras through Gondwana Sequence in Damodar Graben**

Objective : *To search for characters in dispersed spores and pollen useful for determining major changes in patterns of morphologies*

Based on evolutionary changes in the morphology of the pollen groups, their FADs and LADs, eleven Biohorizons and ten Interval- Zones have been identified through the span of Gondwana Sequence. For this purpose simple character-state analysis was done. By extrapolation of lineages, four unique monosaccate and one simple disaccate organizations could be identified to have their origin in the Early Carboniferous stock of Australia. The relation cladistics has reinforced the validity of the proposed biohorizons. The cladograms and stratograms together depict the maximum radiation at the lower Upper Talchir and at P/T boundary.

Vijaya & R.S. Tiwari

Analysis of data on Permo-Triassic boundary has revealed that there had been no mass extinction at this boundary. It was an episode of high turnover. The climatic changes and alteration in geomorphology due to new tectonic-setup at the boundary were responsible for a major shift in evolution of palynomorphs. Eight palynoevents have been identified along the latest Permian-earliest Triassic transition and they have been tagged with comparable palynoevents in various basins



Cladogram showing relationship of stock morphos based on congruence of parsimonically compatible characterstates.

of the peninsula.

R.S. Tiwari & Vijaya

The palynological succession in the bore-core PGD-2 (Panagarh area, West Bengal) is being analysed for dating of strata in this new coal-bearing sub-basin.

Vijaya

Programme 2.7 : **Composition, relationship and age of the mega-fossil flora of Rajmahal Formation**

Objective : *To study morphotaxonomy of fossils collected from various intertrappean beds*

: *To work out composition of flora in order to arrange different plant beds in a chronological sequence and to correlate with other coeval floras*

: *To reconstruct whole plants based on comparative studies of different plant organs*

Megafloristic investigation of Khutnashi assemblage has revealed the presence of *Ptilophyllum cutchense, Pterophyllum distans*, *Anomozamites* sp., *Pagiophyllum* sp. and *Elatocladus tenerrimus*. Pteridophytes are absent and cycadophytes are frequent than conifers. This floral assemblage is older than Gilamari and Chunakhal floras. It resembles the flora of 2nd Intertrappean bed at Bhutahapahar, Rajmahal Hills.

Jayasri Banerji

Pteridophytic plant fossils, viz., *Gleichenites gleichenoides, Todites indicus, Marattiopsis macrocarpa* and some cycadophytic remains, e.g., *Pterophyllum distans* and *Ptilophyllum cutchense* are identified. Detailed morphotaxonomic study of these taxas has been completed. Updated fossil flora of Brindaban.

Neeru Prakash

Programme 2.8 : **Palynological diversity and palaeoclimate through Gondwana Sequence in Rajmahal Basin**

Objective : *To study selected horizons, mainly from bore cores to fill the existing lacunae in the data for building a complete sequence*

:To tag results with other data, such as megafloral and sedimentological information and geological set-up

: *To determine age and palaeoclimatic condition as depicted by spore and pollen patterns*

As a result of the continuation of the search for angiosperm pollen in Early Cretaceous sediments of Rajmahal Basin, *Clavatipollenites hughesii, Tricolpites variabilis, Asteropollis vulgaris, Retimonocolpites dividus* and *Retimonocolpites* sp. 1 have been recorded from fourth and fifth Intertrappean beds of bore- hole RJNE-32. Palynologically these beds have been dated as Late Neocomian-Aptian. The species distribution through the Intertrappean sediments in bore-hole RJNE-32 has been completed. Six palynolevels have been identified from the Intertrappean and Infratrappean sediments of this bore-hole ranging in age from Late Jurassic/Early Cretaceous to Early Cretaceous.

R.S.Tiwari & Archana Tripathi

Programme 2.9 : **Organic petrographic evaluation of Permian coal seams from Rajmahal Basin, Bihar**

Objective : *To assess the quality of coals for suitability in various industrial and domestic purpose with emphasis on coking and blending potentiality*

Microconstituents of the coals from Lalmatia colliery have been estimated to understand the ratios between various reactive and non-reactive contents. It has

been observed that the coals are rich in trimacerite and of mixed type, indicating inferior quality for selective utilization. Processing, preparation of particulate pellets, grinding and polishing of about 50 bore core samples from the Pachwara Coalfield have been carried out.

B.D.Singh and B.K.Misra

Programme 2.10 : **Palynology of the Gondwana Sequence in Satpura Basin**

Objective : *To study palynostratigraphy, biozonation, palaeoecology, palaeoenvironment, correlation of various strata in the central part of the basin*

Palynoassemblage analysed from Bhonpar Section (Khamtara area), Katni, Madhya Pradesh, contains *Cicatricosisporites, Coptospora, Lametatriletes, Callispora, Boseisporites, Contignisporites, Ischyosporites, Phyllocladidites*, etc. The assemblage has the prominence of *Podocarpidites* followed by *Callialasporites* and *Araucariacites*. It is comparable to Parsapani palynoflora of Satpura Basin indicating an Early Cretaceous age.

Pramod Kumar

Programme 2.11 : **Palynofloral Patterns and Boundary Demarcations in Gondwana Sequence ofGodavari Graben**

Objective : *To standardise palynoflora from different formations of Gondwana Sequence*

: *To recognise biozones having stratigraphical significance*

: *To demarcate time boundaries with special reference to P/Tr boundary*

: *To decipher the nature and significance of evolution of various palynofloras*

Palynofloral patterns studied in bore-holes GS-1,2,3 and 4 from Sattupalli area have shown the presence of Late Permian palynoassemblages. The assemblage is characterised by the presence of striate-disaccates. In bore-hole GS-1 *Striasulcites* is high at 99.25 m while this association is present at 371 m in bore-hole GS-2. Presence of *Lundbladispora, Falcisporites, Crescentispollenites, Corisaccites, Guttulapollenites,* though rare, shows younger aspect. In bore-hole GS-3 (46-74 m) and GS-4 (181-230 m) striate disaccates and *Densipollenites* association is younger than the *Striasulcites* assemblage. The palynological succession studied in bore-hole GAG-1 from Ainapalli-Gompana area in Chintalpudi subbasin shows the presence of Talchir, Karharbari, Barakar and Raniganj equivalent palynoassemblages. The coal seams present at 27 m shows Late Permian palynoassemblage.

Suresh C. Srivastava and Neerja Jha

Palynological succession studied in five bore-cores GM-3,4,5, 8 and 444 re-

veals presence of Karharbari to Raniganj palynoassemblages. Existence of two coal horizons — Early and Late Permian has been established. The younger coal horizon pertaining to Late Permian is correlated to the "Sondila" Seam of Ramagundam area. Seam "A" (split seam) shows Karharbari affinity while thick seam and Seam "B" (top seam) corresponds to Lower Barakar. Presence of *Leiosphaeridia, Singraulipollenites* and *Inaperturopollenites* in high percentage in Upper Permian palynoassemblages is significant as *Leiosphaerids* are considered to indicate marine incursions.

Neerja Jha

Programme 2.12 : **Organic petrographic evaluation of coals from Godavari Basin**

Objective : *To assess the rank and quality of coal from Mailaram and other areas*

The reflectance analysis of coals from Mulug coal belt has been carried out. The study revealed that these coals have a reflectance value ranging between 0.70-0.75 per cent . Thus these coals can be grouped with the high volatile bituminous coals according to the *A S T M System of coal classification.

O.S. Sarate

Programme 2.13 : **Organic petrographic evaluation of coal seams from Talcher Coalfield**

Objective : *To assess quality of coals for coking property and other industrial applications*

A geological study of the two working seams from Talcher Coalfield has shown a complete dominance of durain rich coals in this area. However, a few prominent vitrain bands are present in the coal seams at various levels. The lower workable seam is better in quality as compared to the upper seam, as it contains more vitrain rich bands. The samples collected from South-Belanda, Bharatpur and Ananta collieries, are being processed for microscopic investigations. Besides, a detailed megascopic study of various coal bands has also been carried out, which indicates that the Talchir coals are mostly composed of hard dull bands. They also soil the finger due to the presence of fusion at various levels, suggesting fluctuating hydrological conditions in the basin.

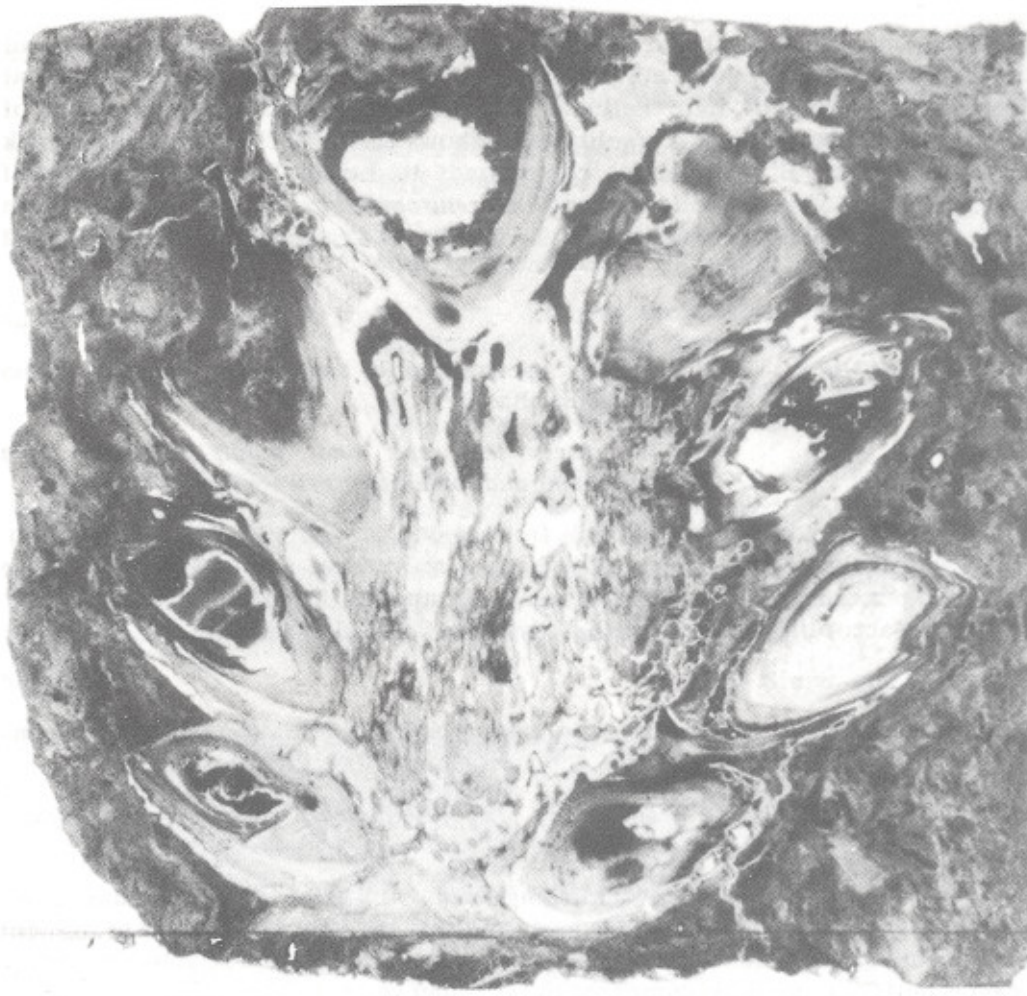
Anand-Prakash and Rakesh Saxena

PROJECT 3 : CENOZOIC PLANT BIOGEOGRAPHY OF PENINSULAR INDIA

Programme 3.1 : **Florstics and plants megafossil biostratigrahy of the Deccan Intertrappean sediments.**

Objective : *To study and understand the Deccan Intertrappean fossils*

: *To determine their age for reconstruction of vegetational history and phytogeography of Peninsular*



Transverse Section of a monocotyledonous infructescence — *Monocotylostrobus bracteatus* from the Deccan Intertrappean beds of Mohgaonkalan, Madhya Pradesh (x 7).

India

Work on the fossil dicotyledonous woods from Nawargaon was continued. A fossil wood similar to *Grewia* (Tiliaceae) with tile cells and radial gum canals was identified. Woods similar to African genera *Trichilia* (Meliaceae), *Blighia* (Sapindaceae) and *Erythroxylon* (Erythroxylaceae) were also identified in the assemblage. Presence of these African genera in the Indian Palaeocene flora is significant.

Studies on fresh material of the monocot infructescence (*Monocotylostrobus bracteatus*) recovered from the Mohgaonkalan chert were continued. Several new important features in addition to *in-situ* pollen were noted. Photography was completed. Attempts are being made to reconstruct the fossil axis and to ascertain its affinity.

M.B. Bande

An infructescence *Callistemonites indicum*, described from Shapura, Mandla District, has been reinvestigated. It shows all the morphological characters of *Musa cardiosperma*, a seeded fossil banana fruit which is already known from Mohgaonkalan chert, but not of *Callistemon* (bottle brush) of the family Myrtaceae.

M.B. Bande, R.C. Mehrotra and N. Awasthi

Programme 3.2 : **Studies on the Tertiary floras of western India**

Objective : *To build up floristic history and phytogeography of western India*

About 25 fossil woods from the Upper Tertiary sediments of western India were studied. The taxa identified are : *Lagerstroemia, Millettia-Pongamia, Terminalia, Hopea, Ziziphus,* and *Chlorophora*. Occurrence of *Hopea* in southern Gujarat is a further evidence of widespread of Dipterocarpaceae in India until Late Tertiary. The genus *Chlorophora* of the family Moraceae, a typical African genus, has been recorded for the first time in the Indian Neogene flora. Identification of the fossil woods from the Intertrappean beds of Kutch has been completed.

J.S. Guleria

Programme 3.3 : **Palynostratigraphy and palaeofloristics of the Mesozoic-Tertiary sediments in Rajasthan Basin**

Objective : *To establish palynological succession in the Cretaceous-Tertiary sequences*

: *To deduce palaeoenvironment*

Qualitative and quantitative analyses of the palynoflora recovered from subsurface sediments drilled near Kapurdi and Jalipa, Barmer District, Rajasthan denote that the lower and upper parts of the bore-hole sequences near Kapurdi are characterised by the dominance of pteridophytic spores and angiospermic pollen respectively. The top part shows almost equal representation of pteridophytic and angiospermic elements. It is inferred that the lower part of this sequence witnessed a short phase of marine transgression as is evidenced by the presence of dinoflagellate cysts. The spore/pollen assemblages are comparable to those of Kutch Basin and contain Palaeocene-Eocene marker taxa, like *Dandotiaspora, Proxapertites, Lakiapollis, Tricolporopollis, Matanomadhiasulcites, Spinizonocolpites, Neocouperipollis* and *Kielmeyerapollenites*.

S.K.M. Tripathi

Programme 3.4 : **Neogene plant megafossils of West Coast**

Objective : *To study morphotaxonomy of plant megafossils, palaeofloristics, palaeoecology and palaeogeography*

Leaf-impressions resembling those of *Calophyllum, Gluta, Cinnamomum-Litsea* collected from Varkala Cliff Section (Warkalli beds) have been studied. Two fruits collected from Varkala Cliff Section and Payangadi clay mine have been studied. One apparently looks like a 2-seeded fabaceous pod and the other triloc-

ular fruit of euphorbiaceous affinity.

N. Awasthi and Rashmi Srivastava

Carbonised woods from Kundara clay mine have been studied. One has been identified with *Euphoria* of the family Sapindaceae and the two with Fabaceae.

Rashmi Srivastava

Programme 3.5 : **Palynological investigation of the Tertiary sediments of Kerala Basin with reference to their biostratigraphy, palaeoecology and age**

Objective : *To study morphotaxonomy of spore-pollen from the measured sections of Quilon and Warkalli beds*

: *To establish palynostratigraphic zonation*

: *To determine their correlative value*

: *To determine the palaeoclimate and environment of deposition prevailing at the time of sedimentation*

Laboratory processing of samples collected from Kundra clay mine has been completed. Morphotaxonomic study and identification of spore-pollen taxa is being continued. The important genera, viz., *Lygodiumsporites, Crassoretitriletes, Polypodiisporites, Polypodiaceaesporites, Quilonopollenites, Lakiapollis, Meliapollis, Margocolporites, Ctenolophonidites, Myricipites, Cruciferoipollenites* and *Malvacearumpollis* have been identified.

M.R. Rao

Programme 3.6 : **Tertiary megafossils from Neyveli Lignite, Tamil Nadu**

Objective : *To study morphotaxonomy of Tertiary megafossils from Neyveli lignite and relate them with extant plants*

: *To deduce palaeoenvironmental, palaeoecological and phytogeographical information*

A number of carbonised wood specimens from Neyveli lignite deposits were studied. A few of them have been tentatively identified with the extant taxa of Sterculiaceae, Lecythidaceae and Sonneratiaceae.

Anil Agarwal

Programme 3.7 : **Palynostratigraphic investigations of the Neyveli Formation and its relationship with other lignite bearing formations of south India**

Objective : *To study palynoflora from the Neyveli Formation of south Arcot District, Tamil Nadu*

: *To find out relationship of the Neyveli Formation with other lignite-bearing formations*

: *To trace lateral continuity of the biozones established in Jayamkondacholapuram area*

: *To deduce palaeoclimate and environment of deposition*

: *To solve the controversy regarding the age of the Neyveli lignite*

Morphotaxonomic study of the palynoflora obtained from the Neyveli Mine-I is being carried out. The assemblage consists of 26 per cent of pteridophytic spores, 64 per cent of angiospermous pollen and 10 per cent of fungal remains. The assemblage is correlatable to the upper zone of the Neyveli Formation, viz., *Trilatiporites sellingii* Cenozone of Jayamkondacholapuram area.

R.K. Saxena

Programme 3.8 : **Organic petrological study of Rajasthan lignites**

Objective : *To carry out petrological evaluation of Rajasthan lignites*

: *To prepare basinal models showing deposition of lignite beds and their coalification trends*

The proposed work in the project could not be undertaken.

Anand-Prakash and R. Saxena

Programme 3.9 : **Organic petrology of Kutch lignites, Gujarat**

Objective : *To evaluate Panandhro lignite for various industrial uses*

: *To understand genesis of lignite and palaeoenvironmental conditions*

The lignite of Panandhro lignitefield is compact and massive in nature and amorphous in texture. It is brown to dark brown in colour and sparingly banded in appearance. Granules, specks and lenses (1 mm to 5 cm in size) of yellow and violet-red coloured resins are present as persistent or impersistent bands throughout the seams. Each resin-rich band varies in thickness from 3 cm to over 7 cm and occurs generally at the intervals of 15 to 40 cm in the lignite seam and also in the shaly lignite, lignitic shale and lignitic clay beds. Occasionally, the bands may be over 1 m apart. The resins are also dispersed randomly throughout the seam. So far, no other coal or lignite seam is known from India which contains this much of resin concentration.

G.K.B. Navale, B.K. Misra and Alpana Singh

PROJECT 4 : PHYTOPLANKTON BIOSTRATIGRAPHY OF

MARINE SEDIMENTARIES OF INDIA

Programme 4.1 : **Phytoplankton biostratigraphy- of Cretaceous-Palaeogene sequences of South Shillong Plateau, Meghalaya with emphasis on time boundaries and palaeoceanography**

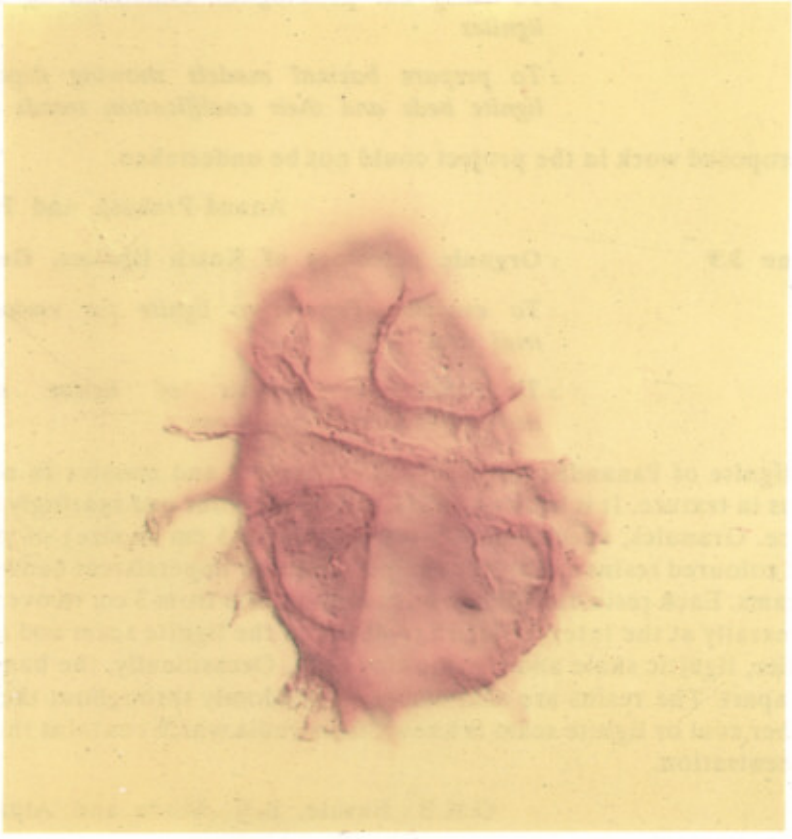
OBJECTIVE : *To document lithological succession and facies variations in outcrop areas*

: *To study dinocyst morphology and biostratigraphy and to document phytoplankton rich levels*

: *To integrate dinocyst, calcareous plankton and palaeontological data for stratigraphic precision*

: *To carry out palynofacies and organic petrographic studies*

: *To carry out oxygen isotope and geochemical studies across K/T boundary*



Danea californica (Drugg) Stover & Evitt 1978, a marker Danian dinoflagellate cyst from Langpar Formation, Um Shoryngkew section ,Meghalaya.

: *To attempt palaeoceanographic interpretations*

Dinoflagellate cyst and calcareous nannoplankton data has been generated from the Langpar Formation exposed along the western bank of the Um Sohrenkew River, on the southern slope of Cherrapunji Plateau, Khasi Hills. Within its lower part K/T boundary has been established below the 1.5 cm thick reddish brown, iridium rich clay layer. For the first time, latest Maastrichtian, low latitude calcareous nannoplankton marker species *Micula prinsii*, has been reported in this section, terminating in stratigraphic order at the base of the clay layer. An integrated scheme, incorporating dinoflagellate cyst, calcareous nannoplankton, planktonic foraminifera and geochemical data, is proposed.

K.P. Jain and Rahul Garg

Programme 4.2 : **Cretaceous phytoplankton biostratigraphy and palaeoceanographic set up of East Coast petroliferous basins**

Objective : *To document lithological succession in outcrop areas*

: *To study dinocyst morphology, taxonomy and biostratigraphy*

: *To integrate phytoplankton data with palaeontological and sedimentological data*

: *To carry out palynofacies study, document plankton-rich levels*

: *To carry out stable carbon isotope (C-13)and organic petrographic studies*

: *To attempt palaeoceanography modelling*

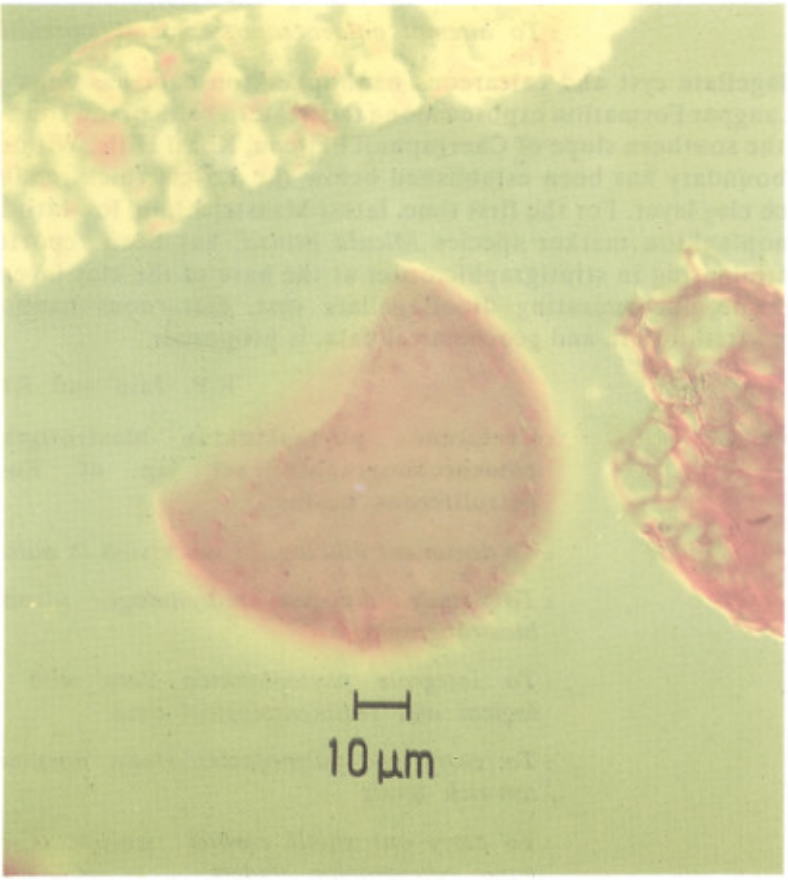
Three new species of the genus *Trichodinium*, viz., *T. minutum, T. brevispinosum*, *T. jainii* and a new combination *Acanthaulax magnum* (Jain) are described from the Grey Shale Member of Dalmiapuram Formation (Lower Albian) together with a new genus *Ectodinium* and a new species, *Callaiosphaeridium tapeum* from Trichinopoly Formation (Turonian-Santonian) of Cauvery Basin.

Khowaja-Ateequzzaman

Photodocumentation and morphological studies of selected Early Cretaceous dinocyst taxa from sedimentaries underlying the volcanics in MON-2 well, Mahanadi Basin are carried out. Several dinocyst productive levels in onshore bore hole MON-4 have been identified.

K.P. Jain, Rahul Garg and Khowaja-Ateequzzaman

A rich dinoflagellate cyst and acritarch assemblage have been recovered from selected core and cutting samples of a 764.9 meters deep bore hole drilled in Puduvoyal, Chingleput District, Palar Basin, southern India. A total of 78 species have been identified and their stratigraphic occurrences throughout the sequence are tabulated. Based on the following stratigraphically significant taxa, viz., *Achomosphaera neptuni, Aprobolocysta alata, Apteodinium maculatum,*



Trichodinium brevispinosum Khowaja - Ateequzzamaan in lateral low view from Trichinopoly Formation, Cauvery Basin.

Batiacasphaera jaegeri, Canningia reticulata, Canninginopsis colliveri, Carpodinium granulatum, Coronifera oceanica, Circulodinium attadalicum, C. distinctum, Cribroperidinium muderongense, Dingodinium cerviculum, Discorsia nanna, Exochosphaeridium phragmites, Gardodinium trabeculosum, Herendeenia pisciformis, H. postprojecta, Kleithriasphaeridium eoinodes, Meiourogonyaulax bulloidea, Muderongia australis, M. mcwhaei, M. tetracantha, Odontochitina operculata, Palaeoperidinium cretaceum, Phoberocysta neocomica and *Pseudoceratium* an Early Cretaceous (Hauterivian-Barremian) age of the sequence has been concluded.

Khowaja-Ateequzzaman and K.P. Jain

Programme 4.3 : **Neogene calcareous nannoplankton paleoceanography of Andaman and Nicobar Islands**

Objective : *To compare Neogene calcareous nannoplankton assemblage of Andaman and Nicobar Islands with that known from nearshore and high latitude and to select cosmopolitan markers*

: *To integrate calcareous nannoplankton and planktonic foraminiferal zonations to improve dating resolution*

: *To record palaeoenvironmental events with special reference to Antarctica glaciation event based on plankton assemblage backed by stable isotope and organic data*

The literature on the Neogene of Andaman and Nicobar region was critically studied. Field observations were made and high resolution lithologs prepared. Close sampling was done in Lacam Point Section of Early Miocene age at Havelock Island to decipher volcanic and quiscent phases related to opening of Andaman Sea.

S.A. Jafar and Jyotsana Rai

Photodocumentation of calcareous nannofossils recovered from samples of East Coast and Nipple Hill sections, was completed. Taxonomy completed for species documented under the Light - and Scanning Electron Microscope. Range of taxa plotted against prepared litholog of the two sections. Draft completed on systematic Palaeontology Chapter of the thesis (Thesis work).

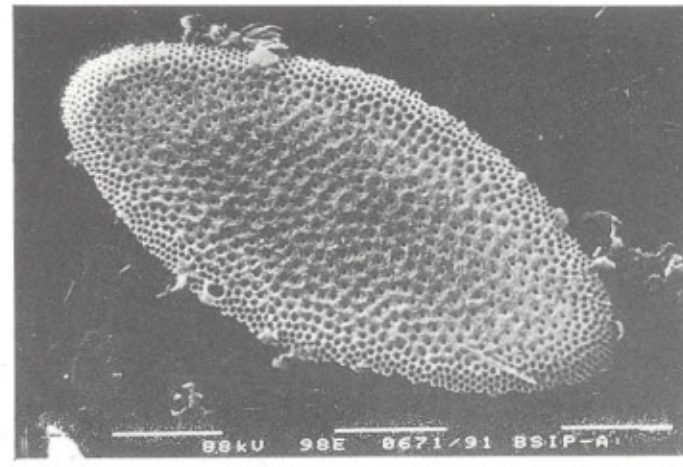
S.A. Jafar and O.P. Singh

Programme 4.4 : **Late Cenozoic diatom biostratigraphy of Andaman and Nicobar Islands**

Objective *:To study morphology and taxonomy of diatom and silicoflagellate taxa from Late Cenozoic surface and subsurface sections (type locality/reference sections) of Andaman Nicobar Islands*

: *To establish biozonation for age determination and correlation with geologically synchronous beds*

: *To interpret palaeoenvironment, palaeogeography*



Actinocyclus ingens from the Middle Miocene of Kamorta, Andaman and Nicobar Islands.

and time boundaries

: *To integrate the diatom biostratigraphy with the established foraminiferal biozones and isotope study*

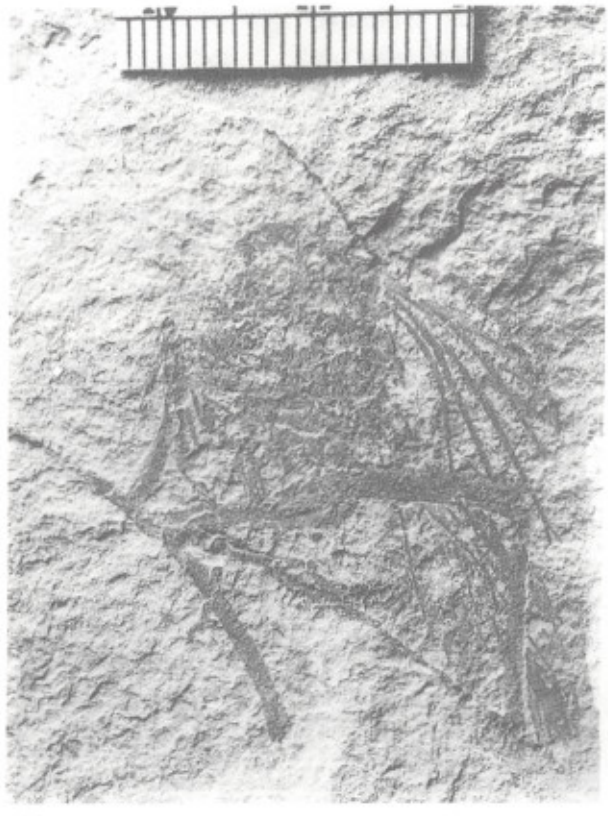
Studies on diatoms and silicoflagellates from the 75 meter thick South Coast Cliff Section of Kamorta Island were continued. SEM photography of selected and stratigraphically important taxa was done for better understanding of the morphology. Middle Miocene age is assigned to this section on the basis of diatom assemblage.

Anil Chandra

PROJECT 5 : PALAEOFLORISTIC DIVERSIFICATION IN THE HIMALAYA

Programme 5.1 : **Palaeozoic flora of Kashmir region : biozonation affinities and biogeography**

Objective : *To make extensive collections of plant fossils from the peri-Gondwana stratigraphical sequences, their identification and comparison with Gondwana, Cathaysian and Angaran elements to trace their origin*



'Cockroach' from Mamal Formation (Early Permian), Kashmir.

A partially preserved cockroach has been recorded from the Mamal Formation of Kashmir Basin. Besides the fore-wings, which are similar to those of *Kashmiroblatta* Verma, the hind wings, limbs, the head capsule and a part of the prothorax are also preserved.

H.M. Kapoor (Emeritus Scientist), Usha Bajpai and H.K. Maheshwari

The Mamal Formation, uppermost formation of the Panjal Group in Kashmir, has been redefined. The nomenclatural status of the formation is accepted but its definition has been modified on the basis of lithology, relative position of different beds and the contained biota. The four beds recognized earlier, viz., Vihi, Marhoma, Munda and Mamal, have been redesigned as Risin, Marhoma, Munda and Dunpathri Formation taking into account the historical aspects and other criteria.

H.M. Kapoor, H.K. Maheshwari and Usha Bajpai

Programme 5.2 : **Palynofloras of the Tethyan sediments of the Himalaya, their provenance and regional relationship**

Objective : *To search palynofossils in the well dated sequence of Palaeozoic and Mesozoic sediments of Niti (Spiti), Malla Johar (Kumaon) and Kashmir (Guryul ravine)*

The highly carbonised nature of palynomorphs and their rarity in the samples available poses problems in recovery and morphographic study. However, some of the material has yielded good assemblages. Repeated maceration with varied techniques proved helpful . Palynomorphs found in Permian section of Rambakot and Shal-Shal localities were studied for their detail morphology. Most of the forms are similar to those in the Permian sequence of the peninsula.

R.S. Tiwari and Vijaya

Programme 5.3 : **Palynostratigraphic studies, evaluation of rank and properties of coal and associated sediments in eastern Himalaya**

Objective : *To correlate the palynoflora with petrography of coal and to compare with the known palynofloras from the peninsular Gondwana*

: *To reconstruct marine pathways, palaeoecology and palaeoenvironment during the deposition of the Permian sediments in Siang District*

Palynological studies have been completed on samples from Garu- Dali Camp and Bomte-Takso sections. The assemblage shows dominance of *Indotriradites-Parasaccites* in Garu-Dali Camp section. Presence of few acritarchs has been documented. Bomte-Takso section shows Karharbari and Lower Barakar assemblages. Palynofossils from coal balls are associated with acritarchs, hystrichosphaeridia, conodont and scolecodont alongwith foraminifera indicating

marine influence during Karharbari.

Suresh C. Srivastava, Anand-Prakash and A.P.Bhattacharyya

Programme 5.4 : **Palynological history of the Tertiary sediments of Jammu area**

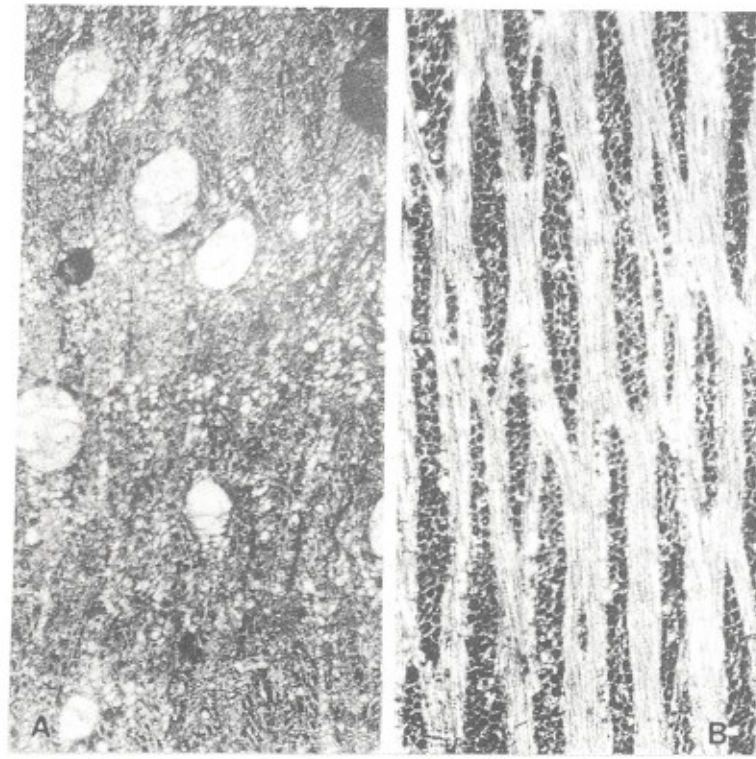
Objective : *To study palynofossils from the Palaeocene-Miocene sediments*

: *To carry out palynozonation, age determination and correlation of the assemblage*

: *To develop information on phytogeography and understanding of the orogeny of Himalaya*

Palynostratigraphical investigations of four measured sections, viz., Dali, Khargala, Sair and Kalakot of Jammu have revealed a rich palynofossil assemblage. Preliminary analysis of the composition of this assemblage depicts its close similarity with those recorded from Kalka-Simla and Banethi-Bagthan areas of Himachal Pradesh. Based on this observation a possible sea-link between these two widely separated areas is envisaged during Eocene time.

H.P. Singh and S. Sarkar



Fossil wood resembling extant *Artocarpus* from the Siwalik of Kalagharh, Uttar Pradesh; **A**, Transverse section x 60; **B**, Tangential logitudinal section x 80.

Programme 5.6 : **Neogene Himalaya : floristics, evolutionary patterns and climate**

Objective : *To undertake extensive study of fossil plants from Neogene sediments of different regions of the Himalaya*

: *To build up the floral succession for interpreting palaeoecology, phytogeography and evolution of the Himalayan flora*

A new collection of plant megafossils comprising leaf-impressions, fruits and seeds from the Siwalik sediments of Surai Khola, Arjun Khola and Rehar, western Nepal has been studied. About 50 new species of leaf-impressions from Arjun Khola were identified and assigned to the genera, viz., *Aglaia, Alstonia, Alsodeia, Anacolosa, Artocarpus, Bridelia, Diospyros, Dracontomelum, Euphoria, Evodea, Filicium, Garcinia, Grewia, Gynocardia, Lagerstroemia, Lepionurus, Miliusa, Millettia, Phyllanthus, Unona, Vitis* etc. of the dicotyledonous families. Two fabaceous fruits have been identified with those of *Butea superba* and *Sindora velutina*.

A fossil leaf resembling extant *Artocarpus* from the Siwalik sediments of Arjun Khola, Nepal.

In the light of the distribution patterns of the modern counterparts of fossil leaves a low land mixed broad-leaved mesophytic tropical evergreen to semi-evergreen forest in the area during Siwalik sedimentation has been envisaged. However, an increase in the deciduous elements towards the upper part of the Siwalik sequence reflects a gradual change in the climatic conditions which could have been caused by the uplift of the Himalaya.

N. Awasthi and Mahesh Prasad

Leaf-impressions from Siwalik sediments of Hardwar, Nainital, and fossil woods from Kalagarh and Hardwar were studied. The fossil woods identified from Kalagarh are : *Dipterocarpus, Hopea, Sterculia, Bursera, Euphoria, Dialium, Millettia* and *Diospyros*, while a wood from Hardwar is comparable to *Dipterocarpus speciosus* and *D. gracilis*.

Mahesh Prasad

Programme 5.7 : **Palynology, palaeoecology and palaeogeograhy of the Tertiary sediments of Nepal Himalaya**

Objective : *To study palynofossils from the Mio-Pliocene sediments*

: *To carry out palynozonation and age determination of assemblages together with reflections on the past vegetation and environment of deposition*

Evidences of micro- and megafossils from the Siwalik sediments (Neogene) of Surai Khola area, Nepal have been used to reconstruct the vegetation and palaeoenvironmental conditions. The fossil assemblage mainly consists of leaf impressions, carbonised woods, seeds, fruits, pollen and spores representing all major plant groups.

The palaeobotanical evidences suggest existence of a lowland mixed mesophytic forest communities of broad leaved semi- evergreen to evergreen trees. An increase in the deciduous elements is also noticed. A fresh water swampy environment of deposition is interpreted for the older horizons due to the presence of algal and other aquatic plants, viz., *Azolla, Ceratopteris, Typha, Nymphea*, etc. Gradually swampy conditions seem to have changed to a bottomland habitat which is depicted by the presence of a number of ferns and other herbaceous elements in the subsequent younger horizons.

S. Sarkar

PROJECT 6 : BIOSTRATIGRAPHY AND PALYNOFACIES OF PETROLIFEROUS BASINS OF EAST INDIA

Programme 6.1 : **Tertiary floral history of northeast India**

Objective : *To study morphotaxonomy of megafossils from the Palaeogene and Neogene sediments of Assam, Meghalaya and Arunachal Pradesh*

: *To reconstruct Tertiary floral history, palaeoecology*

A fossil leaf and fruit resembling *Mesua ferrea* from Makum Coalfield, Assam.

and phytogeography

Fossil woods of *Dipterocarpus* (Dipterocarpaceae), *Canarium* (Burseraceae), *Euphoria*, (Sapindaceae), *Julbernardia*, (Fabaceae), *Barringtonia* (Lecythidaceae), *Madhuca* and *Manilkara* (Sapotaceae) have been identified from Namsang beds near Deomali, Arunachal Pradesh. Of these, *Julbernardia* is an African genus and suggests phytogeographical linkage of Africa with the Indian subcontinent during Neogene.

This genus disappeared from India perhaps at the close of Pliocene, like many other African and Malaysian elements.

A fruit of the genus Mesua has been identified from Tirap Colliery of Makum Coalfield, Assam. It further confirms wider distribution of this genus in northeast India during Oligocene.

From the Upper Palaeocene sediments near Laitryngew, Khasi Hills, a leaf of *Mangifera* has been identified. This supports the view that the genus *Mangifera* appeared first in the Upper Palaeocene in the Indian subcontinent.

N. Awasthi and R.C. Mehrotra

Programme 6.2 : **Palynostratigraphy of sedimentary rocks in Therriaghat Section and its correlation with Jaintia and Garo Hills sediments**

Objective : *To work out palynostratigraphy of different Tertiary formations*

: *To palynologically differentiate Langpar (Lower Palaeocene), Langpar - Lakadong (Middle Palaeocene), Lakadong - Umalatodoh - Prang (Lower-Middle Eocene), Prang - Kopili (Upper Eocene) and Kopili - Barail (Lower Oligocene) sediments*

: *To correlate the Therria assemblages with those of Jaintia and Garo Hills*

The Langpar Formation (Danian) is characterised by *Spinizonocolpites, Proxapert'tes, Matanomadhiasulcites, Saturna, Tercissus* and spores of *Acrostichum*. In Therria Ghat Formation, *Matanomadhiasulcites, Dictyophyllidites, Lycopodiumsporites, Neocouperipollis* occur in good percentage. *Dandotiaspora* and *Lycopodiumsporites* association could easily distinguish the Lakadong Formation. In Prang, *Striatriletes* is first observed in good numbers; *Osmundacidites, Polypodiaceaesporites* and *Polypodiisporites* are also common. In Kopili, *Striatriletes*, *Polypodiisporites* and *Polypodiaceaesporites* are dominant but *Pellicieroipollis* and *Tricolporopilites* are occasionally found. The Barail is ushered by the appearance of *Crassoretitriletes*, *Malayaeaspora* and *Bombacacidites*. In Surma and Tipam *Crassoretitriletes* and *Bombacacidites* continue while *Hibiscaepollenites* for the first time. Besides, in these two formations, reworked Lower Gondwana (Permian) forms like *Striatites, Lahirites, Striatopodocarpites*, etc., also occur in abundance.

R.K. Kar

Programme 6.3 : **Palynostratigraphy of Tura Formation (Palaeocene), Garo Hills, Meghalaya**

Objective : *To establish significance of the palynoflora in biostratigraphic zonation, correlation and dating*

: *To study palynofloras recovered from selected sections in order to recognise their ecological importance and to trace evolutionary lineage*

: *To deduce palaeoclimate and depositional environment prevalent at the time of deposition*

Rock samples from four coal-bearing sections around Rekmangiri Coalfield, Garo Hills, Meghalaya were macerated and the productive samples yielded 25 genera and 48 species. Important palynotaxa are *Dandotiaspora telonata, Lycopodiumsporites palaeocenicus, L. speciosus, Dictyophyllidites kyrtomatus, Palmidites plicatus, Proxapertites emendatus, Neocouperipollis brevispinosus, Kielmeyerapollenites* sp., *Retitricolpites sp., Spinizonocolpites echinatus, Droseridites major, Psilastephanocolporites psilatus*. Histograms depicting distribution reveal that seam nos. 1 and 2 are dominated by the pteridophytic spores while seam no. 3 showed abundance of angiospermous taxa. Occurrence of gymnospermous pollen - *Laricoidites* and dinoflagellate cysts such as *Apectodinium* were also noted in seam no. 3 suggesting its Upper Palaeocene - Lower Eocene limit. The present assem-

blages were also compared with other known Palaeocene - Lower Eocene assemblages.

K. Ambwani

Programme 6.4 : **Palynological investigation of the Tertiary sediments of Jaintia and Cachar Hills**

Objective : *To study morphotaxonomy and affinity of palynofossils*

: *To select ecologically and stratigraphically important palynotaxa for biostratigraphic zonation, correlation and dating*

: *To infer palaeoclimate and environment of deposition of the sediments*

Two sections of Disang sediments exposed along Haflong-Silchar Road were worked out. The samples are poor in spore-pollen content but rich in other organic matter. *Striatriletes, Lygodiumsporites, Cyathidites*, and Polypodiaceae spores are major elements in the palynoassemblage. Angiospermous pollen are poorly represented. Reworked Permian pollen are occasionally met with.

J.P. Mandal

Programme 6.5 : **Palynological studies of Khasi (Upper Cretaceous) and Garo (Late Tertiary) groups in the South-Shillong front, Meghalaya**

Objective : *To collect and process samples for quantitative and qualitative analyses of the palynofloras*

: *To establish palynological zonation for correlation and dating*

: *To infer palaeoclimate and depositional environment*

: *To study extant pollen and spores for comparison with extinct spores and pollen*

Out of fifteen surface exposures of Jadukata and Mahadek formations (Late Cretaceous) only four sections (90 samples) were found to be palynologically productive. Containing the following taxa : *Triporoletes reticulatus, Densoisporites velatus, Appendicisporites potomacensis, Cicatricosisporites dorogensis, C. venustus, C. hallei, Klukisporites reticuloides, Concavisporites concavus, Dictyophyllidites meghalayensis, Ariadnaesporites intermedius, Minerisporites* sp., *Microfoveolatosporis* spp., *Equestosporites* sp., *Pseudopolicapollis* spp., *Basopollis* sp., *Pecakipollis* sp., *Triangulipollis* sp., *Complexipollis* sp., *Neocouperipollis* sp., *Tricolpites* sp., *Palamaepollinites eocenicus* and *Azolla cretacea.*

R.S. Singh and A. Rajanikanth

One hundred samples of Baghmara Formation exposed in Garo Hills of

Meghalaya have yielded a rich spore-pollen assemblage. Pteridophytes are richly represented in the assemblage. The following species were identified : *Lycopodiumsporites abundans, Polypodiaceaesporites tertiarus, P. favus, Biretisporites sp., Faveosporites, Lygodiumsporites lakiensis, Cyathidites spp., Striatriletes susannae, S. sinuosus, Surmaspora sinuosa, Malayaeaspora costata, Pinuspollenites foveolatus, Abiespollenites burmaensis, Laricoidites* sp., *Podocarpidites* sp., *Retipilonapites* sp., *Neocouperipollis* spp., *Trifossapollenites costatus*, *Bombacacidites inausus.* The spore-pollen recovered are comparable with Miocene assemblages of north-eastern India.

R.S. Singh

Programme 6.6 : **Palynostratigraphy of the Tertiary sediments of Mikir and North Cachar Hills, Assam**

Objective : *To select stratigraphically and ecologically important palynotaxa of North Cachar Hill*

: *To study ultrastructure of important palynofossils and to trace their relation with pollen of modern taxa*

: *To reconstruct the environment of deposition and palaeoclimate during sedimentation*

Macerated 67 rock samples from Lumding-Haflong road section, North Cachar Hills, out of which 27 samples yielded spore-pollen. The assemblage is represented by the genera *Polypodiaceaesporites, Pteridacidites, Striatriletes, Piceapollenites, Podocarpidites, Pinuspollenites, Polyadopollenites, Bombacacidites*, *Ericipites* and *Magnamonocolpites*. The reworked Permian miospores are also represented in the assemblage. These are : *Parasaccites, Striatopodocarpidites* and *Densipollenites.*

Madhav Kumar

Programme 6.7 : **Palynostratigraphy of Barail sediments in Upper Assam**

Objective : *To study Barail sediments in order to know their lithic characters, nature of contact and palynofossil content*

: *To study morphotaxonomy of the palynofossils*

: *To establish palynological zonation in the Barail sedimentary succession*

: *To study the botanical affinity of the various spore-pollen taxa*

Palynology of a section in Jeypore Colliery, Tikak Parbat Formation (Upper Oligocene) was completed. The assemblage consists of 54 genera and 79 species, out of which 19 genera and 40 species belong to pteridophytes, 24 genera and 29 species to angiosperms, 3 genera and 4 species to gymnosperms and 8 genera and 6 identifiable species to fungal remains. The taxa are represented by the families

Cyatheaceae, Osmundaceae, Gleicheniaceae, Mataniaceae, Polypodiaceae, Arecaceae, Malvaceae, Meliaceae, Bombacaceae, Alangiaceae, Caesalpiniaceae, etc. It seems that the sedimentation took place in fresh water condition and there was plenty of rainfall.

B.D. Mandaokar

Programme 6.8 : **Palynostratigraphy of the Kopili Formation of Khasi and Jaintia Hills, Meghalaya**

Objective : *To establish palynological zones for correlation and dating*

: *To deduce palaeoclimate and depositional environment*

: *To carry out SEM studies of important palynofossils to trace evolutionary trends*

Palynology of the Kopili Formation (Upper Eocene) in the type area was completed. The assemblage consists of 17 genera and 23 species. The dominant genera are : *Retitribrevicolporites, Dictyophyllidites* and *Polypodiaceaesporites. Cyathidites, Lygodiumsporites, Todisporites* and *Surmaspora* are also occasionally met with. The palynological assemblage has been compared with other assemblages of the equivalent formation. They exhibit a marked contrast as there is hardly any dominant common elements in the assemblages. In the type locality, *Retitribrevicolporites* is the most common taxon whereas at Garampani it is *Operculosculptites*. At Umsohryngkew River section *Echitricolpites* is common and *Striatriletes* is found in dominance in Jowai Badarpur road section.

G.K. Trivedi

Programme 6.9 : **Comparative palynological studies of African and Indian Upper Cretaceous - Palaeocene sediments**

Objective : *To study Upper Cretaceous - Tertiary palynofossils from Senegal and Tanzania to evaluate palynological assemblage and identify common palynofossil markers*

: *To trace patterns of migration for deciphering palaeogeographical distribution and spread of angiosperm taxa*

: *To explore possibilities of obtaining comparative material from southeast Asia*

Palynological investigation on the Cretaceous-Tertiary transition in the bore hole core no. CM5 drilled in the Atlantic ocean off Senegal Coast, West Africa has been carried out. According to the stratigraphic data provided by Dr. A. Ly, Universite Cheikh Anta Diop, Dakar, Senegal the top of the Maastrichtian is marked approximately at 9952 m. The present study is aimed to detail out palynological data and correlate with stratigraphic information. Samples of the sediments

between 1002-944 m show an almost uniform distribution of taxa. Significant Maastrichtian marker taxa, namely *Diporoconia iszkazentgyoergyi, Ariadnaesporites ariadnae, Gabonisporites vigourouxii, Periretisyncolpites magnosagenatus, Tercissus grandis, Longapertites marginatus*, etc. are recorded.

These marker taxa disappear at 958 m level and an abundance of pteridophytic spores is noticed. Thus a major change in floral composition is recorded at this level marking K/T boundary, which is characterized by the disappearance of Maastrichtian marker taxa and presence of a fern spike. Such major floral change is attributed to possible influence of K/T events.

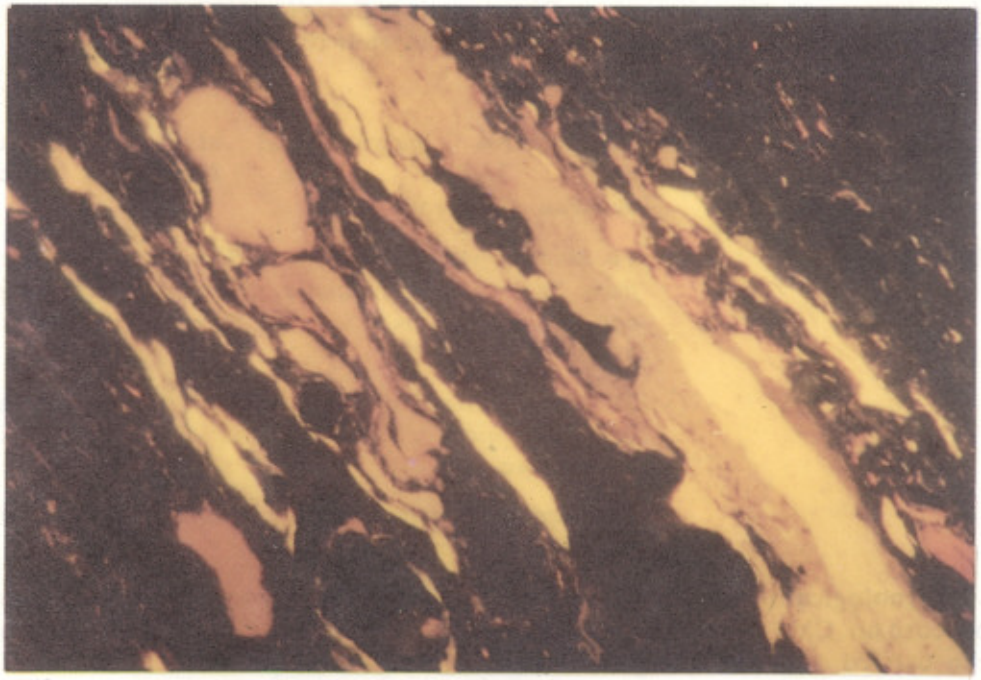
Palynological investigations on the "infratrappean" sediments and equivalents have been carried out. A Maastrichtian palynoassemblage from the Kallamedu Formation has been detailed out.

B.S. Venkatachala, R.K. Kar and A. Rajanikanth

Programme 6.10 : **Biodiagenesis of Tertiary coals from Nagaland and kerogen study from Tertiary sequence of Assam-Arakan Basin**

Objective : *To evaluate Tertiary coals from Nagaland and kerogen study from Tertiary sequence of Assam - Arakan Basin*

A biopetrographic investigation carried out on the exploitable coal seam No. 1 and No. 3 from the Makum Coalfield indicates that they were formed mainly from



Band and discrete bodies of yellow, ochre-yellow and orange fluorescing resinites with sporinites in the Tertiary coal of Assam.

the tree-dominated autochthonous mangrove-mixed angiospermous vegetation growing under moderately per-humid tropical climate. The vegetal accumulation took place in a rheotrophic peat-swamp on a lower delta plain in a near-shore lagoon. The affect of anaerobic degradation under alkaline mileau was more pronounced and resulted in pyrite-rich perhydrous coals by the influence of putrefaction instead of normal humification. Anaerobic alkaline conditions facilitating severe biodegradation of organic matter were not only responsible for the formation of fine-grained authigenic partings within the seams as well as roof and floor of the seams but also for the termination of the coal seams.

B.K. Misra

PROJECT 7 : RECONSTRUCTION OF QUATERNARY VEGETATIONAL PATTERNS

Programme 7.1 : **Ilistory of vegetation and climate in tropical montane forests in south India**

Objective : *To build up a complete palynofloral succession of the Shola forest / grassland in Annamalai Hills, Palni Hills and Silent Valley*

Ten surface samples from Bombay Shola, Palni Hills were pollen analysed and revealed high yield of pollen/spores. The common feature of this study is that the samples collected within the forested zone have recorded higher frequencies for arboreal taxa which decline proportionately in the samples investigated from outskirt and away from the forest.

Twenty five profile samples from Bombay Shola were pollen analysed and recorded preponderance of non-arboreals which is almost matching with composition of the surface samples. Although shola trees are inadequately present but *Impatiens, a close associate of shola woods, is regularly present in the samples which signifies the existence of shola woods.*

H.P. Gupta and S.K. Bera

Pollen morphology of 27 modern trees from Silent Valley has been completed under LM.

H.A. Khan

Programme 7.2 : **Depositional environment and climate during the Quaternary Period in the Himalaya : A palynological approach**

Objective : *To build up a fine resolution climatic sequence of Quaternary Period in the Himalayan region*

Pollen analysed 8 samples from 2 meter deep profile (GT-1) from Gola Tappar, Dehradun. The study has revealed the occurrence of *Holoptelea, Bauhinia, Murraya, Ficus, Mallotus* and Meliaceae. *Strobilanthes,* Fabaceae and Urticaceae are scanty. The ground vegetation is composed of grasses, sedges, Cheno/Ams, Brassicaceae, *Artemisia*, etc. Besides, fungal spores of *Alternaria, Curvularia,*

Tetraploa and Microthyriaceae are also recorded.

Carried out pollen analytical investigation of 12 glacier dust samples from Dunagiri Glacier, Garhwal Himalaya. The broad-leaved components are represented by *Quercus, Betula, Alnus, Carpinus, Ulmus* and *Celtis, Pinus, Abies, Picea* and *Cedrus* are low in values. Poaceae, alongwith Cheno/Ams, Ranunculaceae, Asteraceae, Rosaceae, etc. are the prominent herbaceous elements.

Chhaya Sharma and M.S. Chauhan

Study of 5 surface samples from Nachiketa Tal, Garhwal Himalaya reveals the dominance of *Pinus* and *Quercus, Alnus, Betula, Carpinus, Rhododendron, Celtis, Acer*, etc. are in very low values. Poaceae, Cheno/Ams, Asteraceae, Caryophyllaceae, etc. are poorly represented.

Pollen analysed a 2 meter deep profile (NT-4) from Nachiketa Tal, Garhwal Himalaya. *Quercus, Pinus, Alnus, Betula, Juglans,* etc. are the main arboreal constituents, whereas non-arboreals such as Poaceae, Cheno/Ams, Caryophyllaceae, etc. are represented in low values.

Pollen analysis of a new profile (NT-2) from Nachiketa Tal, Garhwal Himalaya has been undertaken.

Chhaya Sharma and Asha Gupta

Programme 7.3 : **History of mangrove vegetation in India**

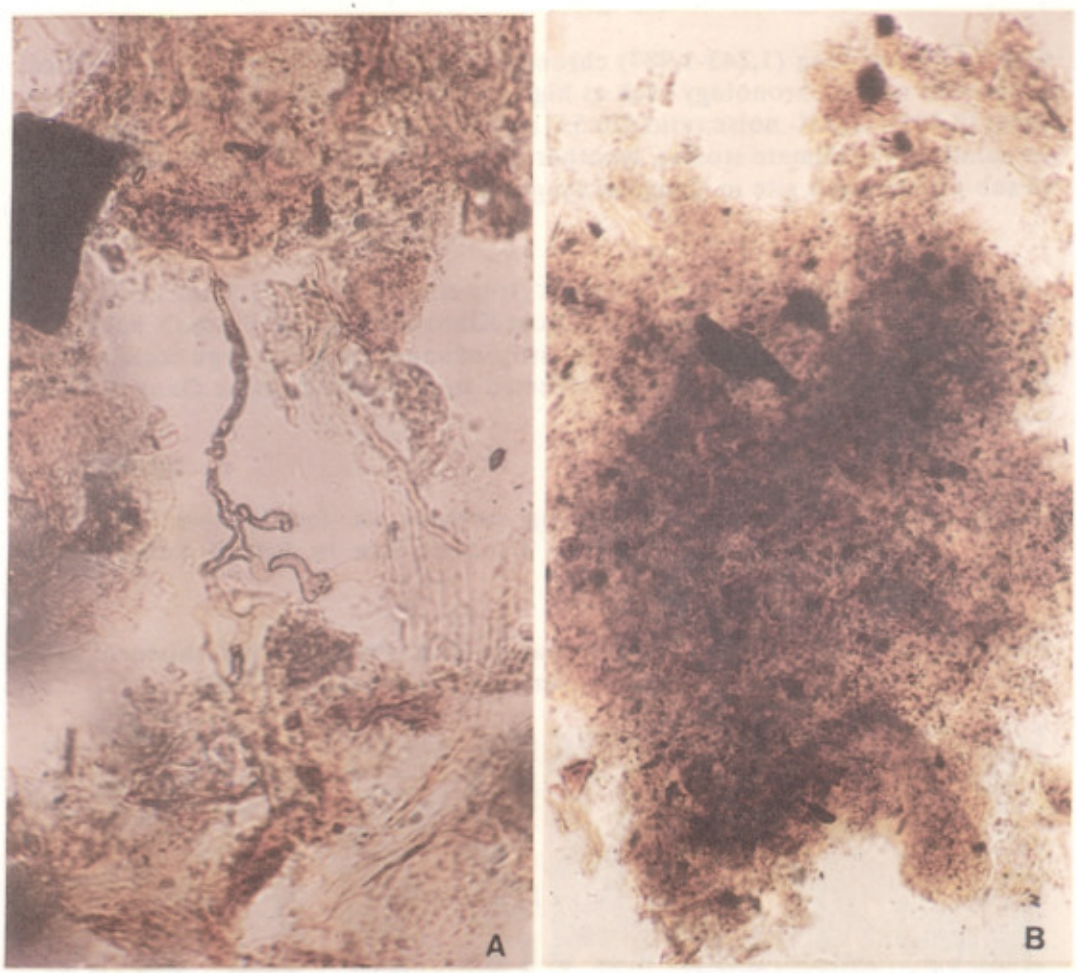
Objective : *To study palynostratigraphy and Dispersed Organic Matter analysis of the sediments from Chilka Lake in Mahanadi - Brahmani - Baitarini deltaic region in Orissa*

Palynology of 4.30 meter deep profile dated 3,800 years B.P. from Rambha on south east flank of Chilka Lake has been completed. The study has enabled to divide whole time span into two phases. The first phase between 3,800 - 2,000 years B.P. records the existence of well developed core-mangrove forest and the second phase from 2,000 years B.P. till date records the overall degradation of core-mangrove vis-a-vis uprise in the values of hinterland taxa. The arrival of *Casuarina* and *Anacardium* in relatively higher values at 700 years B.P. indicates that the anthropogenic activities were accelerated and over exploitation of natural resources began.

Asha Khandelwal and H.P. Gupta

The palynology of 3.75 meter deep profile from muddy island Nalabana within Chilka Lake was completed. It exhibited poor occurrence of both core and peripheral mangroves rather than the island was inhabited althrough its development by non-arboreals such as Poaceae, Chenopodiaceae, Cyperaceae, etc. characterizing the existence of salt-marshes.

Pollen analysed eight samples from Andaman and Nicobar Islands which exhibited poor occurrence of pollen grains. However, the core-mangrove taxa, such as *Rhizophora, Avicennia, Heritiera,* etc. are poorly represented as compared to



A, Fungal hyphae degrading the organic matter; B, amorphous organic matter after complete biodegradation.

peripheral mangrove taxa, such as *Phoenix, Salvadora*, Meliaceae, Myrtaceae, etc. *Casuarina,* hinterland and fresh water taxa are moderate while microforaminiferal test, dinoflagellate cysts, etc. showed variation in quality and quantity.

H.P. Gupta and Asha Khandelwal

Programme 7.4 : **Dendrochronology of temperate and tropical trees and seasonality of cambium activity**

Objective : *To carry out a detailed survey and preparation of a catalogue of fossil woods, producing growth-rings from Palaeozoic to Cenozoic Era in Indian subcontinent*

: *To analyse growth rings of fossil woods to understand change in productivity of trees in relation to climate during geological past*

Tree samples of *Cedrus deodara* from Harshil in Uttarkashi have been dated

and a 745 year long (1,243-1,987) chronology has been prepared. The statistical properties of the chronology such as high standard deviation (35.2), mean sensitivity (0.344), signal- noise ratio (20:53) and low auto-correlation (0.150) indicate its suitability in climate studies. Another chronology of *Pinus wallichiana* growing in sub-alpine mesic site in Gangotri ranges from 1,694 - 1,988 AD.

R.R. Yadav

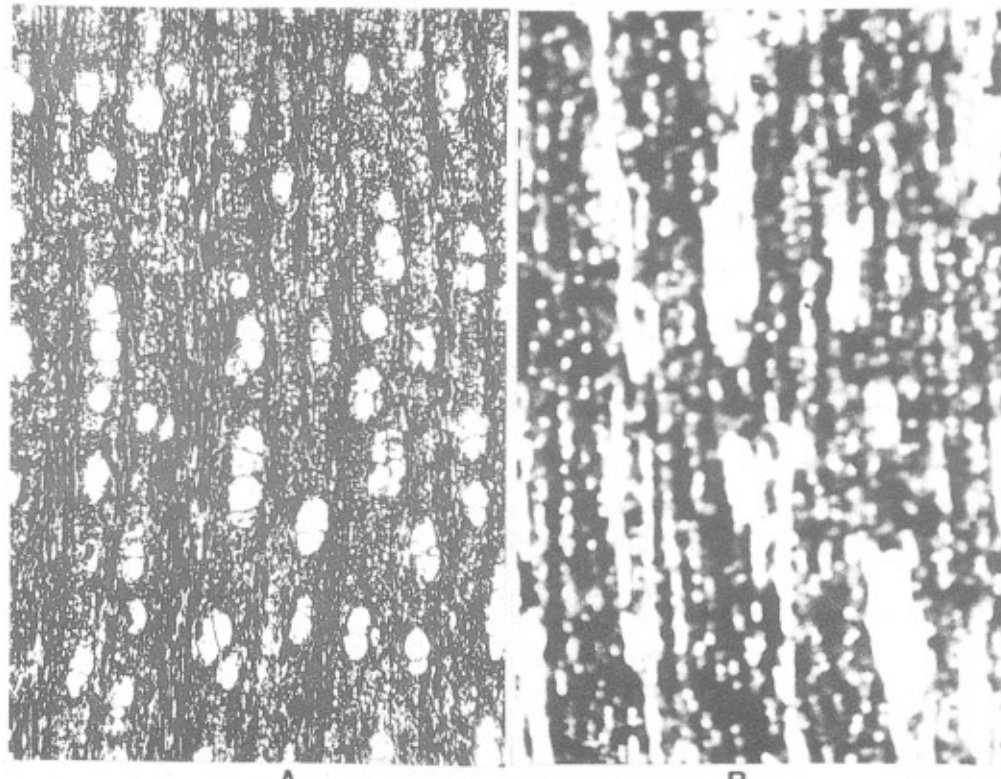
Tree ring width of eight dated cores (tree ring samples) of *Pinus wallichiana* and sixteen *Pinus gerardiana* collected from Kinnaur,Himachal Pradesh have been measured. Mounting, polishing and counting of annual rings through skeleton plot technique of six deodar tree cores collected from Bharashti near Gangotri have been completed.

A. Bhattacharya

Programme 7.5 : Growth-ring analysis in fossil wood from Palaeozoic to Cenozoic Era in Indian Subcontinent

The work was not taken up.

Programme 7.6 : Plant remains from Pre-and Proto-historic sites in northern and northwestern India



Wood charcoals of *Cannabis sativa* from Senuwar, Bihar. **A** , Cross section x 50; **B** , Tangential longitudinal section x 50.

Objective : *To study agricultural practices in context of different cultures in time and space*

: *To sketch the perspectives of ecological potential of contemporary agro-ecosystem and their contemplated further development*

: *To determine the interaction of pre-historic man with the floral wealth*

: *To reconstruct regional models of environment around the cultural settlements*

A. The charcoal remains from Neolithic-Chalcolithic site at Senuwar (ca 2,000 - 600 B.C.), Rohtas, Bihar, were studied and the details are as under :

NEOLITHIC **(ca 2,000-1,800 B.C.)**

Wood charcoals of *Madhuca indica, Capparis sepiaria, Streblus asper, Shorea robusta, Trewia nudiflora* and *Bambusa* species were identified . The occurrence of *Shorea robusta* indicates the exploitation of quality timbers by the settlers.

NEOLITHIC-CHALCOLITHIC **(ca 1,800-1,200 B.C.)**

Besides, timber-taxa from preceding phase, *Aegle marmelos, Cassia fistula, Mesua ferrea* and species of *Albizia, Acacia, Lagerstroemia* and *Ziziphus* were also encountered. Amongst these, the wood of *M. ferrea* is one of the heaviest as well as hardest timbers, which further suggests the knowledge of quality forest products.

CHALCOLITHIC **(ca 1,200-600 B.C.)**

In addition to the use of timber plants in the early two phases, *Mangifera indica, Dalbergia sissoo* and *Cedrus deodara* were also exploited as timber woods. The occurrence of hemp/bhang (*Cannabis sativa*) charcoals suggests that the settlers at this place were known with the narcotic properties of this plant.

The occurrence of pomegranate (*Punica granatum*) from Rohira, Punjab (ca. 2,000 - 1,700 B.C.) has suggested the cultivation of pomegranate in the orchard husbandry of Harappans.

K.S. Saraswat

B. The study conducted earlier on Harappan site at Shikarpur in Kutch, Gujarat (ca 2,500 - 2,200 B.C.) has been finalized. Twenty two samples from Mahorana, in Ludhiana (ca 2,100-1,900 B.C.) were processed and charcoals were investigated. This site covers a transitional phase between Pre-Harappan and Baran cultures. The study has revealed the predominance of *Acacia, Capparis, Prosopis spicigera, Tamarix, Ziziphus*,etc. The taxa recovered typify the arid condition prevailed during 4,000 years B.P. which is also synchronous to the present day condition.

Chanchala

Programme 7.7 : **Aerospora of Lucknow : its biochemical and**

clinical implications

Objective : *To daily monitor the aerospora of Lucknow and surrounding areas for their seasonal and diurnal periodicity*

: *To identify aeroallergens by biochemical and clinical investigations*

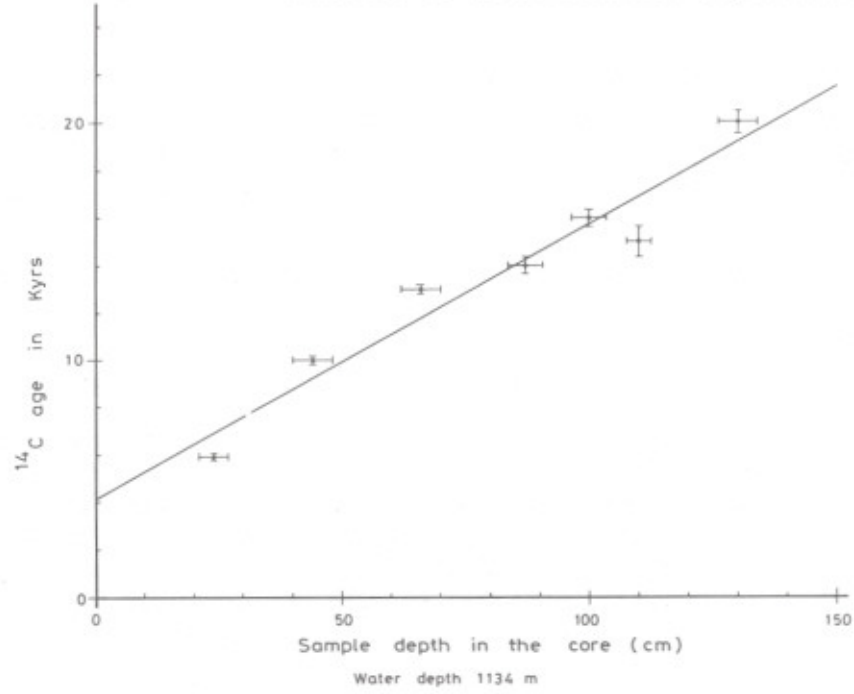
: *To enumerate biota in the aerospora both quantity-wise and quality-wise employing both gravimetric and volumetric techniques in order to achieve precision in seasonal and diurnal periodicity*

Two rain samples collected during the year 1991 (15.06.91 & 26.12.91) exhibited almost the same composition of biogenic pollutants as was recorded in the previous year at the same place. However, a few species of diatom *Gomphonema* and pollen of *Parthenium hysterophorus, Morus alba, Putranjiva roxburghii*, etc. were recorded in the year 1991. The biological degradation of pollen and spores has been recorded.

Asha Khandelwal

PROJECT 8 : GEOCHRONOMETRY OF INDIAN ROCKS

Programme 8.1 : **Radiocarbon dating of Quaternary deposits and materials of archaeobotanical importance**



Radiocarbon age vs. depth of the calcareous sediment core (SM-61) off Narcondam Island in Andaman Sea.

Objective : *To date Quaternary sediment profiles, ocean sediment cores, coastal deposits and shell deposits and Kankar horizons in the Ganga plain*

: *To establish the Liquid Scintillation Counting method for C-14 dating*

Eighty two samples were processed for radiocarbon dating which included 14 background and three standard preparations. For twenty one samples benzene was synthesized for C-14 determination using liquid scintillation counting method. Fifty samples have been dated using both the methods (viz. gas counting and liquid scintillation counting) C-14 age determination.

A fifty two metre thick Quaternary sediment profile from Bilaspur, Nainital was dated for a collaborative programme with the Kumaon University on neotectonic activity of the region. The top 20 metres is within the C-14 age range and only two samples could be dated in this interval. The sedimentation rate is highly variable. A core of lake deposit from Orissa relating to the study on the evolution of mangrove vegetation was dated to 3,470 ± 170 yrs at a depth of 3.5 m. A carbonaceous ocean-sediment core from Andaman Sea was dated using the organic fraction of the sediment. In this core the calcareous part was almost negligible. The C-14 age at a depth of 33 cm is 11,850 yrs and at 1.0 m it is 21,000 yrs. The calculated sedimentation rate is 0.73 cm/1,000 yrs which is lower than that of the predominantly calcareous core obtained from near Narcondam Island. A profile of shell deposit from the shelf region in the East Coast was dated for coastal studies. The shells at a depth of 2.1 m give an age of 33,000 ± 1,200 yrs. In addition C-14 age determinations on lake sediment profiles from Darjeeling, Garhwal and Nilgiris were carried out for palynological and palaeoclimatic studies. Four charcoal samples relating to archaeological studies from Nepal and Mesolithic culture of Kerala were dated. The Mesolithic culture of Kerala has been dated for the first time at 2,850 ± 80 yrs B.P.

The liquid scintillation method for C-14 dating has been established. Twelve samples have been dated using this method. For six samples both the gas counting and liquid scintillation counting methods were employed. The C-14 ages in both the cases are in very good agreement.

G. Rajagopalan

Programme 8.2 : **Fission-Track dating of minerals and fossil materials**

Objective : *To carry out Fission-Track dating of glauconite from Vindhyan Supergroup and other equivalent formations*

: *To attempt Fission-Track dating of petrified wood from the Deccan Intertrappean beds*

: *To carry out Fission-Track dating of check samples and International standard samples*

The Auto Scan system for the fission track scanning and track density determination was installed in the BH2 microscope. The stage movement, counting of tracks and area scanned are controlled and recorded by the software in the PC attached to the Auto Scan system. The stage stepping and grid stepping softwares controlling the stage and programs for F-T age calculation were thoroughly checked using glauconite and petrified wood samples of known age.

The glauconite sandstone samples collected from Jhlawar area were processed for separation of glauconite grains. Fossil Track density has been determined for some of them. Glauconite grains from all the samples have been sent for neutron irradiation to BARC.

Petrified wood samples collected from Deccan Intertrappean beds have been dated using the Auto Scan System; the F-T ages of petrified woods from different localities near Shahpura in Mandla District, M.P. are Ghughua: 57 ± 8 Ma, Umaria: 56 ± 7 Ma, Silther: 53 ± 9 Ma, Parapani: 54 ± 7 Ma and Mehdwani: 58 ± 8 Ma.

A.P. Srivastava

Programme 8.3 : **Potassium-Argon dating of sedimentary and igneous rocks**

Objective : *To date the glauconitic sandstone from Vindhyan deposits in U.P. and Rajasthan*

: *To date the Deccan Trap samples and synthesize the data with fossil studies in collaboration with Cenozoic Department*

: *To develop data acquisition and reduction system*

Considering the relationship between glauconite maturity and their suitability for dating by K-Ar systematics, a detailed sample preparation and analysis programme has been initiated. A number of samples (glauconitic) were subjected to magnetic, heavy liquid and microscopic observation based separation. Two of these samples were subjected to XRD analysis. Thin sections of two Deccan Trap samples were prepared. Work on the analyser and control unit and analysis by Anavac were continued.

C.M. Nautiyal

PROJECT 9 : ANNOTATED ATLASES, CATALOGUES, MONOGRAPHS AND BOOKS

Programme 9.1 : **Data bank for Palaeozoic-Mesozoic palynolgy, using Expert System and compilation of catalogues, atlases and other palynological information**

Objective : *To index and update new data into the existing data banks*

: *To develop data-base for distribution of stratigraphically important taxa*

: *To establish data-base for identification and retrieval of palynotaxa*

Updation of data bank for Palaeozoic and Mesozoic palynology and related aspects has been done.

(Group effort PGGP Department as per Programme of Work)

For finer zonations of Permian to Early Cretaceous assemblages the species range charts have been prepared for Damodar and Rajmahal Basin. On the basis of FADs, LADs and species composition ninteen Marker Assemblage-zones of spore-pollen species have been proposed. Besides,thirty species Acme-zones have been recognised on the basis of epibole of number of species in a genus

R.S.Tiwari and Archana Tripathi

Species range charts have been prepared for Early Permian horizons in Talcher Coalfield.

Archana Tripathi

Programme 9.2 : **Gondwana flora of India**

Objective : *To write a reference book on the Gondwana plants*

Compilation of data on Lower Gondwana ferns is being finalized.

S. Chandra

Compilation of data on Upper Gondwana marattiaceous, matoniaceous, gleicheniaceous, schizaeaceous, osmundaceous and dipteridaceous remains has been done.

Jayasri Banerji

Programme 9.3 : **A catalogue of fossil dinoflagellates from India**

Objective : *Morphological re-interpretation and documentation of published data*

The restudy of holotypes of eighteen "algal microplankton" taxa, described from Matanomadh Formation (Palaeocene) of Kutch by Kar and Saxena (1976) and from Palana lignite (Eocene) of Bikaner, Rajasthan by Sah and Kar (1974) has revealed that most of them are based on biodegraded pieces of organic debris of unidentifiable nature. They do not show any features of organic-walled dinoflagellate cysts or acritarchs. Two "Microplankton" species, viz., *Octoplata palanaensis* Sah & Kar (1974) and *O. rotunda* Sah & Kar (1974) are based on a trilete spore and an angiospermous pollen respectively. Whereas *Leioplanktona madhensis* Kar & Saxena (1976) appears to be a mineral grain. It is recommended that these so called "microplankton" taxa must be rejected and should not be considered for any palynostratigraphic analysis.

K.P. Jain, Rahul Garg and Khowaja-Ateequzzaman

Programme 9.6 : **An Atlas of angiospermic pollen taxa from**

the Indian Tertiary sediments

Objective : *To evaluate all published taxa and to identify valid taxa for use in stratigraphical and palaeoecological studies*

: *To circumscribe and delineate the valid taxa*

Holotypes and other specimens of selected Indian Tertiary pollen have been studied.

R.K. Saxena

A taxonomic assessment of 38 monocolpate and tricolpate Indian Tertiary genera was completed.

S.K.M. Tripathi and Madhav Kumar

A critical morphotaxonomic study of tricolpate angiosperm pollen taxa (31 genera and 94 species) from the Indian Tertiary sediments has been completed.

J.P. Mandal and M.R. Rao

Critical morphotaxonomic evaluation of selected porate pollen grains, viz., *Cryptopolyporites, Varispinitriporites, Thymelaepollis, Rarispinitriporites, Semitectotriporites, Myricipites*, and *Polyporina* was carried out.

Samir Sarkar

More than 400 genera and 1000 species of angiosperm pollen have been described from the Tertiary sediments of India. A large number of these taxa have been proposed and described on the basis of one or few specimens and meagre morphological differentiation based on insignificant criteria. Thus their usefulness is limited. The holotypes, paratypes and other specimens available at the repository of the Birbal Sahni Institute of Palaeobotany, have been restudied, critically evaluated and their morphological limits circumscribed to make them more useful and applicable for age determination and stratigraphic correlation as well as for palaeoenvironmental interpretations with emphasis on their affinity with extant taxa.

B.S. Venkatachala, R.K. Saxena, H.P. Singh, R.K. Kar, S.K.M. Tripathi, M. Kumar, S. Sarkar, J.P. Mandal, M.R.Rao, R.S. Singh, B.D. Mandaokar and K. Ambwani

Programme 9.7 : **Patterns of leaf architecture and cuticle in some tropical dicotyledonous families**

Objective : *To study leaf architecture and cuticle of some tropical angiospermous families : Magnoliaceae, Annonaceae, Dilleniaceae, Combretaceae, Lauraceae, Myrtaceae and Fabaceae*

Leaves of *Magnolia saulangiana* Hort, *M. compbellii* Hook. f. & Thoms., *M. globosa* Hook. f. & Thoms, *M. hypoleuca* SZ., *M. maingayi* King, *M. candollii* (Bl.) H. Keng. var. *Candollii, M. candollii* (Bl.) H. Keng. var. *obovata* (Korth) Noot,

Michelia velutina DC., *M. cathcartii* Hook. F., *M. kisopa* Buch-Ham ex DC. and *M. nilagirica* Zenk were processed. Slides of their cuticle and mounts of leaf venation pattern were prepared. Morphology, venation pattern and cuticular feature were described. The leaf architectural pattern and cuticular feature are constant within a species. It is therefore inferred that these features are useful taxonomic characters in the Magnoliaceae family.

D.C. Saini

Programme 9.8 : **Inventory of Type and Figured palaeobotanical specimens/slides (megafossils) available with Repository of BSIP Museum**

Objective : *Publication of inventory and a guide book to the BSIP Museum*

Published Type and Figured specimens at the repository - An inventory Part I, 1991.

G.P. Srivastava

Programme 9.9 : **Catalogue of Indian Fossil Plants 1971-1990**

Objective : *To prepare an inventory of plant micro- and megafossils reported from Indian sedimentary sequences during the period 1971-1990*

: *To publish the inventory as a Birbal Sahni Centenary contribution*

'A Catalogue of Fossil Plants from India' in 11 fascicules was published.

Part-1 : Archaean and Proterozoic Palaeobiology

Manoj Shukla and Rajendra Bansal

Part-2 : Palaeozoic and Mesozoic Megafossils

Shaila Chandra and Rajni Tewari

Part-3 : A. Palaeozoic and Mesozoic spores and pollen

Suresh C. Srivastava

B. Palaeozoic and Mesozoic megaspores
Rajni Tewari

Part-4 : Cenozoic (Tertiary) Megafossils

Rashmi Srivastava

Part-5 : Cenozoic (Tertiary) A. Spores and Pollen

B. Fungi
R.K. Saxena

Part-6 : Cenozoic (Quaternary) Palynology and Palaeobotany

M.S. Chauhan

Part-7 : Dinoflagellates

Khowaja-Ateequzzaman

Part-8 : Diatoms and Silicoflagellates

Anil Chandra

Part-9 : Nannoplankton

Jyotsana Rai

Part-10 : Calcareous Algae

A. Rajanikanth

Part-11 : Archaeobotany

Chanchala

Programme 9.10 : **Four Decades of Indian palaeobotany : A critical assessment 1950-1990**

Objective : *To critically analyse and evaluate palaeobotanical data generated during the period 1950-1990 for synthesis and review*

: *To compile state-of-the-art reports on selected themes*

: *To publish a compendium as a Birbal Sahni Centenary contribution*

Knowledge on the palaeobotanical and palaeopalynological data generated mostly during the post-Sahni Era has been synthesised and futuristic trends has been discussed. The proceedings volume of the symposium — Four Decades of Indian Palaeobotany is in press. The following research papers were presented by the Institute scientists in the Symposium held during November, 1991 :

P.K. Maithy : Palaeobiology of the Vindhyan sediments

B.S. Venkatachala, Manoj Shukla & Mukund Sharma : Metaphyte and Metazoan fossils from Precambrian sediments of India — a critique

H.K. Maheshwari : Provincialism of Gondwana floras

Anil Chandra : Fossil diatoms and their significance

K.P. Jain, Rahul Garg & Khowaja-Ateequzzaman : Fossil dinoflagellate cysts: an emerging tool in Indian biostratigraphy

Shaila Chandra : Changing patterns of the Permian Gondwana

Vegetation

A.K. Srivastava	: Alien elements in the Gondwana flora of India
Usha Bajpai	: Morphological trends on the Gondwana plants
Jayasri Banerji	: Life and time of *Williamsonia*
Shyam C. Srivastava	: Triassic flora of India — transition
M.B. Bande	: Palaeogene vegetation of Peninsular India
J.S. Guleria	: Neogene vegetation of Peninsular India
N. Awasthi	: Changing patterns of vegetation through the Neogene Siwalik succession
Vijaya	: Evolutionary trends in saccate pollen during the Gondwana
Suresh C. Srivastava	: Permian palynological assemblage in the Godavari Graben
R.S.Tiwari & Archana Tripathi	: Palynofossil assemblages through the Indian Gondwana (marker assemblages)
R.S. Tiwari	: The northern extension of the Indian Gondwana — a palynological approach
H.P. Singh	: Tertiary palynofossils and the Himalayan orogeny
R.K. Kar	: Stratigraphical implications of Tertiary palynological succession in the north- eastern and western India
R.K. Saxena	: Neyveli lignites and associated sediments, their palynology, palaeoecology and correlation with the west-coast lignites
H.P. Gupta	: Changing pattern of vegetation in the intermontane Kashmir Basin since 3 my : a palynological approach
Chhaya Sharma	: Palaeoclimatic oscillations since last deglaciation in western Himalaya : a palynological assay
Asha Khandelwal	: Holocene history of mangrove vegetation in India — a palynological interpretation
K.S. Saraswat	: Plant economy in relation to socio- economic evolution in ancient India
A. Rajanikanth	: Rock building calcareous Cretaceous- Tertiary algae from India — an ecological perspective
S.A. Jafar	: Calcareous nannoplankton in Indian basins — problems and potentials

B.K. Misra	: Genesis of Indian Tertiary coals and lignites
Anand Prakash	: Himalayan coals — their nature, formation, composition and rank
G.K.B. Navale	: Temporal and spatial variation of Gondwana coals —organic petrographic analysis

Sponsored Projects

S.P. 2 : **Studies of palaeoclimates through the application of palaeobotanical methods (DST No. ES/63/028/86)**

Objective : *To reconstruct regional palaeogeography and terrestrial palaeoenvironmental history of the Quaternary Period with special reference to Holocene*

Completed pollen analysis of a 1.3 meter deep profile from Mirik Lake (^{14}C dated to ca 18,000 years B.P.), Darjeeling. The study has revealed the dominance of non-arboreals over arboreals. The sparse arboreal vegetation mainly consists of *Quercus* followed by *Alnus, Betula, Salix* and *Rhododendron*. The herbaceous vegetation is dominated by grasses. Cheno/Ams, sedges, Asteraceae, etc. are also prominent constituents.

Pollen analytical investigation of a 1.5 meter deep profile from Jore-Pokhari, Darjeeling has depicted equal representation of arboreals as well as non-arboreals. The good representation of *Quercus* followed by *Corylus, Betula, Alnus, Rhododendron*, etc. indicates the presence of mixed Oak forest in the region. Grasses together with sedges, Asteraceae, Cheno/Ams, Caryophyllaceae and Ranunculaceae are the chief representatives of non-arboreal vegetation. Fern spores are in abundance throughout the sequence.

Pollen analysis of 18 samples from BMT/GJR-II Quaternary Section, Bilaspur has revealed the dominance of non-arboreals over arboreals. Arboreals are few and scantily represented by *Quercus, Alnus, Betula, Celtis, Ulmus*, etc. The non-arboreal vegetation is characterised by the frequent occurrence of Poaceae, Cyperaceae, Ranunculaceae, *Polygonum* and Asteraceae.

Chhaya Sharma, M.S. Chauhan and M.C. Pant

Work other than Programmes

Organic petrology and spontaneous combustion susceptibility of coals / lignites

Liptinite macerals in the coals, generally masked by the mineral (inorganic) matter, are most significant in relation to the economical and depositional aspects of the Permian coals. Under blue light excitation, these macerals (up to 57 %) in Singrauli coals show manifold increase. Also made first authentic record of *Botryococcus* algae (alginite) from the coals. A paper on these features has been presented at the Palaeobotanical Conference, Lucknow.

A scheme for indexing spontaneous combustion susceptibility of Indian coals and lignites has been proposed, which incorporates most of physical, chemical and petrological factors recognized to have induced spontaneous heating process. It is also realized that these factors have only relative significance in their complex inter-relationships, not presently understood, and there may be some other potent factors not identified, as yet, in Indian conditions.

B.K. Misra and B.D. Singh

The coal fire data and its various implications have been studied from India, Canada, Germany, Netherlands and western U.S.A. It has shown that this problem is more prevalent in most of the coalfields having low rank coals in the world. The various facets of this problem particularly the role of resin material and fluorescing vitrinite, besides other factors were dealt in a keynote address " Coal fire — a global challenging frontier ", delivered at XII International Congress on Carboniferous and Permian Stratigraphy and Geology (ICCP), Buenos Aires, Argentina. Manuscript has been finalized and submitted for publication.

A biopetrological study of some resin samples from U.S.A. is being carried out. It has indicated that the kauri resin is more brittle in nature as compared to the resinous material of Eocene age. The fluorimetric study is in progress.

Rakesh Saxena

Morphological evolution of pteridophytic spores in relation to aquatic environment was analysed. It was observed that the aquatic ferns are mostly heterosporus with trilete mark. They evolved in Lower Cretaceous and except *Azolla* and *Salvinia* all of them became extinct in Late Maastrichtian. The common genera are : *Arecellites, Molaspora, Balmeisporites, Ariadnaesporites, Glomerisporites, Parazolla, Azolloposis, Azolla* and *Salvinia*. The morphological evolution and adaptation of these genera in relation to aquatic environment is discussed.

R.K. Kar

Studied the pollen morphology (L.M. and SEM) of coryphoid palm genus *Licuala* Wurmb (9 species) and its phylogenetic relationship with other palm genera.

Studied the pollen morphology (SEM only) of *Pseudophoenix* — *P. ekmanii, P. sargentii* and *P. vinifer.*

Studied the pollen morphology and aperture evolution in *Agave* Linn. (Agavaceae). It is observed that the transition of developmental stages in aperture, e.g., monosulcate, bisculate, pont-operculate and anazonosulculate are exhibited by this single genus.

K. Ambwani and Madhav Kumar

One meter deep sediments from Kathuta Tal, ranging in age between ca 200-400 years B.P., were pollen analysed. The study has exhibited good pollen assemblage albeit non-arboreals predominated. The arboreal taxa encountered from sediments are *Holoptelea, Acacia, Capparis,* Combretaceae, Myrtaceae, Malvaceae, etc. and their collective frequencies range between 3-15 per cent of the total assemblage. The ground vegetation is largely dominated by grasses and followed by Chenopodiaceae, Asteraceae, *Alternanthera*, etc. *Polygonum plebejum*, *Eriocaulon*, Cyperaceae, Apiaceae, etc. inhabited the marshyland along the lake margins and *Lemna, Potamogeton, Eichornia, Nymphaea, Nymphoides*, etc. inhabited the lake water. The study has revealed that tree-less conditions prevailed around the lake and crop cultivation was on its peak. The lake had wider spread in the past which was congenial for aquatic and marshy life.

M.S. Chauhan, Asha Khandelwal, S.K. Bera and H.P. Gupta

The study reveals high pollen production in *Shorea robusta* whereas low percentage of sal pollen is recorded in surface soils within the forest and gradually declines across the open land.

S.K. Bera

Yellow spots collected from plant leaves in Vikas Nagar, Lucknow during February, 1992 were pollen analysed and found more or less similar pollen composition as during the previous year. However, several additional taxa belonging to Apiaceae and Asteraceae were reported.

Asha Khandelwal and H.P. Gupta

One meter core from Andman Island has been palynologically investigated . Pollen, spores, diatoms and dinoflagellate cysts have been recorded.

H.P. Gupta and Asha Khandelwal

Subathu Formation exposed in Koshalia Nala Section of Shimla lesser Himalaya has been studied. Detailed documentation of Early Eocene taxa including K/T boundary nannofossil species are recorded.

S.A. Jafar and O.P. Singh

Worked out 35 rock samples of Nupra Shale sequence (Jurassic), Thakkola area, Nepal, for dinoflagellate contents, under the "International Earth Science Expedition Lost Ocean II in the Plate Tectonic suture zone between Nepal and Tibet"

K.P. Jain, Rahul Garg and Khowaja-Ateequzzaman

A well preserved and datable Palaeocene dinoflagellate cyst assemblage is discovered from an outcropping carbonaceous shale sequence overlying the Deccan Traps near Nareda, south-western Kutch as well as from Lakhpat subcrop. This is extremely significant as age of the earliest Palaeogene clastic sequence in Kutch has generated much controversy in recent years because existence of Palaeocene - Early Eocene rocks dated earlier on foraminiferal and bivalve evidence has often been denied based mainly on a "false identification" criteria.

Rahul Garg

The distribution of pteridophytic spores in the Tertiary sediments of India has been critically analysed. One hundred and fifty fossil spore genera have been studied to understand their morphological range of variation. They have been compared with the spores of extant taxa. A range chart of pteridophytic spores incorporating data from the Tertiary strata of India has been prepared.

Samir Sarkar

Palynological and palaeoecological study of the Kundlu and Nalagarh formations pertaining to Lower Siwalik sediments (Mid- Miocene) exposed in and around Kundlu has been made. Palynological evidences coupled with plant megafossil records have been used to reconstruct the history of the vegetation of this area. Two distinct palynoassociations have been identified. Palynoassociation I characterises the entire Kundlu Formation which extends into the lower part of the younger Nalagarh Formation. It exhibits the exclusive presence of *Cosmarium, Pediastrum* along with high incidence of *Ceratopteris, Lycopodium* and *Polypodium*. Palynoassociation II is characterised by the presence of *Pinus, Podocarpus, Acacia, Dipterocarpus*, etc. and is confined to the upper part of Nalagarh Formation. Angiospermous pollen register a dominant position in this assemblage whereas the algal elements sharply decline. The present palynoflora augumented by megafossil evidences brings to light a broad leaf type of vegetation conforming to warm humid climate with tropical to subtropical distribution.

Samir Sarkar and H.P. Singh

During floristic survey of Mahuadanr Valley (Chhechari Valley) which is situated in Chotanagpur plateau region of south Bihar in Palamau District, some angiospermic plants have been collected from different localities in the area for reference collection. 94 species have been identified. Leaf impressions of each species have been prepared in order to understand the morphology of fossil plant leaves. The vegetation of the area is tropical deciduous type. Sal is the dominant species in the forest.

The study of sedge flora has long been neglected possibly because of its minute grass-like appearance and complicated floral morphology. There are some members in the family Cyperaceae which play major role in soil reclamation and prevention of soil erosion. 96 species belonging to 8 genera of Cyperaceae family have been collected from eastern Uttar Pradesh. The area includes the districts of Bahraich, Gonda, Basti, Gorakhpur and Deoria. A key for identification of plant

remains based on field and herbarium studies, is prepared. Importance has been given to the nut morphology, stigma, number of stamens and inflorescence characters.

D.C. Saini

International Geological Correlation Programmes

I.G.C.P. Project No. 216 : **Global biological events in Earth history**

K.P. Jain
Member, National Working Group

I.G.C.P. Project No. 237 : **Floras of Gondwanic continents**

H.K. Maheshwari
Co-convener, National Working Group
R.S. Tiwari
Member, National Working Group

I.G.C.P. Project No. 245 : **Non-marine Cretaceous Correlation**

K.P. Jain
Member, National Working Group

I.G.C.P. Project No. 261 : **Stromatolites and their biostratigraphic significance**

P.K. Maithy
Member, International Working Group
Manoj Shukla
Member, National Working Group

I.G.C.P. Project No. 303 : **Precambrian-Cambrian event stratigraphy**

P.K. Maithy
Member, National Working Group

I.G.C.P. Project No. 320 : **Neo-proterozoic events and resources**

B.S. Venkatachala
Member, International Working Group
Manoj Shukla
Member, International Working Group

Global Sedimentary Geology Programme (IUGS)

Cretaceous Resources / Events and Rhythms (CRER)

K.P. Jain
Member, National Working Group

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Ambwani, K. & Kumar, M. — Occurrence of vicin threads in *Daemonorobs ruber* Bl, Palmae. *Phytomorphology.*

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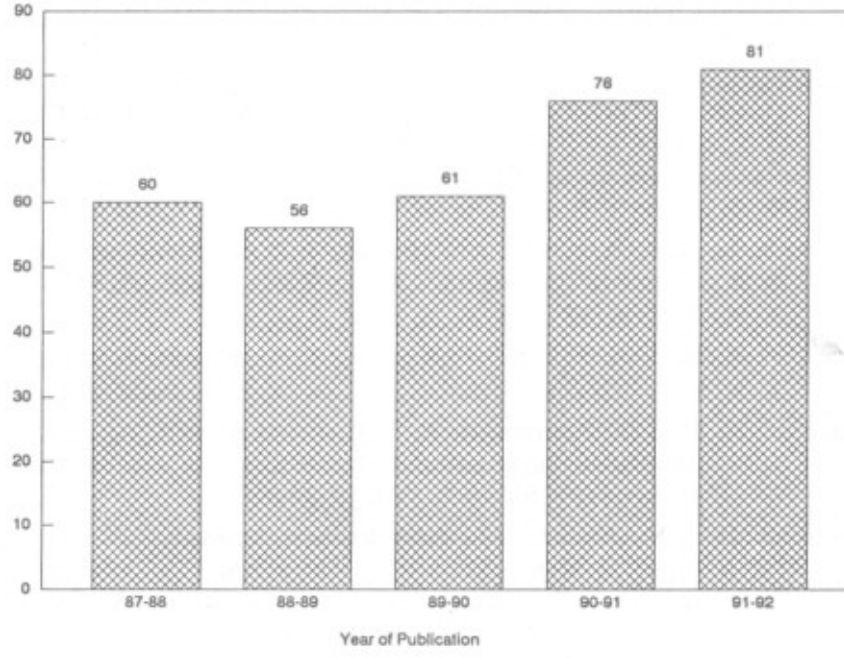

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Khandelwal, Asha 1991. Airborne diatoms at Lucknow, India. *6th Nat. Aerobiological Conf., Pondicherry* : 80.

Khandelwal, Asha & Gupta, H.P. 1991. Palynological evidence of mangrove degradation during mid-Late Holocene at Rambha, Chilka Lake, Orissa. *6th Nat. Aerobiological Conf., Pondicherry* : 66.

Khowaja-Ateequzzaman 1991. Some new dinoflagellate cyst taxa from Cretaceous of Cauvery and Palar Basins, southern India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 67.

Khowaja-Ateequzzaman & Jain, K.P. 1991. Hauterivian-Barremian dinoflagellate cyst assemblage from subsurface of Palar Basin, Tamil Nadu, southern India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP,*

Lucknow : 68.

Maheshwari, H.K. 1991. Provincialism in the Gondwana Flora. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow.*

Maheshwari, H.K. 1991. Palaeogeographic implications of the occurrence of palynofossil *Marsupipollenites* in the Late Permian sediments of South Rewa Gondwana Basin. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow.*

Maheshwari, H.K. & Jana, B.N. 1991. Palynostratigraphy of the Mesozoic sedimentaries of the Kutch Basin. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 76-77.

Maheshwari, H.K. & Srivastava, A.K. 1991. The glossopterid group of plants in an evolutionary perspective. *Symposium, Evolutionary Plant Biology, BSIP, Lucknow.*

Maithy, P.K. 1991. Palaeobiology of Vindhyan sediments. *Symposium, Four Decades of Indian Palaeobotany ,BSIP, Lucknow* : 41

Mandal, J. 1991. Palynofossils of Barail sediments from Nagaland : their age and palaeoenvironment. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 78.

Mandaokar, B.D. 1991. Fungal remains from Jeypore Colliery, Tikak Parbat Formation, Assam, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 79.

Misra, B.K. 1991. Genesis of Indian Tertiary coals and lignites. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow* : 42-43.

Misra, B.K. & Singh, B.D. 1991. Liptinite macerals in Singrauli coals : characterization and assessment. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow :* 82.

Navale, G.K.B. 1991. Temporal and spatial variation of the type and rank of Gondwana coals. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow* : 44-45.

Pinto, I.D., Maheshwari, H.K. & Srivastava, A.K. 1991. Occurrence of blattoid insects in the Gondwana flora of South America and India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow.*

Prakash, Neeru 1991. New additions to the flora of Jabalpur Formation. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow.*

Prasad, M. 1991. Plant megafossils in the Siwalik sediments of Hardwar, Uttar Pradesh and their bearing on palaeoclimate and phytogeography. *Birbal Sahni Birth Centenary Symposium, Siwalik Basin, WIHG, Dehradun.*

Rajanikanth, A. 1991. Rock building calcareous Cretaceous-Tertiary algae from India - an ecological perspective. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow* : 49.

Ram-Awatar 1991. Palynological dating of Pali Formation in Sohagpur Coalfield (M.P.), India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 104.

Rao, M.R. & Rajendran, C.P. 1991. Palynological investigations of Tertiary lignite and associated sediments from Cannanore, Kerala Basin. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 108.

Sahni, A., Venkatachala, B.S., Kar, R.K., Rajanikanth, A., Prakash, T., Prasad, G.V.R. & Singh, R.Y. 1991. New palynological data from the Deccan Intertrappeans : implications for the latest record of dinosaurs and synchronous initiation of volcanic activity in India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 110.

Saraswat, K.S. 1991. Archaeological plant remains in ancient cultural and socio-economical dynamics of the Indian sub-continent. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow* : 50.

Sarate, O.S. 1991. Palynological investigation of Bijori sediments from the type area in Satpura Basin. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 112.

Sarkar, Samir 1991. Diversity of pteridophytic spores in the Tertiary strata of India and their extant relationship. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 113.

Sarkar, Samir & Singh, H.P. 1991. Palaeoecology of the Siwalik palynofloras from Kundlu and adjoining areas, Himachal Pradesh, India. *Birbal Sahni Birth Centenary Symposium on the Siwalik Basin, WIHG, Dehradun* : 37.

Saxena, R. 1991. Coal fire - a global challenging frontier". *In Proceedings XII ICCP, Buenos Aires, Argentina.*

Saxena, R. 1991. Geological and biostratigraphical studies of Barakar (Permian) sediments in West Bokaro Basin, Bihar, India. *Proceedings XIII CCP, Buenos Aires, Argentina.*

Saxena, R.K. 1991. Neyveli lignites and associated sediments: their palynology, palaeoecology, correlation and age. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow* : 53-54.

Sharma, Chhaya 1991. Palaeoclimatic oscillations since last deglaciation in western Himalaya : a palynological assay. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow.*

Sharma, Chhaya & Chauhan, M.S. 1991. Fine resolution pollen analysis of Late-Holocene sediments from Kumaon Himalaya. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow.*

Sharma, Chhaya & Chauhan, M.S. 1991. Pollen analytical interpretation of vegetation and climate during the past 4,000 years in Kumaon Himalaya. *XIII INQUA Congress, Beijing, China.*

Sharma, Chhaya, Chauhan, M.S., Pant, M.C. & Singh, B. 1991. Modern pollen rain study from Sikkim, eastern Himalaya. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 116.

Sharma, Chhaya & Gupta, Asha 1991. LM and SEM pollen studies of Indian Alangiaceae and distribution in the past. *XIII INQUA Congress, Beijing, China* : 325.

Sharma, Mukund, Shukla, Manoj & Venkatachala, B.S. 1991. Metaphyte and Metazoan fossils from Precambrian sediments of India : review and revision. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow* : 60-61.

Sharma, Mukund 1991. *Casserolia sahnii* : a new Archaean tidal pool stromatolite from Chitradurga Group, Dharwar Craton, India and its significance. *Earth-system Science* : 18.

Shukla, Manoj & Sharma, Mukund 1991. Indian Precambrian palaeobiology : goals and gaps. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 120.

Singh, H.P. 1991. Tertiary palynofossils and the Himalayan orogeny. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow* : 62-65.

Singh, H.P. & Sarkar, Samir 1991. Palynology and palaeoecology of Eocene sediments around Garkhal, Himachal Pradesh, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 123.

Singh, R.S. 1991. Diversity of *Nypa* since Late Cretaceous in the Indian sub-continent. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 125.

Srivastava, A.K. 1991. Evidence of fungal parasitism in the Glossopterid flora of India. *XII int. Cong. Carb. Perm. Strat. Geol, Buenos Aires.*

Srivastava, A.K. 1991. Alien elements in the Gondwana flora of India. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow.*

Srivastava, A.K. 1991. Lower Permian plant fossils from Auranga Coalfield, Bihar. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow.*

Srivastava, A.K., Maheshwari, H.K, & Bajpai, Usha 1991. Taxonomy of the cordaitalean type leaves from the Gondwana Supergroup. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow.*

Srivastava, A.P. & Rajagopalan, G. 1991. Radiometric ages of Vindhyan glauconitic sediments exposed at and around Sidhi, M.P. *VII Natl. Conf. on Particle track detectors, Defence Laboratory, Jodhpur. Oct. 9-11.*

Srivastava, A.P. & Rajagopalan, G. 1991. F-T dating of petrified woods from Deccan intertrappean beds exposed at and around Shahpura, Madhya Pradesh. *VII Natl. Conf. on Particle track detectors, Defence Laboratory, Jodhpur. Oct. 9-11.*

Srivastava, G.P., Bande, M.B. & Mishra, V.P. 1991. Further contribution to the Late Cenozoic Flora of Mahuardnr, Palamau District, Bihar. *Birbal Sahni Institute of Palaeobotanical Conference, BSIP,* Lucknow.

Srivastava, Shyam C. 1991 Triassic flora of India : a transition. *Proceedings of Symposium on Four Decades of Indian Palaeobotany, BSIP, Lucknow.*

Srivastava, Shyam C. & Manik, S.R. 1991. Taxonomic diversity of Triassic seeds from India. *8th International Gondwana Symposium, Hobart, Tasmania (Australia) - 1991.*

Srivastava, Shyam C. & Manik, S.R. 1991. Reconsideration of *Savitrispermum. Prodings of Birbal Sahni Birth Centenary Palaeobotanical Conference, Lucknow.*

Srivastava, Suresh C. 1991. Permian palynological assemblages in Godavari Graben. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow* : 70-71.

Srivastava, Suresh C. & Bhattacharyya, A.P. 1991. Palynofossils in coal balls from West-Siang District, Arunachal Pradesh, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 133

Srivastava, Suresh C. & Jha, Neerja 1991. Palynostratigraphy of Permian sediments in Manuguru area, Godavari Graben. *Birbal Sahni Birth Centenary Paleobotanical Conference, BSIP, Lucknow* : 134.

Srivastava, Suresh C. & Jha , Neerja 1991. Palynostratigraphy of Lower Gondwana sediments in Chintalpudi sub-basin, Godavari Graben, Andhra Pradesh. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* :135.

Tewari, Rajni 1991. Important identifying characters for Gondwana megaspores : a critical review. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow.*

Tiwari, R.S. 1991. Permo-Triassic in Indian Gondwana : a mass extinction or high turnover of palynoclads. *Symposium Triassic Stratigraphy, Lausanne* : 29

Tiwari, R.S. & Ram-Awatar 1991. A palynoassemblage from Mahadeva Formation in Nidpur area, Madhya Pradesh. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 143.

Tiwari, R.S. & Tripathi, Archana 1991. Marker Assemblage-zones of spore pollen species through Indian Gondwana Sequence. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow* : 74-76.

Tiwari, R.S., Vijaya & Meena, K.L. 1991. Palynological sequence and relationship of sub-surface Permian Triassic sediments in eastern Raniganj Coalfield, West-Bengal, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 144.

Tripathi, Archana 1991. Advent of angiospermous pollen in India and its spatial relationship in Gondwanaland.*VIII International Symposium Gondwana Geology, Geophysics & Mineral Resources, Tasmania, Australia* : 82

Tripathi, Archana 1991. Palynosequence in subsurface Permian sediments in Talcher Coalfield, Orissa, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 146.

Tripathi, S.K.M. 1991. Early Tertiary palynology of the subsurface near Kapurdi, Barmer District, Rajasthan. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 149.

Trivedi, G.K. 1991. Palynology of the Kopili Formation (Upper Eocene) in the type area, Khorungma, Assam, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 150.

Venkatachala, B.S., Kar, R.K., Rajanikanth, A. & Ly, A. 1991. Palynology of the Cretaceous-Tertiary transition in an Atlantic bore core no. CM5 off Senegal, West Africa. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 153.

Venkatachala, B.S., Kar, R.K., Suchindan, G.K., Ramachandran, K.K. & Kumar, M. 1991. Study on the sedimentary facies, spores - pollen and palynodebris of mud bank and Vembanad Lake, Kerala. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 154.

Vijaya 1991. Palynological synchroneity of events at Permo-Triassic boundary in terrestrial deposits of India. *Symp. Triassic Stratigraphy, Lausanne, 1991*: 59.

Vijaya & Tiwari, R.S. 1991. Morpho-evolutionary biohorizon-stratigraphy and relation cladistics in saccate pollen through Gondwana sequence of India. *Symposium, Four Decades of Indian Palaeobotany, BSIP, Lucknow* : 77-78.

Yadav, R.R. 1991. Tree ring research in India : an overview. *Symposium, Four Decades of Indian Palaeobotany* : 79.

Yadav, R.R. & Karpavichus, J. 1991. Tree ring evidences of Little Ice Age from the northern Russian Forest borders. *Birbal Sahni Birth Centenary Palaeobotanical Conference, BSIP, Lucknow* : 159.

Field Excursions

Anand-Prakash & Saxena, R.

An excursion to Talcher Coalfield was undertaken for collection of coal samples for biopetrological investigations.

Awasthi, N. & Srivastava, Rashmi

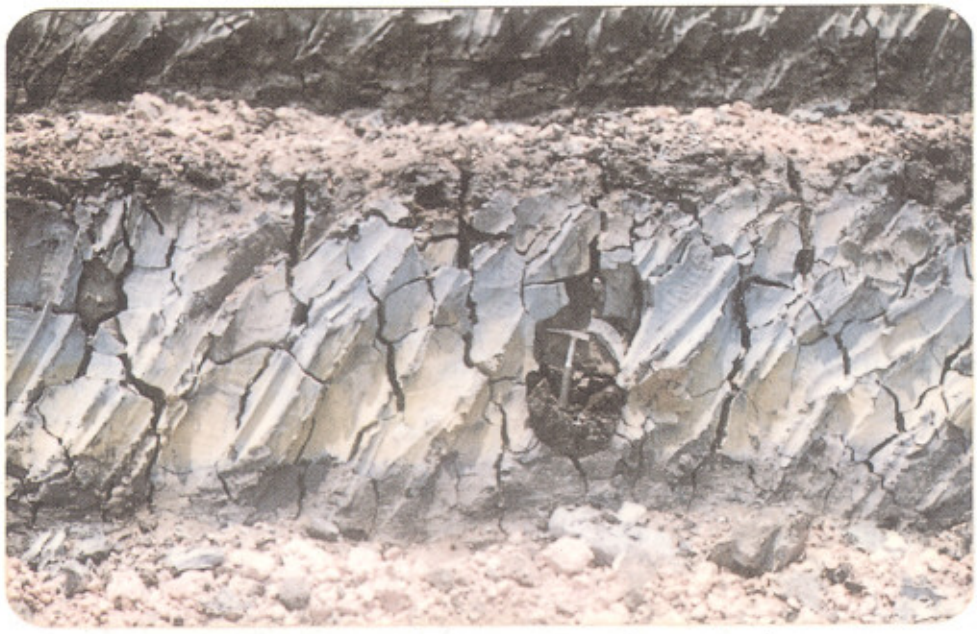
Collected carbonised woods from Varkala Cliff section and Padappakara, Kundra, Payangadi and Cheruvathur clay mines and well cuttings in Kerala.

Bande, M.B. & Dilcher David, L.

A field excursion was undertaken to various Cenozoic and Mesozoic localities in Mandla and Jabalpur districts.

Bhattacharyya, A.

A field trip was undertaken to Dhanotti, Ghansali, Joshimath, Malari, Jogeshwar, etc. in U.P. Himalaya. A large number of tree cores from *Pinus roxburghii*, *Pinus wallichiana*, *Picea smithiana* and *Cedrus deodara* were collected for tree ring analysis.



Fossil wood in Payangadi Clay Mine, Kerala.

Coring operation at Mirik Lake, Darjeeling Himalaya.

Guleria, J.S.

Went to Himachal Pradesh for shooting a film on Prof. Birbal Sahni and collected rock salt samples.

Jafar, S.A. & Rai, J.

Field data collection and systematic sampling for nannoplankton and isotopic studies of Neogene sequences of Car-Nicobar, Neill and Havelock Islands have been done.

Kar, R.K.

Visited Oodlabari, Sevoke, West Bengal; Silchar, Assam and Jampoi Hills, Tripura during January-February, 1992 to collect palynological samples.

Misra, B.K. & Singh, Alpana

A field excursion to the Panandhro lignite field (Kutch Basin), Gujarat was undertaken. Systematic sampling including resin-rich lignite bands was made from two sections of exposed quarry.

Kumar Pramod

Collected coal and carbonaceous shale samples from Mohpani and Katni areas in Satpura Basin, Madhya Pradesh.

High altitude Nachiketa Lake (2,550 m a.s.l.) in Garhwal Himalaya.

Ram-Awatar

Collected bore-core and out-crop samples from Sohagpur Coalfield, Madhya Pradesh.

Sharma, Chhaya & Chauhan, M.S.

Undertook excursion to eastern Himalaya and collected 6 soil profiles and 18 surface samples from temperate and alpine lake sites. Besides, slides were also exposed to study the aerospora of the region.

Srivastava, Shyam C.

Excursion to Permo-Triassic sediments of Mount Wellington. Visited Tertiary basalts and southern hot spot traces formed during separation of Antarctica and Australia.

Papers Presented at Symposia/Conferences/Meetings

Ambwani, K. & Kumar, M. — Morphology and aperture variation in the pollen grains of *Agave* Linn. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Anand-Prakash — Himalayan coals : their nature, formation, composition and rank. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Anand-Prakash & Sarate, O.S. — Nature, composition and rank of Lower Gondwana coals from Pathakhera Coalfield, Satpura Basin, M.P., India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Anand-Prakash, Saxena, R. & Sarate, O.S. — Organic matter types and depositional environment of Karewa peat/lignite, Kashmir Valley. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Awasthi, N. — Changing pattern of vegetation through the Neogene Siwalik succession. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Awasthi, N. & Konomatsu, M. — Siwalik leaf-impressions from Tinsu Khola and Binai Khola, west-central Nepal : a preliminary report. *Birbal Sahni Birth Centenary Symposium, Siwalik Basin,WIHG, Dehradun.*

Awasthi, N. & Mehrotra, R.C. — Additions to the Neogene flora of north eastern India and significance of African elements. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Awasthi, N., Mehrotra, R.C. & Lakhanpal, R.N. — Leaves of *Podocarpus* and *Mesua* from the Oligocene sediments of Makum Coalfield, Assam, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Awasthi, N., Sarkar, Samir & Prasad, Mahesh — Vegetation and palaeoenvironment of Siwalik succession in Surai Khola area, Nepal. *Birbal Sahni Birth Centenary Symposium on the Siwalik Basin, WIHG, Dehradun.*

Awasthi, N. & Srivastava, R. — Some fossil leaves and fruits from Warkalli beds, Kerala Coast. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Bajpai, Usha — Morphological trends in Gondwana plants. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Bajpai, Usha — New fern-like foliage from the Early Permian of Hura Coalfield. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Bande, M.B. —The Palaeogene vegetation of peninsular, India. (megafossils) *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Banerji, Jayasri — Life and time of *Williamsonia. Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Banerji, Jayasri — Plant fossils from Rajmahal Formation, Chunakhal, Bihar. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Bera, S.K. — Pollen dispersal and sedimentation in tropical Sal Forest of Madhya Pradesh. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Bera, S.K. & Gupta, H.P. — Correlation between pollen spectra and modern vegetation of Anamalai Hills, Tamil Nadu, south India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Bhattacharyya, A. — Tree growth and recent climatic changes in the North-west Himalaya. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Chandra, A. — Fossil diatoms and their significance. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Chandra, A. — Fossil silicoflagellates and their significance. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Chanchala — The fruit and seed remains from ancient Hulaskhera, District Lucknow, U.P. (ca. 800 B.C. - 500 A.D.). *Archaeological Conference, Bhopal.*

Chanchala — A new evidence of Harappan subsistence economy in the Rann of Kutch, Gujarat. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Lucknow.*

Chandra, Shaila — Changing patterns of Permian Gondwana vegetation. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Chandra, Shaila & Singh, K.J. — The genus *Vertebraria* : a review. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Chauhan, M.S., Khandelwal, Asha, Goel, Indra, Bera, S.K. & Gupta, H.P. — Palynology of Kathauta Tal, Chinhat, Lucknow. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Chauhan, M.S. & Sharma, Chhaya — Modern pollen deposition pattern in the subtropical zone of Kumaon Himalaya. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Desikachary, T.V., Shukla, Manoj, Sharma, Mukund & Venkatachala, B.S. — Interesting Blue-green algal fossils from the Black cherts of Meso-Proterozoic Jaradag (Nauhatta) Fawn Limestone Formation,Vindhyan Super

group, Rohtas, Bihar, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Garg, R. — Palaeocene dinoflagellate cysts from Kutch. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Garg, R. & Jain, K.P. — Occurrence of Chlorococcaceae alga in Langpar Formation, Meghalaya. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Guleria, J.S. — Neogene vegetation of peninsular India. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Guleria, J.S. — Fossil dicotyledonous woods from the Deccan Intertrappean beds of Kutch, Gujarat. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Guleria, J.S. —Occurrence of *Duabanga* and *Terminalia* in the Late Tertiary of Bikaner, Rajasthan. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Gupta, Asha — Palynological investigation of the Early Tertiary sediments of Sirmaur District, Himachal Pradesh. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Gupta, Asha & Sharma, Chhaya — Recent pollen spectra from Nachiketa Tal in Garhwal Himalaya. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Gupta, H.P. — Palaeoclimatic oscillations and shifts in vegetation in south Indian montanes since 40,000 years B.P. *XIII INQUA, Beijing, China.*

Gupta, H.P. — Changing pattern of vegetation in the intermontane Kashmir Basin since 4 Ma : a palynological approach. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Gupta, H.P. & Khandelwal, Asha — Mangrove development of Nalabana island Chilka Lake : a palynological interpretation. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Jafar, S.A. & Rai, J. — Late Middle Eocene (Bartonian) calcareous nannofossils and its bearing on coeval Post-trappean transgressive event in Kutch Basin, western India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Jain, K.P., Garg, R. & Khowaja-Ateequzzaman — Fossil dinoflagellates : an emerging tool in Indian biostratigraphy. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Jain,K.P., Garg, R. & Khowaja-Ateequzzaman — Comments on some microplankton taxa reported from Kutch and Rajasthan, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Jain, K.P. & Garg, R. — Late Maastrichtian dinoflagellate cysts and calcareous nannoplankton evidence from Um Sohrengkew River Section, Meghalaya.

Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.

Kapoor, H.M., Maheshwari, H.K. & Bajpai, Usha — Mamal Formation of the Peri-gondwana - redefined. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Kar, R.K. — Morphological evolution of pteridophytic spores in relation to free floating environment. *Symposium, Evolutionary Plant Biology, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Kar, R.K. — Stratigraphical implications of Tertiary palynological succession in north-eastern and western India. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Kar, R.K. — Occurrence of *Acrostichum* spores from the Langpar Formation, Early Palaeocene of Meghalaya, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Kar, R.K. — Palynology of Prang Formation (Middle-Upper Eocene) exposed on Jowai-Badarpur Road, Meghalaya, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Kar, R.K. & Ambwani, K. — Light microscopy and SEM studies of *Striatriletes* and *Malayaeaspora* from India and Malaysia. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Kar, R.K., Handique, G.K., Kalita, C.K., Mandal, J., Sarkar, Samir, Kumar, M. & Gupta, A. — Palynological study of Upper Tertiary sediments in Upper Assam Basin. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Khan, H.A. — Palynotaxonomy and phylogeny of Ranunculaceae. *Birbal Sahni Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Khandelwal, Asha — Holocene history of mangrove vegetation in India : a palynological interpretation. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Khandelwal, Asha & Gupta, H.P. — Palynological evidence of mangrove degradation during mid-Late Holocene at Rambha, Chilka Lake, Orissa. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Khandelwal, Asha — Airborne diatoms at Lucknow, India. *6th Nat. Aerobiological Conf., Pondicherry.*

Khowaja-Ateequzzaman — Some new dinoflagellate cyst taxa from Cretaceous of Cauvery and Palar Basins, Southern India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Khowaja-Ateequzzaman & Jain, K.P. — Hauterivian-Barremian dinoflagellate cyst assemblage from subsurface of Palar Basin, Tamil Nadu, southern India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Maheshwari, H.K. — Provincialism in Gondwana flora of India. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Maheshwari, H.K. & Jana, B.N. — Palynostratigraphy of Mesozoic sedimentaries of the Kutch Basin. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow*

Maheshwari, H.K. & Srivastava, A.K. — The Glossopterid group of plants in an evolutionary perspective. *Symposium, Evolutionary Plant Biology, Birbal Sahni Institute of Palaeobotany, Lucknow .*

Mandal, J. — Palynofossils of Barail sediments from Nagaland : their age and palaeoenvironment. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Mandaokar, B.D. — Fungal remains from Jeypore Colliery, Tikak Parbat Formation, Assam, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Misra, B.K. & Singh, B.D. — Liptinite macerals in Singrauli coals (India) : their characterization and assessment. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Misra, B.K. — Genesis of Indian Tertiary Coals and lignites : a biopetrological and palaeobotanical view point. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Pinto, I.D., Maheshwari, H.K. & Srivastava, A.K. — Occurrence of blattoid insects in the Gondwana flora of South America and India. *Birbal Sahni Birth Centeary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Prakash, Neeru — New additions to the flora of Jabalpur Formation. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Prasad, M. — Plant megafossils in the Siwalik sediments of Hardwar, Uttar Pradesh and their bearing on palaeoclimate and phytogeography. *Birbal Sahni Birth Centenary Symposium, Siwalik Basin, WIHG, Dehradun.*

Rajanikanth, A. — Rock building calcareous Cretaceous-Tertiary algae from India - an ecological perspective. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Ram-Awatar — Palynological dating of sub-surface sequence from Pali Formation in Sohagpur Coalfield (M.P.), India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Rao, M.R. & Rajendran, C.P. — Palynological investigations of Tertiary lignite and associated sediments from Cannanore, Kerala Basin. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Sahni, A., Venkatachala, B.S., Kar, R.K., Rajanikanth, A., Prakash, T., Prasad, G.V.R. & Singh, R.Y. —New palynological data from the Deccan Intertrappeans : implications for the latest record of dinosaurs and synchronous

initiation of volcanic activity in India. *Birbal Sahni Birth Centenary Paleobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow*

Saini, D.C. — Sedge flora of eastern Uttar Pradesh. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Saraswat, K.S. — Archaeological plant remains in ancient cultural and socio-economical dynamics of the Indian sub-continent. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Sarate, O.S. — Palynological investigation of Bijori sediments from the type area, Satpura Basin. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Sarkar, Samir — Diversity of pteridophytic spores in the Tertiary strata of India and their extant relationship. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Sarkar, Samir & Singh, H.P. — Palaeoecology of the Siwalik palynofloras from Kundlu and adjoining areas, Himachal Pradesh, India. *Birbal Sahni Birth Centenary Symposium on Siwalik Basin, WIHG, Dehradun.*

Saxena, R. — Coal Fire - a global challenging frontier. *XII International Congress on Carboniferous and Permian Stratigraphy and Geology, Buenos Aires, Argentina.*

Saxena, R.K. — Neyveli lignites and associated sediments : their palynology, palaeoecology, correlation and age. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Sharma, Chhaya — Palaeoclimatic oscillations since last deglaciation in western Himalaya : a palynological assay. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Sharma, Chhaya & Chauhan, M.S. — Fine resolution pollen analysis of Late Holocene sediments from Kumaon Himalaya. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Sharma, Chhaya, Chauhan, M.S., Pant, M.C. & Singh, B. — Modern pollen rain study from Sikkim, eastern Himalaya. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Lucknow, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Sharma, Mukund, Shukla, Manoj & Venkatachala, B.S. — Metaphyte and Metazoan fossils from Precambrian sediments of India - review and revision. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Sharma, Mukund — *Casserolia sahnii* a new Archaean tidal pool stromatolite from Chitradurga Group, Dharwar Craton, India and its significance. *Indian Science Congress, Baroda.*

Shukla, Manoj & Sharma, Mukund — Indian Precambrian palaeobiology : Goals and Gaps. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Singh, H.P. — Tertiary palynofossils and the Himalayan orogeny. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Singh, H.P. & Sarkar, Samir — Palynology and palaeoecology of Eocene sediments around Garkhal, Himachal Pradesh, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Singh, R.S. — Diversity of *Nypa* since Late Cretaceous in the Indian subcontinent. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Srivastava, A.K. — Alien elements in the Gondwana flora of India. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Srivastava, A.K. — Lower Permian plant fossils from Auranga Coalfield, Bihar. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Srivastava, A.K. — Evidence of fungal parasitism in the Glossopteris flora of India. *XII Int. Cong. Carb. Permian Strat. Geol., Argentina.*

Srivastava, A.P. — Radiometric ages of Vindhyan glauconitic sediments exposed at and around Sidhi, M.P. *VII Natn. Conf. on Particle track detectors. Defence Laboratory, Jodhpur.*

Srivastava, A.P. — F-T dating of petrified woods from Deccan intertrappean beds exposed at and around Shahpura, Madhya Pradesh. *VII Natn. Conf. on Particle track detectors. Defence Laboratory, Jodhpur.*

Srivastava, G.P., Bande, M.B. & Mishra, V.P. — Further contribution to the Late Cenozoic Flora of Mahuardanr, Palamu District, Bihar. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Srivastava, Shyam C. & Manik, S. R. — "Indian Triassic flora - transition". *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Srivastava, Shyam C. & Manik, S.R. — "Reconsideration of *Savitrispermum*". *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Srivastava, Suresh C. & Bhattacharyya, A.P. — Palynological study of coal balls from W. Siang District, Arunachal Pradesh. *Birbal Sahni Birth Centenary Paleobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Srivastava, Suresh C. & Jha Neerja — Palynostratigraphy of Permian sediments in Manugum area, Godavari Graben. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Srivastava, Suresh C. & Jha , Neerja — Palynostratigraphy of Lower Gondwana sediments in Chintalpudi sub-basin, Godavari Graben, Andhra Pradesh. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Instiute of Palaeobotany, Lucknow.*

Tewari, Rajni — Important identifying characters for Gondwana megaspores - a critical review. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Tiwari, R.S. — "Khanij Koyla : Kala Heera" - at Workshop on "Hindi men Vigyan Lekhan" at CSIR, New Delhi.

Tiwari, R.S. — Permo-Triassic in Indian Gondwana : A mass extinction or high turnover of palynoclades. *Symp. Triassic Stratigr. Lausanne.*

Tiwari, R.S. & Ram-Awatar — A palynoassemblage from Mahadeva Formation in Nidpur area, Madhya Pradesh. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Tiwari, R.S. & Tripathi, Archana — Marker Assemblage-Zones of spore pollen species through Indian Gondwana Sequence. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Tiwari, R.S., Vijaya & Meena, K.L. — Palynological sequence and relationship of sub-surface Permian-Triassic sediments in eastern Raniganj Coalfield. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Tripathi, Archana — Advent of angiospermous pollen in India and its spatial relationship in Gondwanaland. *8th int. Symp. Gondw. Geol. Geophy. Min. Resources, Tasmania, Australia.*

Tripathi, Archana — Palynosequence in subsurface Permian sediments in Talcher Coalfield, Orissa, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Tripathi, S.K.M. — Palynology of the subsurface near Kapurdi, Barmer District, Rajasthan. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Trivedi, G.K. — Palynology of the Kopili Formation (Upper Eocene) in the type area, Khorungma, Assam, India. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Venkatachala, B.S. — Impact of plant fossil research on Indian geology. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Venkatachala, B.S. — Four Decades in Indian Palaeobotany - an introduction to the theme. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Venkatachala, B.S. — Evolutionary plant biology - an introduction to the theme. *Symposium, Evolutionary Plant Biology, Birbal Sahni Institute of Palaeobotany, Lucknow*

Venkatachala, B.S., Kar, R.K., Rajanikanth, A. & Ly, A. — Palynology of the Cretaceous-Tertiary transition in an Atlantic bore core no CM5 off Senegal, West Africa. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Venkatachala, B.S., Kar, R.K., Suchindan, G.K., Ramachandran, K.K. & Kumar, M. — Study on the sedimentary facies, spores - pollen and palynodebris of

mud bank and Vembanad Lake, Kerala. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Vijaya — Palynological synchroneity of events at Permo-Triassic boundary in terrestrial deposits of India. *Symp. Triassic Stratigraphy, Lausanne.*

Vijaya & Tiwari, R.S. — Morpho-evolutionary biohorizon- stratigraphy and relation cladistics in saccate pollen through Gondwana Sequence of India. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Yadav, R.R. — Tree ring research in India : an overview. *Symposium, Four Decades of Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Yadav, R.R. & Karpavichus, J. — Tree ring evidences of Little Ice Age from the northern Russian Forest borders. *Birbal Sahni Birth Centenary Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany, Lucknow.*

Lectures Delivered

Anand-Prakash — "*Himalaya ki utpatti*", Doordarshan Lucknow.

M.B. Bande — "*Life and works of Professor Birbal Sahni*", Holkar Science College, Indore.

—"*Fundamentals of Wood Anatomy*", Holkar Science College, Indore.

Rahul Garg — "*Petroleum ki Utpatti main powdhon ka yogdan*" Doordarshan, Lucknow.

Asha Khandelwal — "*Aspects and prospects of palaeobotany*", Government Girls College, Bhopal, M.P.

— "*Evolution of Angiosperm*", Government Girls College, Bhopal, M.P.

H.K. Maheshwari — *Contribution of Birbal Sahni Institute of Palaeobotany to Science*, Rotary Club of Lucknow Khaas, RI District 312.

C.M. Nautiyal — "*Hamara Sooraj*", AIR, Lucknow.

— "*Ulka*", AIR, Lucknow.

— "*Bhookamp*", AIR, Lucknow.

—"*Hamara Saur Mandal*", Doordarshan Lucknow.

— Contributed in the making of documentary on Professor Birbal Sahni telecast by Lucknow Doordarshan on the occasion Professor Birbal Sahni's Birth Centenary celebration.

— Compered two programmes on Science for Lucknow Doordarshan.

G. Rajagopalan — "*Dating of rocks*". Two lectures delivered to the Post Graduate students of Geology Department, Lucknow University.

A. Rajanikanth — "*Green House Prabhav*", Lucknow Doordarshan.

R. Saxena — A key note address "*Coal Fire - A Global Challenging Frontier* " at XII International Congress on Carboniferous and Permian Stratigraphy and Geology at Buenos Aires, Argentina.

H.P. Singh — *Modern trends in palaeobotany studies and research*. Botany Department, Lucknow University, Lucknow.

A.K. Srivastava — *Palaeozoic Palaeobotany of India* at Institute of Geosciences, University of Sao Paulo, Brazil.

— "*Jivashmon ka Mahatva*" , Lucknow Doordarshan.

Rashmi Srivastava — "*Bhartiya vanon ka itihaas*", Lucknow Doordarshan.

B.S. Venkatachala — "*Past of the Green World*", Pondicherry University School of Ecology, Pondicherry.

— Address Chief Guest, CIMAP, Annual Day.

Technical Assistance rendered to other Agencies

Training Provided to outsiders

Phytoplankton dating of bore hole samples from Massinger Dam site, Mozambique for Mr B.M. Hukku, Sr. Dy. Director-General (Retd.), Geological Survey of India.

Training on morphotaxonomy of Siwalik leaves to Mr M. Konomatsu, Ph.D. student, Department of Geology, Osaka City University, Japan

Technical Assistance to Agencies/Universities/Institutes

Coal Wing, Geological Survey of India, Calcutta
Himalayan Geology Division, G.S.I., Lucknow
Central Mine, Planning and Design Institute, Ranchi.

Radiocarbon dating of samples

Marine Geology Wing, Geological Survey of India, Calcutta
Physical Research Laboratory, Ahmedabad
French Institute, Pondicherry
Geology Department, Kumaon University, Nainital
Archaeological Dating of samples fromBiren Roy Research Laborry, Jadavpur University, Calcutta.

SEM Facility

Lucknow University, Lucknow
Allahabad University, Allahabad
Banaras Hindu University, Varanasi
French Institute, Pondicherry
Delhi University, Delhi

Deputation/Training/Study Abroad

H.P. Gupta

Participated in the XIII INQUA Congress held at Beijing, China during August 2-9, 1991 and visited Quaternary research centres at Beijing.

Rakesh Saxena

Participated in the XII International Congress on Carboniferous and Permian Stratigraphy and Geology at Buenos Aires, Argentina, between 22-27 September 1991.

Manoj Shukla

Attended meeting of the IGCP - 320, Lamont Dorthy Observatory, New York, U.S.A.

A.K. Srivastava

Participated in XII International Congress on Carboniferous and Permian Stratigraphy and Geology at Buenos Aires, Argentina between September 22-27, 1991; chaired a Palaeobotanical session. Visited Institute of Geosciences, Universities of Porto Alegre and Sao Paulo, Brazil and Natural History Museum, New York, U.S.A.

Shyam C. Srivastava

Participated in International Symposium on Gondwana Geology, Geophysics and Mineral Research at Hobart, Tasmania (Australia). Visited the Palaeobotanical Laboratory, Department of Plant Science and Geology, University of Tasmania and Geological Survey of Victoria, Melbourne.

R.S. Tiwari

Participated in Symposiumon Triassic Stratigraphy, Laussanne, October, 1991.

Archana Tripathi

Participated in 8th International Symposium on Gondwana Geology, Geophysics and Mineral Resources, Tasmania, Australia, June, 1991.

Vijaya

Participated in Symposiumon Triassic Stratigraphy, Lausanne, October, 1991.

Courses/Lectures in the Institute by outside Scientists

Professor V.K.Gaur	:	Antarctica Science — Indian Scene, September 6, 1991
Dr Nachiketa Das	:	Chemistry of Silurian Sea waters, — September 25, 1991
Professor David L. Dilcher	:	Origins of Angiosperms, October 4, 1991
	:	Eocene floras of Southeast North America, October 9, 1991
	:	Use of dispersed cuticles in stratigraphic analysis, October 10, 1991
	:	Diversity of megafossils and pollen from the Cretaceous and Eocene, October 21, 1991
	:	Fossil fungi, November 1, 1991

Deputation to Conferences/Symposia/Seminars/ Workshops

All the scientific staff of BSIP	• Symposium *Evolutionary Plant Biology*, Birbal Sahni Institute of Palaeobotany, Lucknow, November, 1991
All the scientific staff of BSIP	• Symposium *Four Decades of Indian Palaeobotany*, Birbal Sahni Institute of Palaeobotany, Lucknow, November, 1991
All the scientific staff of BSIP	• *Birbal Sahni Birth Centenary Paleobotanical Conference*, Birbal Sahni Institute of Palaeobotany, Lucknow, November, 1991
B.S. Venkatachala **G. Rajagopalan** **H.K. Maheshwari** **K.P. Jain** **R.S. Tiwari** **P.K. Maithy** **N. Awasthi** **R.K. Kar** **Shyam C. Srivastava** **Manoj Shukla** **G.P. Srivastava**	• *14th All India Botanical Conference*, Lucknow University, Lucknow, December 1991
R.S. Tiwari **Vijaya** **Rahul Garg**	• Birbal Sahni Centenary, *DST Workshop on Major Stratigraphic boundaries*, Jammu Uni vesity, November, 1991
S.K. Bera	• Workshop on *Glaciology Research Programme - A ten year plan perspective,* WIHG, Dehradun, March 20-21, 1992
B.S. Venkatachala **H.P. Singh** **K.P. Jain** **G.P. Srivastava**	• Symposium on *Siwalik Basin*, Wadia Institute of Himalayan Geology, Dehradun, December, 1991.
Asha Khandelwal	• *6th National Aerobiological Conference*, Pondicherry
C.M. Nautiyal	• *Workshop on Past Global Changes (PAGES)* under the auspices of IGBP at National Physical Laboratory, New Delhi, March 13, 1992.

G. Rajagopalan **A.P. Srivastava**	• *VII National Conference on Particle Track Detectors,* Defence Laboratory, Jodhpur October 9-11, 1991.
B.S. Venkatachala **A. Rajanikanth**	• *IGBP Modelling Meeting*, NPL, New Delhi, February 1992.
K.S. Saraswat	• *Workshop on Pre-historic contacts between South Asia and Africa-The dispersal of plant cultivars along the north Indian sea board,* Pune, December, 7-8, 1991.
K.S. Saraswat **Chanchala**	• *Annual Archaeological Conference*, Bhopal, December, 16-18, 1992.
Chhaya Sharma	• *International Symposium on Evolution of Desert*, PRL, Ahmedabad, February 11-14, 1992.
Mukund Sharma	• *79th Indian Science Congress*, Baroda, 3-8 January, 1992.
Manoj Shukla **Mukund Sharma**	• *Workshop on Ediacara fauna and the Precabrian-Cambrian boundary,* April, 5-7 1992.
A.K. Srivastava	• *XII International Congress on Carboniferous-Permian Stratigraphy and Geology*, Buenos Aires.
Shyam C. Srivastava	• *Eighth International Gondwana Symposium,* Hobart, Tasmania, Australia, 1991.
R.S. Tiwari	• *Workshop on "Hindi mein Vigyan Lekhan",* CSIR, New Delhi.
R.S. Tiwari **Vijaya**	• *Symposium on Triassic Stratigraphy*, Lausanne.

Representation in Committees/Boards

Anand-Prakash	• Treasurer, Indian Association of Palynostratigraphers • Treasurer, The Palaeobotanical Society, Lucknow
N. Awasthi	• Chief Editor, Geophytology • Editor Newsletter, The Palaeobotanical Society.
Usha Bajpai	• Member, Managing Council, Indian Association of Palynostratigraphers • Member, Executive Council, The Palaeo- botanical Society, Lucknow
Anil Chandra	• Editor, Geophytology
Shaila Chandra	• Vice-President, Indian Society of Geoscientists
H.P. Gupta	• Business Manager, Indian Association of Palynostratigraphers
S.A. Jafar	• Organising Secretary, Lucknow Chapter, Zaheer Science Foundation, New Delhi
K.P. Jain	• Secretary, Indian Association of Palynostratigraphers • Member, Executive Committee, The Palaeobotanical Society, Lucknow • Member, National Working Group, IGCP-CRER • Member, Advisory Committee, Conference of SAARC Scientists and Planners on "Environment Management in Developing Countries", Feroze Gandhi College, Rai Bareilly
Asha Khandelwal	• Member, Executive Council, Indian Aerobiological Society
H.A. Khan	• Member, Executive Council, Palynological Society of India • Editor, Indian Journal of Bio-Research
H.K. Maheshwari	• Member, Committee for Fossil Plants, International Association for Plant Taxonomy • Editor, Indian Association of Palynostratigraphers • Editor, The Palaeobotanist • Co-editor, Asian Journal of Plant Science
B.K. Misra	• Joint Secretary, Indian Society of Geoscientists

C.M. Nautiyal	• Member of the Jury for Model competition on Science organised by Regional Science Centre, Lucknow
G. Rajagopalan	• Member, National Organising Committee, Nuclear Track Society of India, Calcutta • Member, Academic Committee of School of Archaeological Dating, Jadavpur University, Calcutta
A. Rajanikanth	• Joint Secretary, The Palaeobotanical Society, Lucknow
Rakesh Saxena	• Member, International Commission of Gondwana Working Group for Coal Classification, ICCP
R.K. Saxena	• Secretary, Indian Society of Geoscientists • Member, Editorial Board, ISG, Bulletin
Manoj Shukla	• Editor, Geophytology (till December 1991)
H.P. Singh	• Editor, The Palaeobotanist • Treasurer, The Palaeobotanical Society (till December, 1991) • President, The Palaeobotanical Society (from January, 1992)
Jaswant Singh	• Editor, Geophytology (till December, 1991)
A.K. Srivastava	• Treasurer, Indian Society of Geoscientists • Member, Editorial Board, ISG Bulletin
Shyam C. Srivastava	• Secretary - Convener, Birbal-Savitri Sahni Foundation, Lucknow. • Member, Birbal Sahni-IOP Medal Selection Committee.
R.S. Tiwari	• Member, Editorial Board, Geophytology • Secretary, The Palaeobotanical Society • Member, Executive Committee, The Palaeontological Society • Editor, The Palaeobotanist • Co-Editor, Asian Journal of Plant Science
S.K.M. Tripathi	• Member, Executive Council, The Palaeobotanical Society (till December, 1991)
B.S. Venkatachala	• Vice-President, International Federation of Palynological Societies • Member, Committee for Fossil Plants, International Association for Plant Taxonomy

- Member, Editorial Board, Acta Palynologica, Montpellier, France
- Chief Editor, The Palaeobotanist
- President, The Palaeobotanical Society (till December 1991)
- Chairman, Programme Advisory and Monitoring Committee of the Palaeoclimate and Palaeoenvironmental Research, Department of Science & Technology
- Member, National Committee on National Core and Drill Cutting Sample Library, Department of Science & Technology, New Delhi
- Member, Governing Body, Wadia Institute of Himalayan Geology, Dehradun
- Member, National Committee on Palaeoseismicity, DST, New Delhi
- Trustee, INTACH, Indian Conservation Institute, New Delhi, 1991-continuing
- Editor, Extinct plants, Evolution and Earth's History, Birbal Sahni Special issue, Current Science 61(9 & 10), 1991.
- Editor, Indian Gondwana, Memoir of Geological Society of India 21, Sahni Volume, 1991
- Co-convener, Symposium on Evolutionary Plant Biology, Birbal Sahni Birth Centenary Celebrations, BSIP, Lucknow, 1991
- Co-convener, Symposium on Palaeofloristic and palaeoclimatic changes in Cretaceous and Tertiary times, 8th International Palynological Congress, Aix-en-Provence, France, 1992

Vijaya

- Editor, Geophytology

Honours and Awards

Asha Gupta	• Fellow of Linnean Society of London, 1991.
Mukund Sharma	• Indian Science Congress Association Young Scientist Award in Earth System Sciences for the year 1992.
Alpana Singh& B.D. Singh	• Awarded H.C. Das Gupta Memorial Medal from the Geological, Mining and Metallurgical Society of India (Calcutta) for a scientific paper on particulate organic material in the Neyveli lignite [*Indian J. Geol.*, 63 (1) :17-39].
Rakesh Saxena	• Chairman, Biostratigraphy Session, XII International Congress on Carboniferous and Permian Stratigraphy and Geology, Buenos Aires, Argentina (22-27 September 1991).
A.K. Srivastava	• Designated Chairman, Palaeobotanical Session of XII International Congress on Carboniferous and Permian Stratigraphy and Geology, Buenos Aires, Argentina.
Suresh C. Srivastava	• Elected, Fellow of The Palaeobotanical Society.

Publications of the Institute

The Palaeobotanist

Volume 39, Number 1 and 2 of the journal, "The Palaeobotanist", were published. Manuscripts of Number 3 of Volume 39 were also edited and sent to Press; the proofs were partly corrected and returned to printer.

Birbal Sahni Memorial Lecture

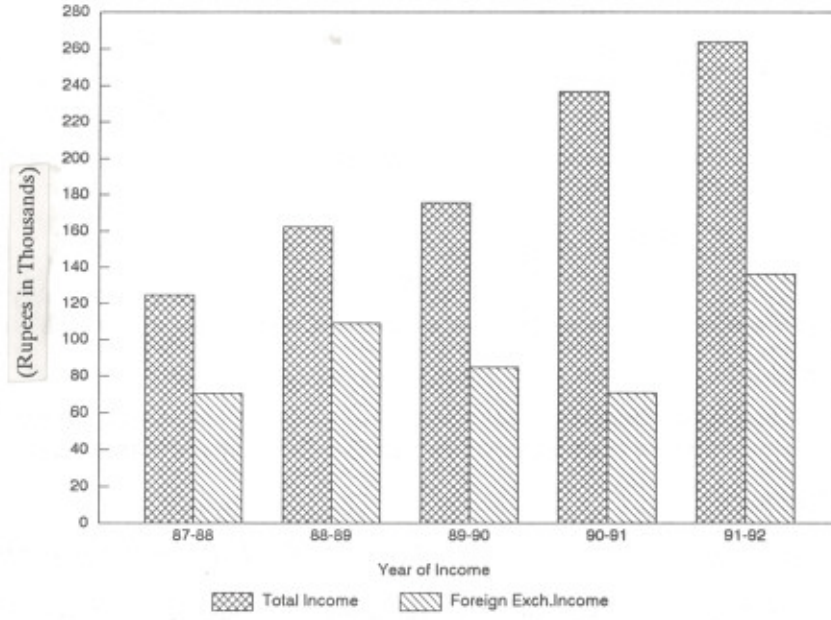
Nineteenth Birbal Sahni Memorial Lecture "Rates of floral turn-over and diversity change in the fossil record" delivered by Norman Frederiksen, United States Geological Survey was published.

Sir Albert Charles Seward Memorial Lecture

The 35th Seward Memorial Lecture "Floristic composition and distribution of evergreen forests in the Western Ghats, India" delivered by Dr J.P. Pascal, Director, French Institute, Pondicherry was also published.

A catalogue of fossil plants from India

To unify, update and incorporate information on the Indian fossil plants covering a period of about two decades, beginning from the year 1971, a catalogue comprising a series of 11 fascicules has been published. These are :



Income from Institute's publications from 1987-88 to 1991-92.

1. Archaean and Proterozoic Palaeobiology	— Manoj Shukla & Rajendra Bansal
2. Palaeozoic and Mesozoic Megafossils	— Shaila Chandra & Rajni Tewari
3A. Palaeozoic and Mesozoic Spores and Pollen	— Suresh C. Srivastava
3B. Palaeozoic and Mesozoic Megaspores	— Rajni Tewari
4. Cenozoic (Tertiary) Megafossils	— Rashmi Srivastava
5. Cenozoic (Teriary) A. Spores and Pollen, B. Fungi	— R. K. Saxena
6. Cenozoic (Quaternary) Palynology and Palaeobotany	— M. S. Chouhan
7. Dinoflagellates	— Khowaja-Ateequzzaman
8. Diatoms and Silicoflagellates	— Anil Chandra
9. Nannoplankton	— Jyotsana Rai
10. Calcareous Algae	— A. Rajanikanth
11. Archaeobotany	— Chanchala

These fascicules comprising about 840 printed pages were released on Birbal Sahni Birth Centenary Celebrations during 14-20 November, 1991.

Brochure

On the occasion of Birbal Sahni Birth Centenary Celebrations a Brochure was brought out, which throws light on Birbal Sahni, his vision, i.e., the Institute, and the research activities and achievements in the field of Palaeobotany. This Brochure comprises 54 printed pages with a number of coloured pictures.

Type and Figured Specimens at the Repository : An Inventory Part - I

This special publication released during Birbal Sahni Birth Centenary Celebrations comprises 126 printed pages and documents the Type and Figured specimens/slides of megafossils available at the Museum of the Institute till 1970.

Research Papers of Birbal Sahni and of Birbal Sahni Institute of Palaeobotany : A catalogue

This catalogue contains references of about 1670 research papers published over a period of more than 40 years by the Institute's scientists till October, 1991.

Annual Report

Annual Report of the Institute, both in English and Hindi was published.

The publications of the Institute netted an income of Rs. 2,64,064.00 out of which about Rs. 1,36,444 were earned in foreign exchange which is approximately equivalent to U.S. $4,873.

Library

The holdings of the Library are :

Particulars	Additions during 1991-1992	Total
Books	56	4447
Journals	392	9651
Reprints	525	33895
Microfilms/ Fisches	4	294
Theses	1	83
Reports	—	46
Maps & Atlases	3	58
Reference Books	4	184

The services of the library were also made available to scientists of other organisations and universities. The total number of registered borrowers is 122. Sixty eight current periodicals are being procured on exchange basis and seventy four current periodicals are subscribed by the library.

Reprint Section

(i) Reprints of research papers purchased	20
(ii) Reprints sent out in exchange	3111
(iii) Institutions on exchange list	62
(iv) Individuals on exchange list	398
(v) Professor Sahni's paper sent out	433
(vi) Institute Publication sent out	168

Library Facility Provided :

Department of Botany, M.L.K. College, Balrampur

U.P. Pollution Control Board, Lucknow

Department of Applied Geology, Sagar University, M.P.

Department of Botany, Lucknow University, Lucknow

Department of Botany, University of Allahabad

Department of Botany, Bangalore University, Bangalore

Indian Institute of Tropical Meteorology, Pune

Jawaharlal Nehru University, New Delhi

Kumaon University, Nainital

Environmental Resources Research Centre, Kerala.

Use of Computer in Library

Data on all the journals subscribed by the Library has been entered according to a specially developed retrieval programme.

Herbarium

An inventory of plant specimens in the Herbarium has been prepared. About 125 plant specimens, 11 wood samples, 90 samples of seeds and fruits and 30 samples of polleniferous material have been added in the Herbarium during this year. About 16 wood slides and 20 pollen slides have been prepared. About 235 plant specimens and 30 leaf specimens have been identified, mounted and placed in their respective families.

The holdings of the Herbarium materials are :

Particulars	Addition during 1991-1992	Total
Herbarium		
Herbarium sheets of plant specimens	235	12,375
Herbarium sheets of leaf specimens	30	290
Xylarium		
Wood blocks	11	3,946
Wood discs	—	29
Wood core samples	—	187
Wood slides	16	4,721
Sporothek		
Polleniferous materials	30	1,220
Pollen slides	20	11,404
Carpothek		
Fruits/Seeds	90	2,191
Photo negatives	—	5

Herbarium Facility Provided to scientists from :

Department of Botany
Banaras Hindu University
Varanasi

Department of Botany
Sagar University
Sagar, Madhya Pradesh

Department of Botany
Shivlee National College
Azamgarh, Uttar Pradesh

Florida Museum of Natural History
Gainesville
Florida, U.S.A.

Ethnobotany Section
Department of Botany
University of Rajasthan
Jaipur, Rajasthan

Museum

The Museum of the Institute was actively engaged in executing multifarious activities particularly relevant to the Professor Birbal Sahni Birth Centenary Celebrations. The gallery of the institute was adorned with several mounted photographs of Professor Birbal Sahni and his family members. The photographs also cover important events of Professor Sahni's life as well as those of the institute. Personal belongings of Professor Sahni, like his music book, address book, loan register and hand-written biography were suitably displayed in the museum. The Sahni Centenary logo was prominently displayed on the multistorey building of the institute.

Three paintings depicting the Earliest Biosphere and Deccan Intertrappean Vegetational Scenarios were added to the Museum. Another attractive addition was of a model of the geological clock (Kal Chakra). Black and white photographs of the palynofloral assemblages were replaced by the coloured ones. The legends were updated and changed. Inventory (part I) of the Type and Figured specimens/slides (megafossils) was also published.

The museum collaborated in organising an exhibition on **"The Past of the Green World"** with National Council of Science Museum at the Regional Science Centre, Lucknow. Various aspects of palaeobotany, arranged thematically, were projected through specimens, slides, photographs, paintings, transparencies and vegetational scenarios. Important events of the institute, its frame work of investigations and work culture were shown with the help of audio-visual system. The room of Professor Birbal Sahni was recreated mostly with his personal belongings. So far, exhibition has been visited by about 95,000 persons including representation from 140 institutions. Besides, an archive has been established to preserve important documents, photographs, films, audio and video-tapes, etc.

Exhibitions were also organized at the Wadia Institute of Himalayan Geology, Dehradun, coinciding with the symposium on the Siwalik Basin dedicated to Professor Sahni's memory, and at the Indian Science Congress, Baroda. Some exhibits were sent to the Department of Geology, Jammu University, Jammu along with a set of publications released during the Sahni Centenary Celebrations. Several photographs/specimens were gifted to other institutions who had planned exhibitions on the life and work of Professor Birbal Sahni. On the same theme, a mobile exhibition has been designed. Several fossil specimens mounted on wooden pedestals or embedded in transparent plastic resin were presented as gifts to the guests/delegates during the Sahni celebrations.

The National Science Day was celebrated on February 28, 1991. This day was observed as an open house.

Delegates from the country and overseas, viz., citizens from Argentina, Australia, Hungary, Holland, Madagascar, China, Japan, Poland, Germany, Italy, France, Sweden, Switzerland, U.K. and U.S.A. visited the Museum.

Type and Figured specimens/slides/negatives

Type and figured specimens of twenty two research papers were submitted to the repository of the museum.

	Addition during during the year	Total
Type and Figured specimens	101	4,960
Type and Figured slides	203	10,397
Negatives of the above	205	13,265

New Collections

The staff of the Institute has submitted specimens/samples as detailed below collected during the field excursion

Department	Specimens /	Samples
Cenophytic Evolutionary Botany	1,393	—
Pre-Gondwana & Gondwana Palyno-stratigraphy	—	473
Post-Gondwana Palynostratigraphy of Peninsular India	—	403
Biodiagenesis	—	96
Radiometric Dating	—	6
DST Scheme on origin of life	—	57

Specimens/samples received for investigation

1. G.S.I. Camp at Khammam, A.P.	12
2. Geologist Camp at Jammu (ONGC)	3
3. Director, G.S.I. (Training Camp), Lucknow	1
4. Dr I.L. Krishnan of Norway (of Thakhola, Nepal)	44
5. Director I/C, Marine Wing, G.S.I.	2
6. Director I/C O.P. Lab-Research & dates G.S.I. (N.R.), Lucknow	39
7. Professor M. Srinivasan B.H.U., Varanasi	10
8. Dr. R.N. Mishra G.S.I. operation Orissa (EGD-II) Unit-8, Bhubaneshwar	1

Presentation of fossil specimens within the country

1. Bhavan's Gandhi Vidyashram, Kodaikanal, Tamil Nadu
2. K.U. Pendharkar College of Arts, Science & Commerce
   MIDC, Dombivli, Maharashtra
3. Navyug Kanya Mahavidyalaya, Lucknow
4. Christian College, Lucknow
5. Forest Department of West Bengal, Jalpaiguri Division, Siliguri
6. Botany Department, University of Lucknow, Lucknow

Presentation of fossil specimens abroad

1. Zhu Wei-Qing
   Department of Palaeobotany,
   Institute of Botany, Academy Sinica
   Xiangshan, Beijing 100 093
   China
2. Professor Henri Rakotoarivelo
   Palaeobotany-Palynology Lab.
   University Department of Natural Sciences
   P.O. Box 906, 101 Antanamarivo
   Madagascar

Institutional Visitors

1. U.N. Post-Graduate College, Padrauna, Deoria, U.P.
2. M.S. University, Baroda, Gujarat
3. Stella Harris College, Madras, Tamil Nadu
4. B. Baruah College, Guwahati, Assam
5. Darrang College, Teztruv, Assam
6. S.K. University, Anantpur, A.P.
7. Gargi College, Delhi University, Delhi
8. College of Forestry, Ranchi, Bihar
9. University of Rajasthan, Jaipur, Rajasthan
10. Nehru College, Chhibramau, U.P.
11. A.V. College, Guwahati, Assam
12. Saraswati Shishu Mandir, Nirala Nagar, Lucknow
13. Trainees of Ethnobotany Workshop, NBRI, Lucknow
14. Delegation of Botanical Conference
15. Lucknow University (Refresher Course Group), Lucknow

Distinguished Visitors

1. His Excellency Sri B. Satyanarayan Reddy
   Governor of Uttar Pradesh
2. Professor S.Z. Qasim
   Member Planning Commission, Govt. of India
   New Delhi
3. Professor T.S. Sadasivan
   "Gokulam," St. Koil Street
   Madras
4. Dr Harsh K. Gupta
   Advisor, Government of India,
   Department of Science & Technology, New Delhi
5. Dr A.P. Mitra
   Chairman, National Council of Science Museum
   Bidhan Nagar, Calcutta
6. Professor B.P. Radhakrishna
   Geological Society, Bangalore
7. M. Bonardi
   Geologist, C.N.R., Sen Polo
   1364 30125, Venice, Italy
8. Professor N.N. Bhandari
   Botany Department, Delhi University, Delhi

9. Boulter, M.C.
Division of Environmental Sciences
Polytechnic of East London, Ranoford Road
London E15 42Z, U.K.

10. P.K. Bhaumik
National Science Centre
New Delhi

11. Professor T.V. Desikachary
Centre for Advanced Studies in Botany
University of Madras, Madras

12. M. Dettman
Department of Botany
University of Queensland
St. Lucia, 4072, Australia

13. David L. Dilcher
Florida Museum of Natural History
University of Florida, Gainesville
FL-32611, U.S.A.

14. Saroj Ghosh
D.G. National Council of Science Museums
Bidhan Nagar, Calcutta

15. Professor Y. Lemoigne
Vice President of University of Lyon
Lyon1, France

16. P.D. Malhotra
12 Vasant Vihar - I
Dehradun 248 006

17. Esther Nagy
Scientific Adviser of the Hungarian Geological Institute
Budapest, H-1118
Menesiut 10, Hungary

18. H. Nishida
841 Shinkon, Katsura, 299-52
Japan

19. K. Jacob
52/2, 17th Main
Canara Bank Road, 4th Block
Koramangla, Bangalore 560 034

20. M.J. Norstog,
5929, J. Road
Waterloo, Illinois 62298(618)479-2435
U.S.A.

21. Zhu Wei Quing
Department of Palaeobotany
Institute of Botany, Academica Sinica
Xianghan, Beijing, China

22. Henri J. Rakotoarivelo
Palaeobotany-Palynology Lab.
University Department of Natural Sciences
P. O. Box 906, 101 Antanamarivo, Madagascar

23. Professor C.G.K. Ramanujam
Department of Botany
Post Graduate College of Science
Osmania University, Saifabad
Hyderabad-500004

24. Professor Ashok Sahni
Punjab University
Chandigarh

25. A. Sadowska
University of Wroclaw
Institute of Geological Sciences
50-205, Wroclaw Ul
Cybulskiego 30, Poland

26. Professor B.D. Sharma
University of Jodhpur
Jodhpur, Rajasthan

27. Professor C.V. Subramaniyam
CIMAP, Lucknow

28. Professor V.C. Thakur
Director
Wadia Institute of Himalayan Geology, Dehradun

29. H. Visscher
Laboratory of Palaeobotany & Palynology
State University of Utrecht
Hiedel Berglaan 23584 CS
Utercht, The Netherlands

30. Professor A.B. Vora
Department of Botany
Gujarat University
Ahmedabad, Gujarat

31. C.P. Vohra
D.G., Geological Survey of India
Calcutta, West Bengal

Scientists

Director

B.S. Venkatachala, Ph.D., F.N.A.Sc., F.G.S., F.B.S., F.Pb.S., F.Pn.S.

Distinguished Scientist

Hari P. Singh, Ph.D., F.Pb.S.

Assistant Directors (Special Grade)

Nilambar Awasthi, Ph.D., F.Pb.S., F.I.A.P.

Anil Chandra, Ph.D., F.P.S., F.S.G. (w.e.f. 01.04.1991)

Shaila Chandra, Ph.D., F.S.G.

Hari P. Gupta, Ph.D., F.I.A.P.

Krishna P. Jain, Ph.D., F.Pb.S., F.I.A.P., F.P.S.

Ranajit K. Kar, Ph.D., F.Pb.S.

Hari K. Maheshwari, Ph.D., F.Pb.S., F.I.A.P., F.P.S., F.G.S.

Prabhat K. Maithy, Ph.D., F.Pb.S.

Garud K.B. Navale, Ph.D., F.G.S., F.G.M.S., F.I.A.M.S., F.Pb.S. (Retired w.e.f. 30.06.1991)

Govindraja Rajagopalan, Ph.D., F.Pb.S., F.S.G.

Suresh C. Srivastava, Ph.D., F.I.A.P. (w.e.f. 01.01.1991)

Ram S. Tiwari, Ph.D., F.Pb.S., F.I.A.P., F.P.S., F.S.G.

Assistant Directors

Anand-Prakash, Ph.D., F.I.A.P.

Mohan B. Bande, Ph.D.

Jayasri Banerji, Ph.D.

Syed A. Jafar, Dr.Phil.nat., F.P.S.

Kripa S. Saraswat, Ph.D., F.B.S.

Chhaya Sharma, Ph.D.

Jaswant Singh, Ph.D.

Shyam C. Srivastava, Ph.D.

Ashwini K. Srivastava, Ph.D. (w.e.f. 01.04.1991)

Senior Scientific Officers

Krishna Ambwani, Ph.D.

Usha Bajpai, Ph.D. (w.e.f. 01.04.1991)

Rahul Garg, Ph.D., F.P.S., F.S.G.

Jaswant S. Guleria, Ph.D.

Brijendra N. Jana, Ph.D.

Neerja Jha, Ph.D. (w.e.f. 01.04.1991)
Hafiz A. Khan, Ph.D.
Asha Khandelwal, Ph.D. (w.e.f. 01.04.1991)
Pramod Kumar, Ph.D.
Jagannath P. Mandal, Ph.D.
Basant K. Misra, Ph.D. (w.e.f. 01.04.1991)
Chandra M. Nautiyal, Ph.D.
Mulagalapalli R. Rao, Ph.D. (w.e.f. 01.04.1991)
Samir Sarkar, Ph.D. (w.e.f. 01.04.1991)
Rakesh Saxena, Ph.D. (w.e.f. 01.04.1991)
Ramesh K. Saxena, Ph.D., F.S.G., F.P.S.
Manoj Shukla, Ph.D., F.G.S.
Rama S. Singh, Ph.D. (w.e.f. 01.04.1991)
Gajendra P. Srivastava, Ph.D.
Archana Tripathi, Ph.D., F.P.S.
Vijaya, Ph.D., F.L.S.,F.P.S.
Ram R. Yadav, Ph.D. (w.e.f. 01.04.1991)

Junior Scientific Officers

Anil Agarwal, Ph.D.
Rupendra Babu, Ph.D.
Samir K. Bera, Ph.D.
Amalava Bhattacharyya, Ph.D.
Anant P. Bhattacharyya, Ph.D.
Chanchala, Ph.D.
Mohan S. Chauhan, Ph.D.
Asha Gupta, Ph.D., F.L.S., F.P.S.
Khowaja-Ateequzzaman, Ph.D.
Madhav Kumar, Ph.D.
Bhagwan D. Mandaokar, Ph.D.
Surendra R. Manik, Ph.D.
Kalyan L. Meena, Ph.D.
Kindu L. Meena, Ph.D.
Rakesh C. Mehrotra, Ph.D.
Neeru Prakash, Ph.D.
Mahesh Prasad, Ph.D.
Annamraju Rajanikanth, Ph.D., F.G.S.
Jyotsana Rai, Ph.D.

Ram-Awatar, D.Phil.
Dinesh C. Saini, Ph.D.
Omprakash S. Sarate, Ph.D.
Mukund Sharma, M.Sc., F.G.S.
Alpana Singh, Ph.D.
Bhagwan D. Singh, Ph.D.
Kamal J. Singh, Ph.D.
Abhay P. Srivastava, Ph.D.
Rashmi Srivastava, Ph.D.
Rajni Tewari, Ph.D.
Surya K.M. Tripathi, Ph.D.
Gyanendra K. Trivedi, Ph.D.

Research Fellows (Sponsored Projects)

M.C. Pant, M.Sc.
Brijesh Kumar Singh, M.Sc.

C.S.I.R. Fellow

Om Prakash Singh, M.Sc.

Technical and Administrative Personnel

Library

Jagendra N. Nigam, B.A., B.Lib.Sc. (J.T.O.—Library ; w.e.f. 01.04.1991)
Kavita Kumar, B.Sc., B.Lib.Sc. (J.T.A. — Library)
Shail Singh Rathore (L.D.C.)

Museum

Naresh C. Saxena, B.A. (J.T.O. — Museum ; retired on 31.05.1991)
Prem Prakash, B.Sc. (S.T.A.—Museum)
Sant R. Yadav, B.A. (Fossil Cataloguer)

Herbarium

Jagdish C. Srivastava, M.Sc. (S.T.A. — Herbarium)
Diwakar Pradhan, B.Sc. (S.T.A. — Herbarium)

Laboratory Services

Hirendra N. Boral, B.Sc. (T.O.)
Balasubramanian Sekar, B.Sc., A.I.C. (T.O.)
Kamala M. Chhabra, B.Sc. (J.T.O.)
Madhabi Chakraborty, B.Sc. (J.T.O. ; w.e.f. 01.04.1991)
Indra Goel, B.Sc. (J.T.O.)
Asha Guleria, B.Sc. (J.T.O.)
Sunita Khanna, B.Sc. (S.T.A.)
Eknath G. Khare, B.Sc. (S.T.A.)
Tapan K. Mandal, B.Sc. (S.T.A.)
Vinod K. Singh, M.Sc. (S.T.A.)
Reeta Banerji, B.Sc. (J.T.A.)
Ramesh C. Misra, B.Sc. (J.T.A.)
Chandra Pal, B.Sc. (J.T.A.)
Vijay P. Singh, B.Sc. (J.T.A.)
Avinesh K. Srivastava, B.Sc. (J.T.A.)
Sangita Gupta, B.Sc. (L.A.)
Keshav Ram, B.A. (L.A.)

Technical Services

Madhukar Arvind, B.Sc. (J.T.A. — Computer; w.e.f. 10.09.1991)
Chandra Bali (Mechanic)
Alok K. Ghosh (Electrician)
Chhotey Lal (Mechanic; w.e.f. 01.04.1991)

Vijai S. Panwar (Glass Blower; w.e.f. 01.04.1991)
Purshottam S. Saluja (Mechanic)

Photography and Drawing

Pramod K Bajpai, B.F.A. (J.T.O. — Artist)
Paresh C. Roy (S.T.A. — Photographer)
Pradeep Mohan, B.F.A. (J.T.A.— Photography)

Sponsored Project

Jagdish Prasad (T.A.)

Administration

Surendra B. Verma, M.A., B.Com., D.P.A., LL.B. (Registrar)
Suraj P. Chadha, B.A. (P.S. to Director)
Hari S. Srivastava, B.Com. (S.O.[G])
Bhagwan Singh (S.O. [A])
Ramesh Chandra (Assistant)
Radha B. Kukreti (Jr. Assistant)
Usha Chandra (U.D.C.)
Hari Lal (U.D.C.)
S. Murukan Pillai, B.A. (L.D.C.)
V. Nirmala (U.D.C.)
Gopal Singh, B.A. (L.D.C.)
P. Thomas (U.D.C.)
Koshy Thomas (L.D.C.)
N. Unnikannan (L.D.C.)

Accounts Section

J.C. Singh, M.A. (Accounts Officer)
Tej N. Shukla, B.A. (S.O. [F & A])
Nitya N. Joshi (Assistant)
Raj K. Takru, B.A. (Assistant)
Raj K. Kapoor, B.A. (U.D.C.)
Dhoom Singh, B.A. (Cashier)
Swapna Acharya, B.A. (L.D.C.)

Stores

Baresh K. Jain, B.A. (S.O. [S & P]) (w.e.f. 07.06.1991)
Inder J. Mehra, B.A. (S.O. [S]) (w.e.f. 07.06.1991)
Inder J.S. Bedi (Assistant)
Ruchita Chatterji, M.A. (Store Keeper)

Kunwar P. Singh, M.A. (L.D.C.)

Drivers

Hanuman Prasad
Lallan
Balbir Singh
Nafees Ahmed

General Help

Sarju Prasad (Daftari)
Sia Ram (Duplicating Machine Operator)
Mohd. Shakil (Binder)
Raja Ram (Attendant)
Satrughan (Attendant)
Sunder Lal (Attendant)
Prem Chandra (Attendant)
Ram Singh (Attendant)
Rajendra Kumar (Attendant)
K.C. Chandola (Attendant)
Chhange Lal (Attendant)
Haradhan Mahanti (Attendant)
Krishna Kumar Bajpai (Peon)
Maya Devi (Peon)
Ram Dheeraj (Peon)
Hari Kishan (Peon)
Ram Kishan (Peon)
Dhan Bahadur Kunwar (Peon)
Mani Lal (Peon)
Munni (Peon)
Kailash Nath (Peon)
Mahadev Prasad (Peon)
Sri Ram (Peon)
Bam Singh (Peon)
Ram Ujagar (Peon)
Kedar Nath Yadav (Peon)
Ram Deen (Chowkidar)
Ram Dhari (Chowkidar)
Bishnu Dutt (Chowkidar)
Vishnu Kumar (Chowkidar)

Kesho Ram (Chowkidar)
Prem Shanker (Chowkidar)
Rameshwar Prasad Pal (Mali)

Promotions and Appointments

Promotions

Anil Chandra, Assistant Director, promoted as Assistant Director (Spl. Grade) w.e.f. 01.04.1991.

Suresh C. Srivastava, Assistant Director, promoted as Assistant Director (Spl. Grade) w.e.f. 01.04.1991.

A.K. Srivastava, Senior Scientific Officer, promoted as Assistant Director w.e.f. 01.04.1991.

B.K. Jain, Assistant (F & A), promoted as Section Officer (Stores & Purchase) w.e.f. 07.06.1991.

I.J. Mehra, Senior Assistant, promoted as Section Officer (Stores & Purchase) w.e.f. 07.06.1991.

Usha Bajpai, Junior Scientific Officer, promoted as Senior Scientific Officer w.e.f 01.04.1991.

Neerja Jha, Junior Scientific Officer, promoted as Senior Scientific Officer w.e.f. 01.04.1991.

Asha Khandelwal, Junior Scientific Officer, promoted as Senior Scientific Officer w.e.f. 01.04.1991.

B.K. Misra, Junior Scientific Officer, promoted as Senior Scientific Officer w.e.f. 01.04.1991.

M.R. Rao, Junior Scientific Officer, promoted as Senior Scientific Officer w.e.f. 01.04.1991.

Rakesh Saxena, Junior Scientific Officer, promoted as Senior Scientific Officer w.e.f. 01.04.1991.

R.S. Singh, Junior Scientific Officer, promoted as Senior Scientific Officer w.e.f. 01.04.1991.

R.R. Yadav, Junior Scientific Officer, promoted as Senior Scientific Officer w.e.f. 01.04.1991.

Madhabi Chakraborty, Senior Technical, Assistant promoted as Junior Technical Officer w.e.f. 01.04.1991.

Kamala M. Chhabra, Senior Technical Assistant, promoted as Junior Technical Officer w.e.f. 01.04.1991.

J.N. Nigam, Senior Technical Assistant, promoted as Junior Technical Officer (Lib.) w.e.f. 01.04.1991.

V.S. Panwar, Glass Blower, promoted as Glass Blower (Gr. 5) w.e.f. 01.04.1991.

Chhotey Lal, Mechanic-Cum-Section Cutter, promoted as Mechanic w.e.f. 01.04.1991.

Appointments

Rattan Lal Mehra appointed as Proof Reader w.e.f. 05.08.1991 (AN)

Sudhir Tandon appointed as Senior Technical Assistant (Computer) w.e.f. 19.08.1991

Madhukar Arvind appointed as Junior Technical Assistant (Computer) w.e.f. 10.09.1991

R. Nandgopal appointed as Junior Technical Assistant (Computer) w.e.f. 09.10.1991

Retirements

N.C. Saxena, Junior Technical Officer, retired on superannuation on 31.05.1991.

G.K.B. Navale, Assistant Director (Spl. Grade), retired on superannuation on 30.06.1991.

Organisational Structure
Governing Body

Chairman

Professor H.Y. Mohan Ram,
Department of Botany, University of Delhi,
Delhi 110 007

Members

Professor R.N. Kapil,
Department of Botany, University of Delhi,
Delhi 110 007

Dr Harsh K. Gupta,
Adviser (ESS),
Department of Science & Technology,
Technology Bhavan, New Mehrauli Road,
New Delhi 110 016

Sri S.B. Krishnan
Joint Secretary & Financial Adviser,
Department of Science & Technology, Technology Bhavan,
New Mehrauli Road,
New Delhi 110 016

Dr B.D. Sharma,
Director,
Botanical Survey of India,
P-8, Brabourne Street,
Calcutta 700 001

Sri C.P. Vohra,
Director General,
Geological Survey of India,
27 Jawaharlal Nehru Road,
Calcutta 700 016

Dr S.C.D. Sah,
Vikaspuram Enclave
General Mahadeo Singh Road
Ballupur, P.O.E.R.I.
Dehradun 248 006

Professor D.D. Pant,
106, Tagore Town,

Allahabad 211 002

Professor C.P. Sharma,
Nominee of Vice-Chancellor, University of Lucknow,
Department of Botany, University of Lucknow,
Lucknow 226 007

Secretary

Dr B.S. Venkatachala,
Director, Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Assistant Secretary (Non-member)

Sri S.B. Verma,
Registrar, Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Finance and Building Committee

Chairman

Professor H.Y. Mohan Ram
Department of Botany, University of Delhi,
Delhi 110 007

Members

Sri S.B. Krishnan
Joint Secretary & Financial Adviser,
Department of Science &Technology, Technology Bhavan,
New Mehrauli Road,
New Delhi 110 016

Sri S.C. Jain,
Former Divisional Engineer, Northern Railway,
A-431, Indira Nagar,
Lucknow 226 016

Nominee of Secretary to the Government of India,
Department of Science and Technology, Technology Bhavan,
New Mehrauli Road,
New Delhi 110 016

Professor C.P. Sharma,
Head, Department of Botany, University of Lucknow,
Lucknow 226 007

Chief Engineer, U.P.P.W.D. or his nominee,
95th Circle, P.W.D.,
Lucknow 226 001

Secretary

Dr B.S. Venkatachala,
Director, Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Research Advisory Council

Chairman

Dr B.S. Venkatachala,
Director, Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Members

Dr S.C.D. Sah,
Vikaspuram Enclave,
General Mahadeo Singh Road,
Ballupur, P.O.E.R.I.,
Dehradun 248 006

Professor R.N. Kapil,
Department of Botany,
University of Delhi,
Delhi 110 007

Dr B.D. Sharma,
Director,
Botanical Survey of India,
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Calcutta 700 001

Professor C.G.K. Ramanujam,
Palaeobotany-Palynology Laboratory,
Department of Botany,
P.G. College of Science, Osmania University,
Saifabad, Hyderabad 500 004

Professor B.L.K. Somayajulu,
Physical Research Laboratory,
Navrangpura,
Ahmedabad 380 009

Professor S.K. Tandon,
Department of Geology,
Delhi University,
Delhi 110 007

Professor Ashok Sahni,
Professor of Geology,
Centre of Advanced Study in Geology,
Panjab University,
Chandigarh 160 014

Professor D.D. Nautiyal,
Department of Botany,
Allahabad University,
Allahabad 211 002

Professor S.K. Dutta,
Department of Applied Geology,
Dibrugarh University,
Dibrugarh

Convener

Dr. H.P. Singh,
Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Departments

1. Department of Non-Vascular Plants
2. Department of Palaeophytic Evolutionary Botany
3. Department of Mesophytic Evolutionary Botany
4. Department of Cenophytic Evolutionary Botany
5. Department of Quaternary Biogeography & Archaeobotany
6. Department of Pre-Gondwana and Gondwana Palynostratigraphy
7. Department of Post-Gondwana Palynostratigraphy of Peninsular India
8. Department of Post-Gondwana Palynostratigraphy of Extra-Peninsuar India
9. Department of Planktonology
10. Department of Biodiagenesis
11. Department of Radiometric Dating

Internal Committees

1. Research Programming Committee

B.S. Venkatachala	— Convener
H.P. Singh	
K.P. Jain	
H.K. Maheshwari	
R.S. Tiwari	

2.Excursion Committee

P.K. Maithy	— Convener
N. Awasthi	

3. Instrument Maintenance Committee

Suresh C. Srivastava	— Convener
Anil Chandra	

4. Quality Control Committee

M.B. Bande	— Convener
Bhagwan Singh	
B.K. Jain	

5. Purchase Committee

B.S. Venkatachala	— Convener
H.P. Singh	
Suresh C. Srivastava	
M.B. Bande	
Registrar	
Accounts Officer	
Section Officer (S & P)	

6. Maceration Committee

K.P. Jain	— Convener
Suresh C. Srivastava	

7.Building Construction and Maintenance Committee

H.K. Maheshwari	— Convener
Anand Prakash	
Registrar	
S.O.(A)	
P.K. Bajpai	

8. Vehicle Maintenance Committee

Anand Prakash	— Convener
Registrar	
R.K. Takru	— Vehicle In-Charge

9. Garden Maintenance Committee

G.P. Srivastava	— Convener

D.C. Saini

10. Canteen Committee

M. B. Bande	— Convener
P. K. Bajpai	— Secretary
Indra Goel	— Treasurer
K. J. Singh	
V. Nirmala	

Auditors Report

to the

Governing Body of Birbal Sahni Institute of Palaeobotany, Lucknow

We have audited the annexed BALANCE SHEET of Birbal Sahni Institute of Palaeobotany, Lucknow as at 31st March, 1992 and its relative Income & Expenditure Account and Receipts & Payment Account for the year then ended with the records produced before us.

In our opinion and to the best of our information and according to the explanations given to us the said accounts read with the comments there on attached hereto in Annexure-I given a true and fair view:

(i) In the case of Balance Sheet of the state of affairs of the Institute as at 31st March, 1992;

(ii) In the case of Income and Expenditure Account, of the excess of Income over Expenditure for the year ended on that date.

For KISHORE & KISHORE

Chartered Accountants

(R.K. MATHUR)

Partner

Place : Lucknow

Dated : 03.07.1992

Annexure I

COMMENTS ON ACCOUNT OF
BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY, LUCKNOW
AS AT 31ST MARCH, 1992.

1. Accounts have been maintained on each system except for adjustments of unsettled advances.

2. During the year one NELCO EPABX SYSTEM has been installed at a cost of Rs.3,30,947.00. The old Uptron EPABX has been disposed off for Rs.20,000/- for which sanction of the competent authority was not available for our verification. The old Uptron EPABX System still continues to appear under the head 'Office and Miscellaneous Equipments', though the same does not physically exist; to that extent the fixed assets are overstated.

3. Balance of various projects and seminars have not been incorporated in the Balance Sheet and Income and Expenditure Account.

4. Cement though totally consumed, on repairs and maintenance of the building, continues to appear at Rs. 5,830/- under the 'Head Building Material' in the Balance Sheet , to that extent the 'repairs and maintenance' is understated the' building material' is overstated.

5. Unsettled advances Rs.25,86,556.73 and payment to C.P.W.D., Lucknow Rs.21,95,385.00 under 'Deposit Works' include payments made as old as in 1988-89, which remain unadjusted inspite of repeated reporting. This was resulted in under stating capital/revenue expenditure and overstating advances/deposits.

6. No proper has been maintained for library advances, therefore, it has not been possible to verify the adjustment of unsettled Library advances.

7. Completion certificates for various works transferred to work and building, wherever required, still remain to be obtained.

For KISHORE & KISHORE

Chartered Accountants

(R. K. MATHUR)

Partner

Place : Lucknow

Dated : 03.07.1992

BIRBAL SAHNI INSTITUTE OF

Balance Sheet as at

Liabilities	*Up to Last year 1990-91*	*Total up to 1991-92*
Capital	3,82,56,888.52	4,25,56,888.52
Excess of Income over Expenditure	34,92,612.86	31,53,665.63
Donations/Gifts	4,31,291.20	4,37,258.15
G.P.F. Deposits	74,55,132.41	83,13,021.16
Deposits under Security & Earnest money	54,208.90	42,936.90
Group Insurance	40,677.76	4,375.00
Total Rs.	4,97,30,811.65	5,45,08,145.36

Place : Lucknow.
Date : 3-7-1992

(J.C. SINGH)
Accounts officer

PALAEOBOTANY, LUCKNOW

31st March, 1992

Assets	*Upto Last Year 1990-91*	*Total Upto 1991-92*
Land & Buildings	59,55,335.30	69,47,566.88
Apparatus & Equipment	1,96,44,462.41	2,50,68,825.30
Apparatus & Equipment	1,38,868.15	1,38,868.15
Vehicles	6,51,398.57	6,51,398.57
Furniture & Fixtures	19,79,507.32	22,61,466.48
Furniture & Fixtures Donated	4,264.07	4,264.07
Books & Journals etc.	19,05,032.60	22,09,546.36
Founder's Library Books	50,000.00	50,000.00
Investments (Donation)	1,04,600.00	1,04,600.00
Founder's Fossil Collection	50,000.00	50,000.00
UNesco Coupons	543.12	543.12
Advances	53,89,386.95	25,86,556.73
Deposits With CPWD	26,08,529.00	21,95,385.00
Security money	3,000.00	6,100.00
Lones to Employees	24,78,928.37	24,22,773.00
GPF Accumulation	74,55,132.41	83,13,021.16
Closing Stock	5,830.00	5,830.00
Closing cash Balances:		
(i) In hand	464.10	28.55
(ii) In Bank	13,05,529.28	14,91,371.99
Total Rs.	4,97,30,811.65	5,45,08,145.36

(S.B. VERMA) (B.S. VENKATACHALA)

Registrar *Director*

COMMENTS TO BE READ WITH REFERENCE TO ANNEXURE I ON PAGE 133

1. Need no comments.
2. The offer of the cost of NELCO EPABX system had taken into account the value of Rs. 20,000.00 of the old UPTRON EPABX system under the buy back scheme. Formal sanction of the competent authority has since been obtained (Finance & Building Committee meeting dated July 29, 1992 and Governing Body meeting dated July 30, 1992).
3. The balances in the Accounts of Projects, Seminars, etc. are to be refunded to the respective sponsored funding authorities and do not accrue to the Institute. These are time bound one time activities whose accounts are distinct and separate from that of the Institute. Assets created on such projects remain the property of the sponsoring agencies till such time specific authorisation transferring the same in favour of the Institute is received.
4. Necessary accounting entries have since been carried out.
5. The matter is being vigorously pursued with the C.P.W.D., Lucknow to ensure expeditious settlement.
6. Records maintained for Library advances have been seen by the Finance & Building Committee held on July 29, 1992 and will be shown to auditors.
7. The matter is being pursued with the C.P.W.D.