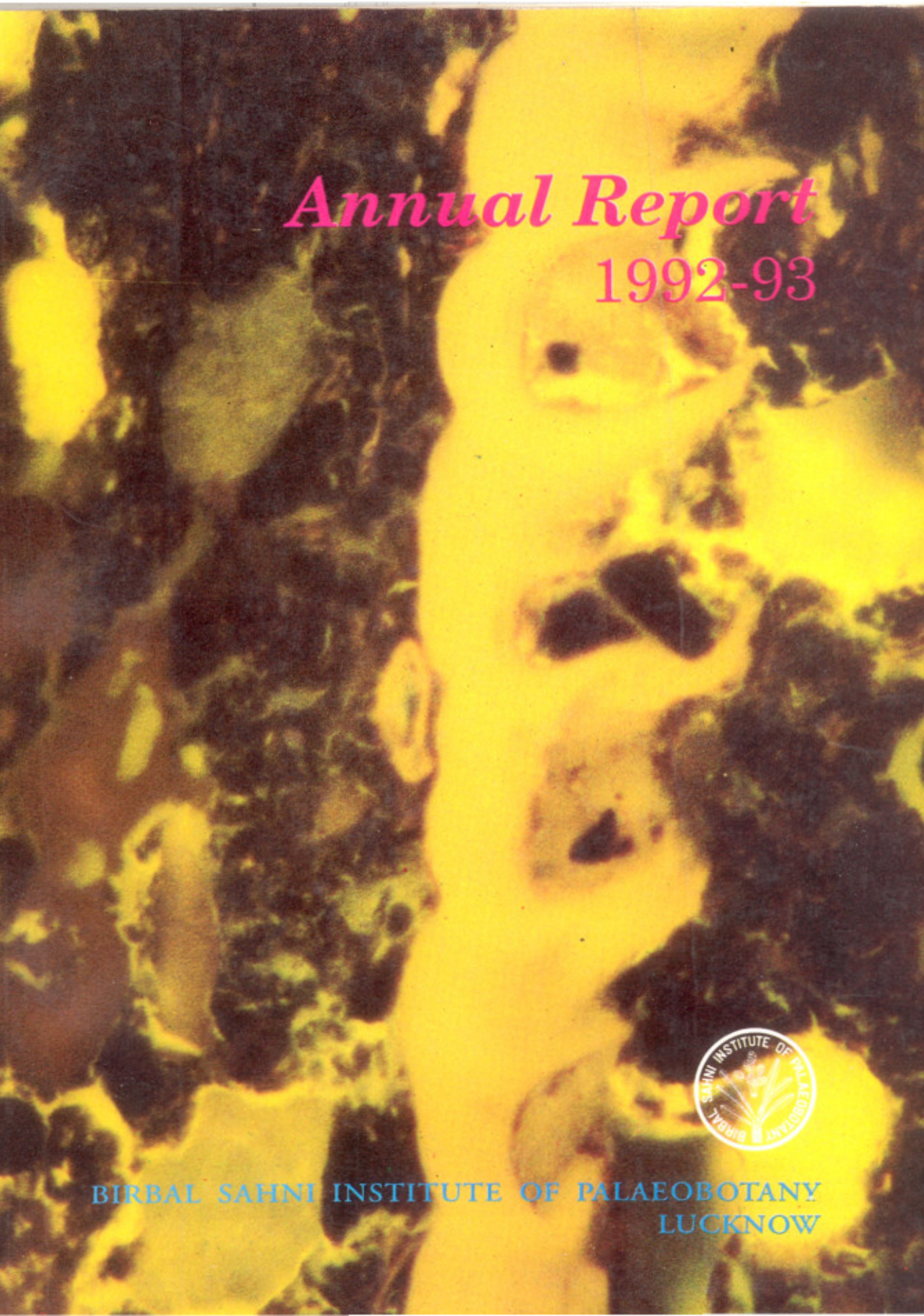
Annual Report
1992-93



BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY
LUCKNOW

ANNUAL REPORT
1992-93

Front Cover Photo : Thick-walled yellowish-orange fluorescing cutinite in the Palaeocene lignite from Panandhro Lignitefield, Kutch, Gujarat (under blue light excitation).

Back Cover Photo : Grey to reddish-brown cell-filling resinites in a well preserved plant tissue in the Palaeocene lignite from Panandhro Lignitefield, Kutch, Gujarat (under normal incident light).

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Contents

Foreword

The research programmes of the Birbal Sahni Institute of Palaeobotany have been structured to generate knowledge, expertise and techniques related to the study of fossil plants through ages and their bearing with the geological system. The following are the main objectives of the research activities:

- 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 diversification of early life, exploration of fossil fuels, vegetation dynamics, climatic modelling, conservation of forests, etc., and
- Dissemination of palaeobotanical knowledge.

In order to achieve the above objectives inter-institutional collaboration was inculcated which provided an opportunity to the scientists for multidisciplinary approach in solving the problems. The year-long Birbal Sahni Birth Centenary Celebration, commenced on 14 November, 1991, was concluded on November 14, 1992. The ideals of the Founder – Professor Birbal Sahni continue to inspire the scientists at the Institute.

The main research activities during the academic year 1992-1993 are summarised below:

The Vendian marker cyanobacteria *Sphaerocongregus,* endosporulating and its colonies, have been recorded from Lower Bhander Limestone Formation in Damoh District, Madhya Pradesh. Varied types, viz., *Stratifera, Collenia, Colonella, Columnocolenia, Cryptozoan, Gymnosolen, Inzeria,* etc. and tiny digitate stromatolites are represented in the Vaimpully Dolomite and Shale Formation, Cuddapah Supergroup. The tiny digitate microstromatolites are invariably associated with phosphorite.

The study of Permian sequence in Koel Valley reveals the absence of leaf fossils in beds containing *Vertebraria* axes and seeds; it reflects on preferential preservation of different dispersed organs. Typical Karharbari plant megafossil assemblage has been recorded from Gopal Prasad area, Talcher Coalfield. A fertile structure–seed, *Beckeaspermum montidorsum* from Nidpur bed, Madhya Pradesh has shown angiospermoid affiliation.

The palynological studies in Bore-holes TCW-24 and TCC-19 from Talcher Coalfield has shown the presence of Karharbari, Barakar, Barren Measures and Raniganj assemblages. The palynoflora of Bore-holes UM-51 and KU-1 from Umaria Coalfield indicates the presence of Permian-Triassic transitionary levels in these bore-holes. Presence of Talchir palynoassemblage in Bore-hole GAG-7, Ainapalli-Gompana area, and Karharbari, Barakar and Kamthi palynofloras in Bore-hole GAM-10, Mailaram

area has been recorded in Godavari graben.

Based on character-state analysis, six basic character-clans have been identified in the morphology of dispersed pollen. Their expression, manifestation and recurrence in different groups of palynomorphs have been considered significant for evolutionary relationship. These adaptations have been tied-up through the Permian sequence to interpret the climatic changes.

The organic-walled microfossils of doubtful origin have been recorded from certain horizons in almost all the basins at various time planes in Talchir, Karharbari, Barakar, Kulti, Raniganj, Panchet and Dubrajpur formations. On the basis of their diversification, proliferation and distributional pattern, change in the salinity of the palaeodrainage system during the transgressive phases has been proposed which has resulted in the increase in area of brackish water regime on the Indian Peninsula.

The petrological studies of coals in Bore-hole RCH-3 from Chuperbhita Coalfield, Rajmahal Basin, reveals presence of high amount of hydrogen-rich microconstituents (perhydrous vitrinite and liptinite macerals) which render them suitable for liquefaction. Occurrence of alginite (*Botryococcus* up to 0.6%) indicates that the source material (vegetal matter) has been deposited under brackish water conditions.

Reconstruction of monocotyledonous infructescence, *Monocotylostrobus bracteatus* from Deccan Intertrappean sediments has been made. The plant megafossil investigation from Siwalik sediments has revealed the presence of leaf-impressions belonging to *Artocarpus, Lagerstroemia, Filicium, Hydnocarpus, Terminalia,* etc., from Surai Khola, Nepal and *Euphorbia didyma, Terminalia belerica, Pongamia glabra, Bouea burmanica* and *Anacolosa luzoniensis* from Kathgodam and Koilabas, Nepal.

The palynological studies of subsurface sediments of Kapurdi and Jalipa, Barmer District have revealed the presence of new angiospermous pollen genera *Kapurdipollenites* and *Retiverrumonosulcites* showing affinity with some members of family Arecaceae.

The palynoassemblages from the Tertiary sediments of west and northeast India have shown similarity due to presence of *Dandotiaspora dilata, D. telonata, D. auriculata* and *D. densicorpa* in the Palaeocene sequence. The taxa *Matanomadhiasulcites maximus, Kielmeyerapollenites syncolporatus, Tripilaorites triangulus, Spinizonocolpites echinatus* and *Neocouperipollis kutchensis* are present in Palaeocene-Lower Eocene assemblages while *Striatriletes* appears in Middle Eocene.

Fossil spores assigned to *Acrostichumsporites* gen. nov. resembling the extant spores of *Acrostichum aureum* Linn. have been recorded from the Langpar Formation (Early Palaeocene) exposed at Therria Ghat on Umshoryngkew River, Meghalaya.

The phytoplankton investigations have shown presence of *Micula prisonii,* a terminal Cretaceous marker for precise demarcation of KTB, from basal part of Langpar Formation exposed in Umshoryngkew section in Meghalaya. This evidences for the

presence of youngest Maastrichtian sediments. Distribution of planktonic and benthonic communities alongwith terrestrial organic influx in the sediments of Trichinopoly Formation Cauvery Basin has evidenced significant changes from anoxic conditions during Albian to well-oxygenated open sea conditions through Cenomanian-Turonian.

On the basis of calcareous nannofossils, recovered from sections representing Sawai Bay Formation in Nipple Hill and Neill west coast of Neill Island, these sections could be assigned to Late Miocene (Tortonian) CN9a *Discoaster berggrenii* subzone of Okada & Bukry 1980. The diatom and silicoflagellate assemblage from the West Coast section of Kamorta Island indicates a Middle Miocene age for the sediments.

The petrological studies of lignite and lignitic clay samples from Kapurdi area, Rajasthan have revealed the presence of almost all the macerals of liptinite group. The presence of alginite indicates that the lignite seams were formed under near-shore condition. The quality of lignite is considerably reduced due to mineral matter which constitutes the dominant fraction.

The biopetrological, chemical, palaeobotanical and geological data on Upper Palaeocene deposits in Garo Hills (West Daranggiri Coalfield) reveal the non-caking nature of coal while coals of Jaintia Hills show strongly coking nature. The coalseams in both areas have high contents of syngenetic pyrite and calcite, whereas clastic minerals are persistently low. The study of these coals under fluorescence mode suggests their perhydrous nature.

The pollen analysis of two profiles (NT-1, NT-2) from Nachiketa Tal, Garhwal Himalaya reveals the dominance of arboreals (*Quercus, Pinus, Alnus, betula, Carpinus, Rhododendron,* etc.) rather than non-arboreals (Poaceae, Cyperaceae, Cheno/Ams, Caryophyllaceae, etc.).

The dispersed organic matter analysis of samples form Rambha profile, Chilka Lake, Orissa has shown that a major part of organic matter deposited on southern flank is terrigenous in origin. The different stages of transformation of structured organic matter into semi-amorphous and amorphous states have been documented.

The study of plant remains from Neolithic-Chalcolithic Senuwar (Ca 2,000-600 B.C.), district Rohtas, Bihar has revealed that the cultivation of fruit trees of Jack or Katahal (*Artocarpus heterophyllus*) and Mango (*Mangifera indica*) is a newly established proclamation. The presence of seeds of *Cannabis sativa,* in addition to wood charcoals, suggests the use of "*Bhang*" or "*Ganja*" for narcotic confection. A rich, varied plant economy comprising cereals, pulses, fruits, millets and weeds is indicated at the site of Manjhi, about 2,500 years ago. Advanced agricultural practices and import techniques seem to have been known to the ancient settlers by that time.

The C^{14} age data of marl deposits in abandoned channels of Mesa Tal, Gosaiganj and Barabanki indicate that the deposition of marl in Gangetic alluvium probably started around 8,500 years B.P. in response to higher precipitation and sea level rise.

The Research Programming and Evaluation Committee consisting of Drs G. Rajagopalan, K.P. Jain, H.K. Maheshwari, P.K. Maithy and R.K. Kar helped to prepare this document. Drs Suresh C. Srivastava, Archana Tripathi and B.D. Singh of the Coordination Unit for Scientific Activities (CSA) rendered immense help in bringing out this report. The printing of this report has been looked after by Dr J.S. Antal.

(R. S. Tiwari)
Director

Overview

The Birbal Sahni Institute of Palaeobotany is committed to undertake research with an objective to understand patterns and processes of evolution against the backdrop of past vegetations and floras, and their application in exploring fossil fuel resources of the country and to decipher the palaeoenvironment. Research programmes have been designed to generate knowledge, expertise and techniques related to the study of fossil plants through geological era.

The research activity is organised under nine projects as given below :

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

Dr S. Varadrajan lighting the ceremonial lamp.

SARASWATI VANDANA

These research programmes would effectively decode the — (i) Origin and evolution of life, (ii) Development and expansion of the Gondwana floras, (iii) Origin and spread of angiosperms, (iv) Effect of Himalayan orogeny on the evolution of modern Indian flora, (v) Climatic vicissitudes during the last 40,000 years, (vi) Origin of agriculture and domestication of plants, etc. The data generated shall also meet societal obligations by creating Research and Development information base for user agencies engaged in exploration of fossil fuels, ground water, medicine, forestry and environment.

In order to achieve the objectives of above projects, the Institute has established close co-ordination and collaboration with the Geological Survey of India, Oil India Limited, Mineral Exploration Corporation Limited, Oil and Natural Gas Commission, Coal India Limited, Central Mine Planning and Design Institute Limited, Neyveli Lignite Corporation of India, National Geophysical Research Institute, Bhaba Atomic Research Centre, Wadia Institute of Himalayan Geology, Institute Francaise du Pondicherry, Indian Institute of Tropical Meteorology, Physical Research Laboratory and other institutions and universities.

The main achievements in research during the year 1992-93 include several new findings and interpretation of data. Some are given below :

The Vendian Marker cyanobacteria, *Sphaerocongregus*, endosporulating and its colonies, have been recorded from the Lower Bhander Limestone Formation in Damoh District, Madhya Pradesh.

The palynological studies in Bore-hole TCW-24 and TCC-19 from Talcher Coalfield have shown the presence of Karharbari, Barakar, Barren Measures and

Dr Harsh Kumar Gupta delivering the 22nd Birbal Sahni Memorial Lecture.

Raniganj assemblages.

Based on character-state analysis, six basic character-clans have been identified in the morphology of dispersed pollen.

On the basis of diversification, proliferation and distributional pattern of acritarch, change in the salinity of the palaeodrainage system during the transgressive phases has been proposed which has resulted in the increase in area of brackish water regime on the Indian Peninsula.

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The C-14 age data of marl deposits in abandoned channels of Mesa Tal, Gosaiganj and Barabanki indicate that the deposition of marl in Gangetic alluvium probably started around 8,500 years B.P. in response to higher precipitation and sea level rise.

Ninety five research papers and forty three Abstracts have been published and forty three research papers and twenty seven Abstracts were submitted for publication during the year 1992-1993.

In all, thirty three research papers have been presented in various National and International conferences. During the year seven scientists have been deputed to International and sixteen scientists to National conferences. Thirteen lectures have been delivered by nine scientists of the Institute.

Technical assistance have been provided to various institutes, agencies and universities for radiocarbon dating and palynological dating of samples. The library services are made available to scientists of eight organisations and universities. At

Professor H.Y. Mohan Ram welcoming Professor S.K. Sah who delivered 38th Sir Albert Charles Seward Memorial Lecture.

Dr S. Varadrajan showing keen interest in the Institute's achievements.

present the total number of registered borrowers is one hundred and twenty four; fifty nine current periodicals are being procured on exchange basis and seventy six are subscribed. The Herbarium facilities have been provided to various scientists of other universities and organisations in India and abroad.

A number of scientists and distinguished visitors from sixteen organisations visited the Museum. An Inventory of the Type and Figured specimens/slides of papers published between 1971-1980 has been prepared. A poster session on recent achievements of the Institute was also organised as a part of concluding ceremony of Birbal Sahni Birth Centenary Celebrations. One hundred and thirty eight palaeobotanical specimens have been gifted to twenty three educational institutions. The Institute has published Volume 39 number 3 of the journal The Palaeobotanist. Volumes 40 and 41 of the journal were published as the special volumes to mark a tribute to Professor Birbal Sahni Birth Centenary Celebrations during 1992.

Thirty Seventh Sir Albert Charles Seward Memorial Lecture was delivered by Professor V. Visscher, University of Utrecht, The Netherlands on the title "Links with the past in the plant world : cuticles as recorders of diversity, kerogen formation and palaeoatmospheric CO_2 level".

The total strength of the Institute staff is one hundred and eighty four; out of these, seventy seven are scientists and rest include technical and administrative members. During the year 1992-93, eleven appointments and eleven promotions have

been made. Five persons retired from the service.

During the year 1993-1994, the above mentioned nine projects will continue. Besides, one new project of *Geobotany* has been launched to provide significant results for implications in mineral prospecting and reconstruction of history of modern vegetation through Cenozoic Era. Among the other scientific activities, four *In House Training Programmes* have been proposed to prepare computer literate generation in the Institute and to generate awareness and discussion among scientists about various aspects of research activities. A training course, including lectures and practical demonstrations, on *"Coaliferous fuel resources of India - Parameters of studies in palynology and biodiagenesis* has been proposed to train and create awareness among the scientists from other organisations of the country. About forty five research scholars, young scientists, teachers and technicians are expected to join this programme. A group discussion on *"Contribution of Palaeobotany to Gondwana Geology"* has been proposed in January 1994 in which about 40 scientists have been invited from various overseas universities and research organisations. This activity has been linked with the International Gondwana Symposium, to be held at Hyderabad (Andhra Pradesh) from 10 to 14 January, 1994.

Research

Projects and Programmes

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

Programme 1.1 : **Palaeobiology of Vindhyan Basin**

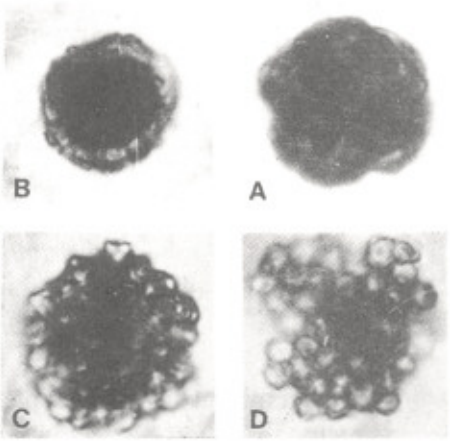
Objective : *To identify metaphyte and metazoan body fossils, ichnofossils and their relics from the Proterozoic succession and their evolution and diversification*

: *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*

Endosporulating cyanobacterium *Sphaerocongregus* in the chert band preserved in the Lower Bhander Limestone Formation exposed near Narsinghgarh, Damoh District, Madhya Pradesh was studied. The organic-walled microfossils exhibit endosporulating and various stages of cyanobacterial colonies. This cyanobacterium is known to be Vendian marker world wide.

Observations on the organic-walled microfossils in the Sirbu Shale Formation exposed in central India indicate the presence of large sized acritarch and few Acanthomorph acritarchs.



Endosporulation stages of *Sphaerocongregus* from near Narsinghgarh, Vindhyan Supergroup, Madhya Pradesh; **A,** Compactly packed endospores; **B,** An endospore showing closely associated blastocytes; **C,**. After desolution of endospore wall blastocytes are seen: **D,** Cells forming a flat colony.

Study of microbiota in the siliceous oncolites preserved in Nagod Limestone Formation exposed in Khemri-Kotar Hill, Satna District was done. The oncolite preserves Entophysalidaceae and tubular forms.

P.K.Maithy & Rupendra Babu

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*

Recorded *Stratifera, Collenia, Colonella, Columnocolenia, Cryptozoan, Gymnosolen, Jacutophyton, Kussiella, Inzeria, Tungussia* and tiny digitate stromatolites and probably *Omachitinia* in the Vaimpully Dolomite and Shale Formation, Cuddapah Supergroup. Stromatolite microtextures are dominated by regular streaky, wavy streaky, striated, irregular streaky, grouped streaky and filiform streaky types. The tiny digitate microstromatolites are invariably associated with phosphorite. Phosphate is present in between the laminae. On the basis of these, it is assumed that relationship exists in between microfossils and phosphorite precipitation and mat building of stromatolites. Tadpati Shale Formation shows low diversity of stromatolites. Four forms, viz., *Conophyton, Jacutophyton, Stratifera* and *Pseudogymnosolen* were recorded. Thin section study of cherts reveals the presence of microfossils belonging to coccoid and tubular structures, *Eomycetopsis.*

Manoj Shukla & Mukund Sharma

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

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

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*

Morphographical features of plant fossils collected from sections exposed near the confluence of Deori-Ghora Sumi and Chelha-Koel rivers in Koel Valley were

Scutum sp. – glossopteris fructification from Jharia Coalfield, Bihar.

investigated. The plant fossil assemblage comprises 4 species of the genus *Glossopteris,* 3 species of *Gangamopteris,* 1 species each of *Noeggerathiopsis* and *Vertebraria,* besides few seeds of Samaropsis-type. It has been observed that leaf fossils are absent in beds containing *Vertebraria* axes; however, seeds are preserved. This possibly reflects on preferential preservation of different dispersed organs.

A.K. Srivastava

Cuticles of several species of the genus *Glossopteris,* collected from Raniganj Formation of Bhatdih Colliery of Jharia Coalfield, were prepared. The recovered cuticles are not well preserved. Morphographical descriptions of several species of this genus collected from Lohapiti Kendra and Lohapiti II collieries were completed. The recorded species are *Glossopteris angustifolia, G. communis, G. rhabdotaenioides, G. damudica, G. conspicua, G. nautiyalii, G. spathulata, G. tenuifolia,* etc.

Rajni Tewari

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

The study of megafossils collected from Gopal Prasad area, Talcher Coalfield indicates typical Barakar flora of Late Permian age.

Nearly 250 specimens from South Belanda Colliery, Talcher Coalfield were studied and photographed. Cuticular preparations are in progress. The Early Permian assemblage contains *Euryphyllum, Noeggerathiopsis, Gangamopteris, Glossopteris, Gondwanophyton* and a number of conifer specimens.

A paper on the genus *Glossopteris* from Handapa, Dhenkanal District, Orissa was finalised.

Shaila Chandra & 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*

In the course of study of detached fertile structures, two new seed taxa have been identified. It is quite interesting to note that one of these seeds *Beckeaspermum montidorsum* has shown angiospermoid affiliation. The other seed *Saksenaspermum puteum* closely match in its epidermal characters with that of the scale leaf genus *Glottolepis rugosa* most frequently found in Nidpur Bed. Besides, the revision of genus *Dicroidium* is also being carried out.

Shyam C. Srivastava

Sorted out some *Dicroidium* plant fossils, taken out their peels, macerated and prepared cuticular slides.

Neeru Prakash

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 intra-formational succession of Johilla Coalfield*

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

Detailed study of a morphographically significant acritarch from Barakar assemblage of bore-hole TCW-25, Talcher Coalfield, has been done which is indicative of marine habitat. The behaviour patterns of climate sensitive morphographic characters of palynomorphs in various assemblages of Talcher Coalfield were analysed. Besides, chemical processing of samples from bore-hole TCC-19 has been done for the recovery of spores and pollen.

The lithological aspect of recently collected bore-core material reveals presence of thick Kamthi sediments grading from khaki green to reddish facies in the western part of the Talcher Coalfield.

Archana Tripathi

The palynological study in bore-hole TCC-20 of Talcher Coalfield revealed the presence of Karharbari and Barakar sequences. The Karharbari type of assemblage was encountered between 140.25 to 174.55 m. The predominance of *Parasaccites* was noticed in this assemblage. The Barakar type of assemblage was found up to 130.65 m depth and is characterized by the dominance of *Scheuringipollenites*.

The palynological assemblages studied from bore-hole TCW-24 of Talcher Coalfield has shown the presence of Barakar, Barren Measures and Raniganj assemblages. The Barakar assemblage (265.45 - 532.30 m) is dominated by the genus *Scheuringipollenites*. The Barren Measures assemblage at 223-260 m showed the prominence of *Striatopodocarpites/Scheuringipollenites*. The Raniganj assemblage at 200.80 m showed the presence of forms like *Cyclogranisporites gondwanensis, Horriditriletes brevis, Lophotriletes rectus, Densipollenites densus, Densipollenites magnicorpus, Striatopodocarpites brevis*, etc.

B.N. Jana

Quantitative analysis of the yielded samples in bore-hole SPB-18 has been completed which reveals Late Permian assemblage. Search for the qualitatively important species in the Middle Pali Member is continued.

Maceration of 50 samples from bore-hole SPB - 14 has been completed. Macerated 3 samples from bore-hole MSN-6, two samples from bore-hole MSN-3 and one coal sample for dating of sediments in the newly identified areas in Singrauli Coalfield. The assemblage shows Raniganj age affiliation. A report on the study has been sent to Mineral Exploration Corporation Limited, Ranchi.

Chemical processing of samples in two bore-holes - UM-51(6 samples) and KU-1 (7 samples) has been completed and the palynoflora is indicative of Permian-Triassic transition. The palynological report has been sent to the Mineral Exploration Corporation Limited, Umaria. Photomicrography has also been completed.

Ram-Awatar

Maceration of 20 samples in bore-hole IBSH-6 from Belpahar area, Orissa has been done. The quantitative analysis of the yielded samples has been taken up. In first phase of study scanning and photography of distinct forms are in progress.

K. L. Meena

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

Processed a large number of carbonified specimens of the leaf genus *Glossopteris* collected from the Raniganj Formation of Raniganj Coalfield for recovery of cuticles. Very small pieces of cuticles, practically of no use for morphological studies, were recovered.

Bulk macerated 20 samples collected from Barakar Formation of Hahajor area, Rajmahal Basin. Small pieces of cuticles recovered were processed for ultrathin sectioning. Due to brittle nature of the cuticle embedding was not perfect; the experiment needs repetition. Selected specimens were sorted and photographed for morphographical studies.

H. K. Maheshwari & 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*

The structuring of palynoassemblages based on evolutionary state of characters is significant for finer zonations and correlation. Based on character-state analysis, six basic character clans have been identified in the morphology of dispersed spore-pollen. Their expression, manifestation and recurrence in different groups of palynomorphs have been considered significant for evolutionary relationship. These adaptations have been tied-up through the Permian Sequence to interpret the climatic adversities.

R.S. Tiwari & Vijaya

Programme 2.7 : **Composition, relationship and age of the megafossil 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*

Investigation of fossiliferous intertrappean bed at Bhutapahar was carried out. The assemblage is represented by various taxa, viz., *Marattiopsis, Sphenopteris, Ptilophyllum, Anomozamites, Taeniopteris, Taeniopteris / Nilssonia, Phyllopteroides/ Thinnfeldia, Brachyphyllum* and *Pagiophyllum*. This assemblage seems to be equivalent to Khutnashi assemblage of Rajmahal Basin. Reconstruction of *Pentoxylon* has been prepared.

Jayasri Banerji

Finalized the studies on Dhokuti flora. Sorted out Amarjola material and selected some important megafossils which are *Ptilophyllum acutifolium, P. amarjolense, P. sahnii, Taeniopteris* cf. *spatulata, Anomozamites* sp., *Williamsonia* cf. *kakadlshidensis* and *Bucklandia* sp. Their detailed morphotaxonomic study and photography were also carried out.

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*

The palynoflora from intertrappean sediments in bore-hole RJNE-35 has been

studied to trace the marker species of spores and pollen. A search for angiosperm pollen has been made in this bore-hole and other Rajmahal palynoassemblages. The acritarchs observed in the bore-hole RJNE-32, Late Permian sediments, have been analysed for their morphography. Their high percentage reveals brackish water near shore palaeoenvironment.

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 purposes with emphasis on coking and blending potentiality*

Quantitative estimation of macerals under fluorescence mode (blue light excitation) was made on 43 particulate pellets, representing eight coal seams in bore-hole RCH-3 from Chuperbhita Coalfield. Appreciably high amount of liptinite macerals (7-66% m.m.f.) chiefly constituted by sporinite (2-58%) and liptodetrinite (1.6-20.0%) were recorded. Cutinite, fluorinite, resinite, alginite and exsudatinite are in subordinate amount. The perhydrous vitrinite ranges between 2 to 80 percent m.m.f. Non-reactive inertinite fraction shows wide variation and ranges from low (4%) to high (68%) proportions.

High amount of hydrogen-rich microconstituents (perhydrous vitrinite and liptinite macerals) in the coals render them suitable for liquefaction. Occurrence of alginite (*Botryococcus* up to 0.6%) indicates that the source material (vegetal matter) has been deposited under brackish water conditions.

B.D. Singh & 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 from Bhonpar (Khamtara area), Katni, Madhya Pradesh further includes some more taxa, e.g., *Divisisporites, Reticulatisporites, Cibotisporites* and some new taxa. This assemblage closely compares with the Early Cretaceous palynofloras known from Umia plant beds of Kutch, Rajmahal Formation of Rajmahal Hills, Jabalpur Formation of Satpura basin, Bansa beds of S.R.G. Basin, and Gangapur Formation of Godavari Basin of India. Processing of rock samples from Baskhera section is completed. Identification and photodocumentation are in progress. Processing of rock

samples from Mohpani section is in progress.

Pramod Kumar

Programme 2.11 : **Palynofloral patterns and boundary demarcation in Gondwana Sequence of Godavari 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/T boundary*

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

Compilation of palynological data from Sattupalli area (bore-hole GSS-1; GS-1,2,3&4) reveals presence of Talchir, Barakar and Kamthi formations in this area. Coal seams which were earlier dated by others as Barakar have now been identified as Upper Permian (Kamthi Formation).

Presence of Karharbari, Barakar and Kamthi palynofloral assemblages has been demarcated in bore-hole GAM-10 from Mailaram area.

Processing of 30 samples from Ainapalli-Gompana area (bore-hole GAG 3, 4, 5 & 7) has been completed. In bore-hole GAG-7 at 172.45 m *Parasaccites* + *Plicatipollenites* dominating assemblage has been recorded.

Suresh C. Srivastava & Neerja Jha

Samples from Bazargaon (bore-hole DGW-6) in the southern part of Nagpur and bore-hole MSW-23 and 33 from Western Coalfield of Nagpur have been processed. Identification, counting and photomicrography of stratigraphically important taxa have been taken up.

Suresh C. Srivastava & A.P. Bhattacharyya

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*

Completed reflectance measurements of 50 coal pellets from bore-hole 732 from

Ramagundam area. It has been observed that these coals have a reflectance value ranging from 0.5 to 0.8 percent in oil. Some of the samples have still higher reflectance. Thus, these coals are comparable with the High Volatile Bituminous A & B stages coals. The biopetrological study indicates that these coals are rich in vitrinite and inertinite group of macerals. The significant amount of mineral matter recorded in some samples have adversely affected the quality of coals.

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*

The coal samples representing bottom and top seams from South Belanda, Ananta and Bharatpur quarries have been processed for biopetrological investigations. These are characterized by the dominance of macerals of vitrinite, exinite and inertinite groups. The association of these macerals in variable amount is represented in the form of clarite, duroclarite and clarodurite microlithotypes. Some well preserved megaspore exines have also been observed. Besides, mineral matter forms a sizable fraction of coals which has greatly reduced its quality.

Anand-Prakash & Rakesh Saxena

PROJECT 3 : CENOZOIC PLANT BIOGEOGRAPHY OF PENINSULAR INDIA

Programme 3.1 : **Floristics and plant megafossil biostratigraphy of the Deccan Intertrappean sediments**

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

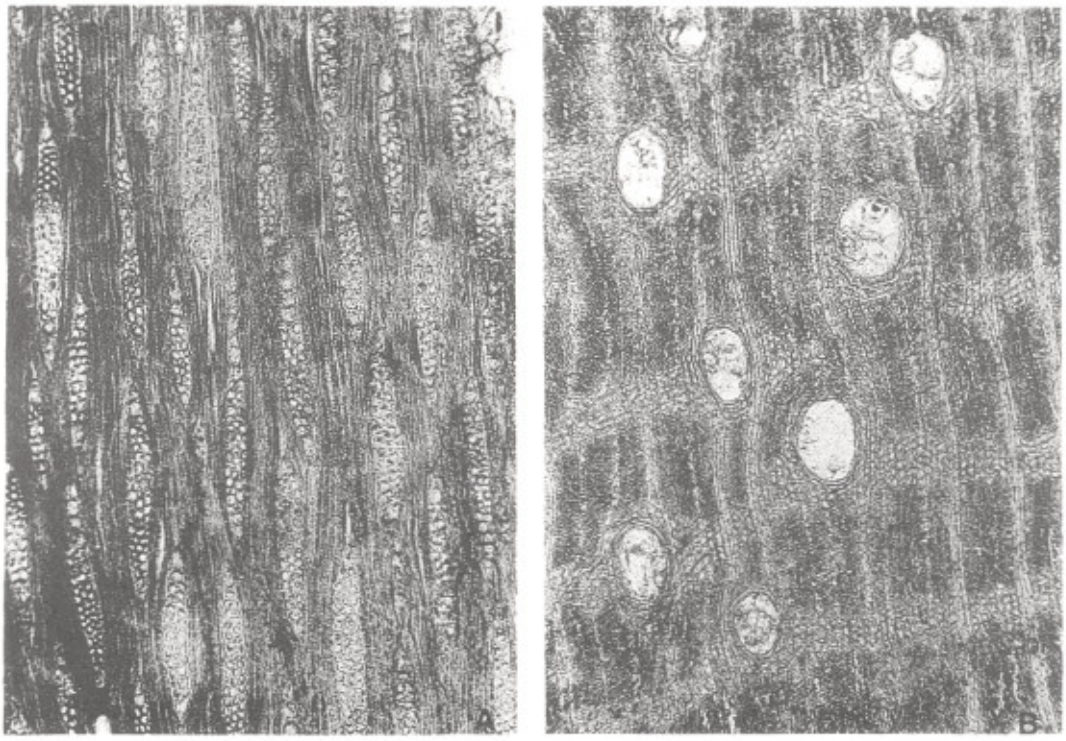
: *To determine their age for reconstruction of vegetational history and phytogeography of Peninsular India*

Reconstruction of a monocotyledonous infructescence *Monocotylostrobus bracteatus* Lakhanpal has been done and finalized a manuscript.

M.B. Bande

Grewia type of fossil wood with tile-cells and radial gum canals has been identified. This special feature has not been observed in any of the extant species of *Grewia*.

M.B. Bande & Rashmi Srivastava



Fossil wood resembling extant *Chlorophora excelsa*, an African element, from the Pliocene of Kutch, Gujarat; **A**, Transverse section x 40; **B**, Transverse longitudinal section x 65.

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

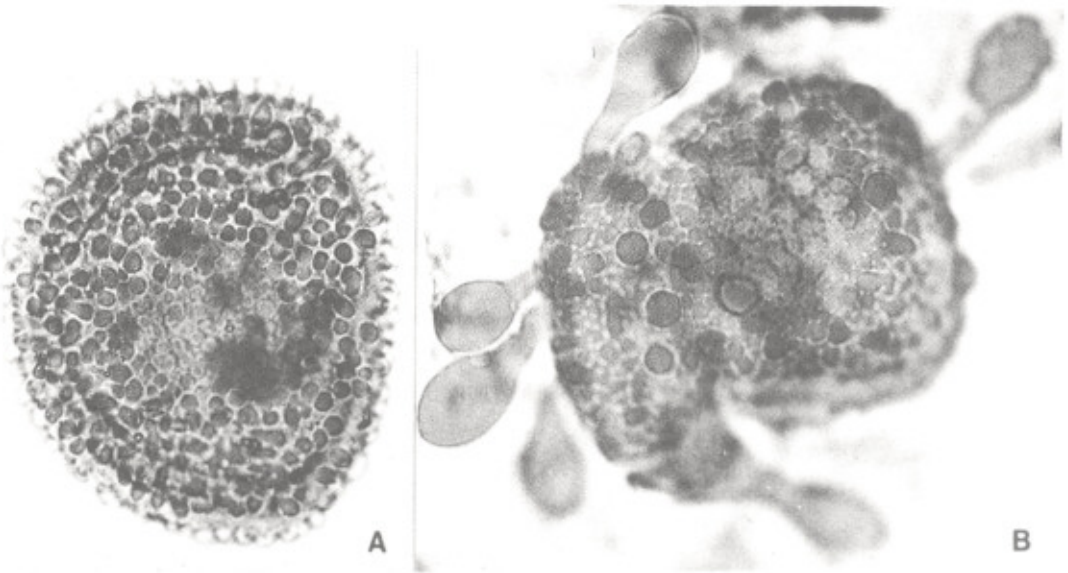
Objective : *To build up floristic history and phytogeography of western India*

A number of fossil woods were cut and studied from Rajasthan and Gujarat. In addition to already known genera, a new African genus belonging to family Fabaceae has been identified from the Late Tertiary sediments of Rajasthan. Three different kinds of palms have been identified from the Deccan Intertrappean beds of western India. Prepared drafts of two papers, viz., History of Indian fossil palms, and occurrence of *Chlorophora excelsa,* an African member of family Moraceae in the Neogene of western India.

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*



A, *Kapurdipollenites gemmatus* gen. et sp. nov. and B, *Retiverrumonosulcites barmerensis* gen. et sp. nov. from the Eocene sediments near Kapurdi, Rajasthan.

: *To deduce palaeoenvironment*

Palynological studies on subsurface samples from five well sections, viz., MK-145, MK-165, MK-327, MK-332 and MJ-4 drilled near Kapurdi and Jalipa, Barmer District were completed. The recorded palynofloras are diverse and represented by dinoflagellate cysts, fungal remains, pteridophytic spores and angiospermous pollen. The flora is closely comparable with that recorded from the Palaeocene-Eocene sediments of Kutch. Two new angiospermous pollen genera, *Kapurdipollenites* and *Retiverrumonosulcites*, were identified. *Kapurdipollenites* is a zonisulcate pollen with verrucate, baculate or gemmate exine. *Retiverrumonosulcites* is monosulcate with verrucate or clavate exine. These pollen show affinity with those found in some members of the family Arecaceae.

S.K.M. Tripathi

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

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

Sixty five carbonised woods from Cheruvathur and Payangadi were studied. A fossil wood of *Sterculia* and *Euphoria* and three fossil woods belonging to family

Fabaceae have been identified. These are new to the flora.

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*

Morphotaxonomic study and identification of spore-pollen taxa recovered from Kundra clay mine have been completed. Photodocumentation and data interpretation of the palynoflora were continued. Besides, chemical processing of the samples of Padappakkara and Varkala sections has been completed.

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*

Fifty carbonised woods were studied from the Neyveli lignite. Amongst them a fossil wood of *Bischofia* has been identified and a paper on this was finalised. In addition, a fossil wood of *Sonneratia* and a wood belonging to Sapindaceae have been provisionally identified.

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, if any*

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

: *To deduce palaeoclimate and environment of deposition*

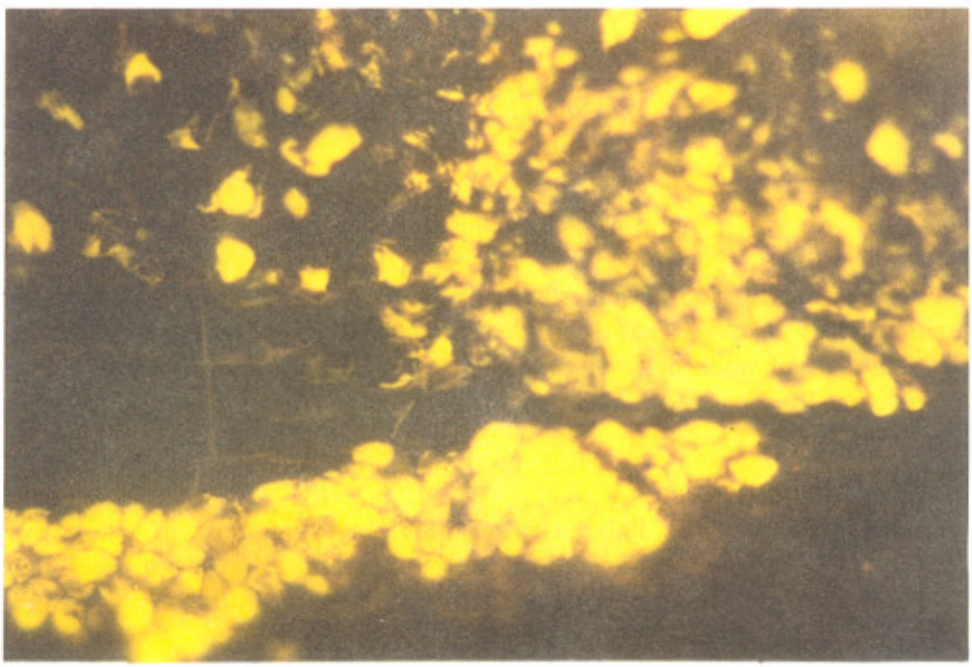
: *To solve the controversy regarding the age of the Neyveli lignite*

Morphotaxonomic study of the palynoflora obtained from the Neyveli Formation of Neyveli Mine-I was continued and photodocumentation and interpretation of the palynoflora are being carried out Study of the palynoflora from the Neyveli Formation of Neyveli Mines-II has also been taken up. Manuscripts dealing with the palynofloral study and zonation of the Neyveli Formation of Jayamkondacholapuram area were finalized.

R.K. Saxena

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

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



Cell-filling resinite in Kapurdi lignites, Rajasthan.

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

The representative samples of lignite and lignitic clay from Kapurdi area have been processed for biopetrological study. An examination of lignite under blue light excitation has revealed the presence of almost all the macerals of liptinite group. However, resinite, sporinite and cutinite represent the dominant microconstituents. Three different varieties of resinous matter characterized by light yellow, yellow and orangish yellow colours have been observed. The presence of alginite has also been recorded. It indicates that the lignite seams have formed under near shore conditions. Besides, mineral matter forms another dominant fraction which considerably reduces the quality of lignite.

Anand-Prakash & Rakesh 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*

Processing and preparation of 95 lignite samples from two mine sections of Panandhro lignitefield were completed. Quantitative assessment of macerals on 15 particulate pellets from bottom bench of New mine section, under fluorescence mode, revealed that the samples contain very high proportion of huminite (72-85%) followed by liptinite (9-25%) and inertinite (1-4%) macerals, respectively. Perhydrous huminite content (up to 65%) was higher than that of the non-fluorescing huminite (up to 35%). Resinite was recorded up to 3.6 percent, whereas alginite was 5 percent though not uniformly recorded in all the lignite samples.

B.K. Misra & 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

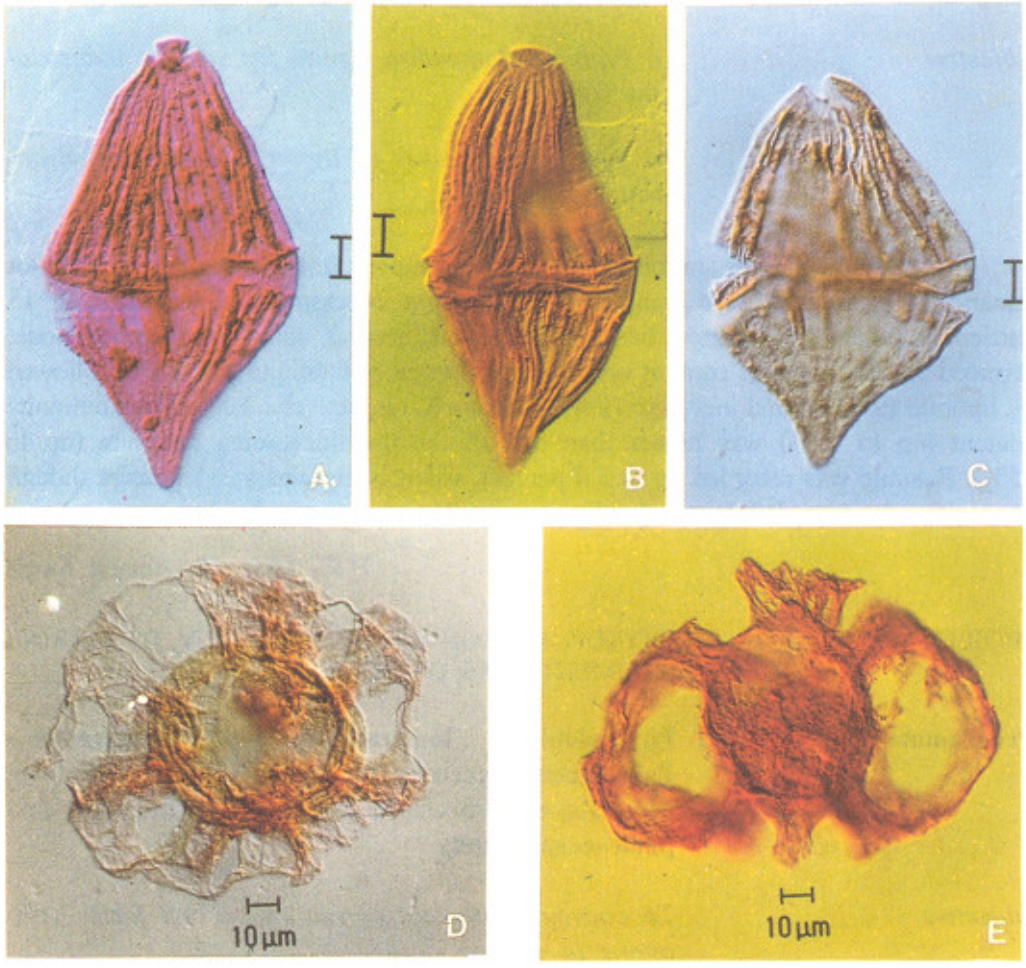
: *To integrate dinocyst, calcareous plankton and palaeontological data for stratigraphic precision*

: *To carry out palynofacies and organic petrographic studies*

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

: *To attempt palaeoceanographic interpretations*

Late Cretaceous calcareous nannoplankton have been documented from basal



Late Maastrichtian dinoflagellate cysts from Langpar Formation, Meghalaya–**A,** *Dinogymnium acuminatum*; **B, C,** *Dinogymnium* sp., **D,** *Disphaerogena monmouthensis*; **E,** *Disphaerogena* sp.

part of Langpar Formation exposed in Umshoryngkew section. Significance of terminal Cretaceous marker *Micula prinsii* for precise demarcation of KTB, providing the most crucial evidence for the presence of youngest Maastrichtian in a continuous, bioturbation-free calcareous-shale sequence, is demonstrated. A manuscript has been finalised.

A rich assemblage of 66 dinoflagellate cyst species has been documented from ca 6 m thick sequence containing the K/T boundary in Umshoryngkew section. No mass extinction in dinoflagellate cyst assemblages across KTB have been observed as shown by calcareous nannoplankton and planktonic foraminifera. The biostratigraphic potential of phytoplankton assemblages has been shown through distribution charts. A high resolution biostratigraphic model based on multidisciplinary integration of dinocyst, nannoplankton, planktonic foraminiferal and geochemical evidences, is proposed to demarcate KTB in this section. A detailed global comparison with key KTB sections is projected. A poster paper highlighting these findings was prepared for the "Fifth International Conference on Modern and Fossil Dinoflagellates" held in The Netherlands.

Rahul Garg & K.P. Jain

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*

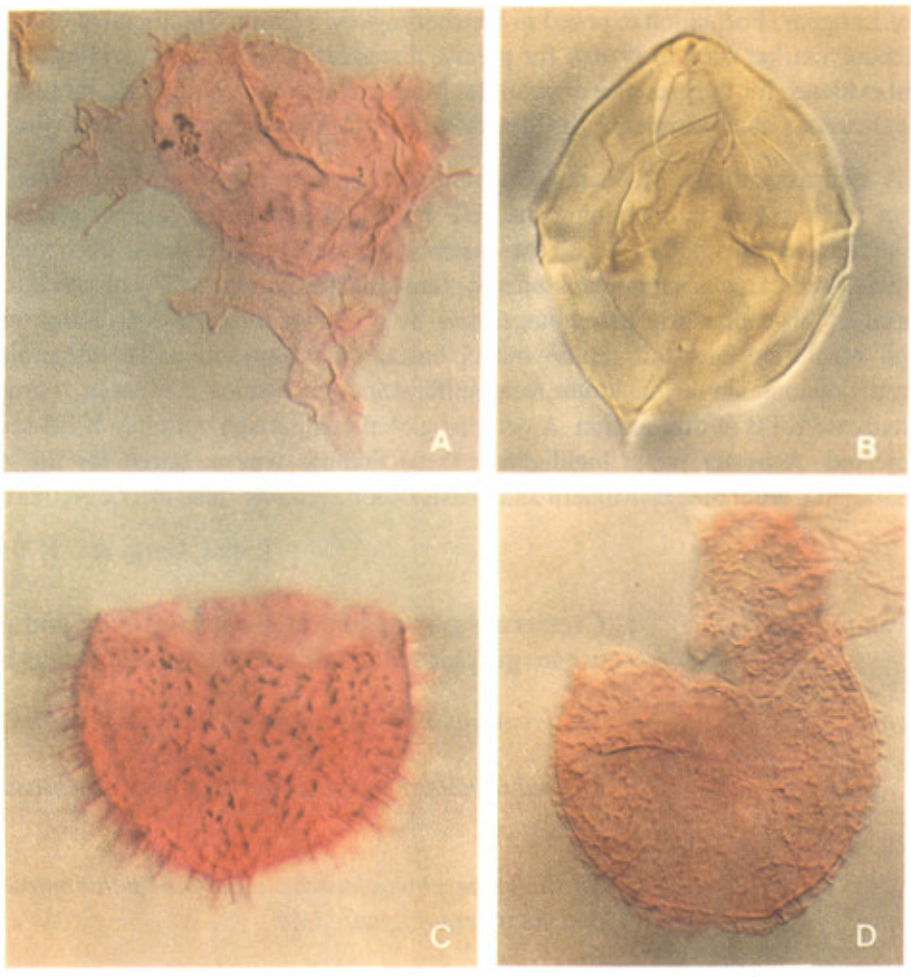
: *To integrate phytoplankton data with palaeontological and sedimentological data*

: *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*

A rich dinoflagellate cyst assemblage comprising 62 species has been recovered from an outcrop sequence of Trichinopoly Formation, Cauvery Basin, southern India. Global stratigraphic ranges of selected taxa, as well as a comparison with other studies is discussed. Four biozones are proposed. Relative abundance of chorate-proximochorate and proximate-cavate dinoflagellate cysts, spores, pollen and terrestrial organic debris are plotted and are interpretted for palaeoenvironmental conclusions. Distribution of planktonic and benthonic communities alongwith terrestrial organic influx has been discussed documenting significant changes from anoxic conditions during Albian to well oxygenated open sea conditions through Cenomanian-Turonian.A poster paper highlighting these findings was prepared for the "Fifth International Conference on



Significant dinoflagellate cyst taxa from Trichinopoly Formation – **A,** *Xenascus ceratioides;* ***B,*** *Isabelidinium acuminatum;* **C,** *Circulodinium distinctum;* **D,** *Cyclonephelium vannophorum.*

Modern and Fossil Dinoflagellates" held in Zeist, The Netherlands.

Khowaja-Ateequzzaman

Further studies on the dinoflagellate cyst and acritarch assemblage, recovered from 55 core and cutting samples of the 764.9 meter deep bore-hole drilled in Puduvoyal, Chingleput District, Palar Basin, southern India, have been carried out. A total of 90 dinoflagellate cyst and 5 acritarch taxa have been documented. Their global geologic and geographic occurrences are tabulated to confirm the age range of the subsurface sequence. Occurrence of *Aprobolocysta eilema, Avellodinium falsificum, Batiacasphaera scrobiculata, B. subtilis, Exochosphaeridium bifidum, Gagiella mutabilis, Gonyaulacysta cassidata, Herendeenia alaskaensis, Kaivaradinium scrutillinum, Muderongia crusis, M. simplex, M. staurota, Oligosphaeridium albertense, Platycystidia eisenackii, Prolixosphaeridium parvispinum, Pseudoceratium*

anaphrissum, Sentusidinium aptiense and *Tehamadinium tenuiceras* together with other age significant dinoflagellate cyst taxa have further supplimented to the earlier Hauterivian-Barremian age conclusion. A manuscript has been finalised.

Khowaja-Ateequzzaman & K.P. Jain

Programme 4.3A : **Neogene calcareous nannoplankton palaeoceanography 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*

Volcanic glass shruds from Lacam Point Silcher, Havelock Island, Andaman-Nicobar Islands.

Calcareous nannofossils were documented from two sections of Neill Island. Close sampling was done at Lacam Point of Havelock Island and the analysis of calcareous nannofossils suggested rich planktonic microfossils intercalated with several Ash layers, suggestive of active volcanic/quiescent phases during Early Miocene, matching NN 4 *Helicosphaera ampliapertura* zone. Scanning electron-microscopy of Glass shruds associated with ash layers was completed to understand the opening of Andaman Sea and the associated volcanic events.

Three sections from Car Nicobar Island were studied for calcareous nannofossils assignable to CN9 *Discoaster quinquevaurus* zone of Late Miocene age with important association of hirefringent ceratoliths, typical of the water masses of this region during Late Miocene. Associated sedimentological data suggest deposition of organic rich mudstones of Sawai Bay Formation in offshore mud facies zone with poor bottom water circulation but strong coastal upwelling, as evidenced by the presence of rich planktonic microfossils.

S.A. Jafar & Jyotsana Rai

Programme 4.3B : Late Cenozoic calcareous nannoplankton biostratigraphy of Neill Island, Andaman sea

Objective : *Calcareous nannoplankton biostratigraphy to be established on samples from East Coast and Nipple Hill sections of Neill Island and to deduce palaeoceanographic assemblage of Andaman and Nicobar Islands with that known from nearshore and high latitude and to select cosmopolitan markers*

The results of this investigation have been compiled in a Ph.D. Thesis. The Neill Island sections yielded rich calcareous nannofossils assignable to CN9a *Discoaster berggrenii* subzone of Okada & Bukry 1980, which is of Late Miocene (Tortonian) age. The organic matter rich carbonaceous mudstones of Sawai Bay Formation were

Discoaster berggrenii Bukry from Late Miocene (Tortonian) Savai Bay Formation, Neill Island, Andaman and Nicobar Islands.

laid down at moderate depth of offshore mud facies zone with strong coastal upwelling.

S.A. Jafar & 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*

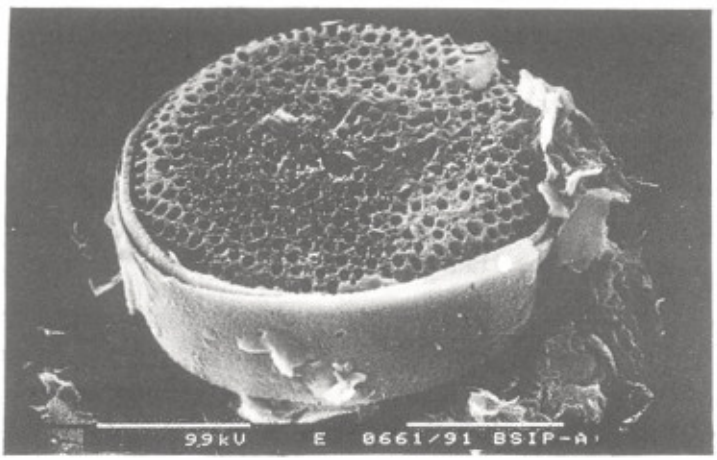
: *To establish biozonation for age determination and correlation with geologically synchronous beds*

: *To interpret palaeoenvironment, palaeogeography and time boundaries*

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

Samples from the West Coast section (70 m thick) of Kamorta Island have been found to be rich in diatom and silicoflagellates. In general, the diatom assemblage is comparable to the South Coast Cliff Section of Kamorta Island. SEM photography of a few specimens was done. The diatom assemblage indicates a Middle Miocene age for this section.

Anil Chandra



Coscinodiscus sp. showing valve and girdle views from the Miocene sediments, Kamorta Island, Andaman-Nicobar Islands.

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*

A detailed analysis of the "Late Palaeozoic plant-geography of the Perigondwana and evolution of the Kashmir Basin" was carried out. Special emphasis was placed on data from two plant-bearing horizons (Early Carboniferous and Early Permian) from the Salt Range, Spiti, Kashmir, Sikkim and South Xizang. The presence of certain plant taxa of Cathaysian affinity in the Early Permian assemblage of Kashmir area creates a reasonable doubt as to whether we are dealing with a pure Gondwana flora, or with a "mixed" flora.

Usha Bajpai

Mamal Formation of the Kashmir Basin contains the key to understand phytogeography of the Perigondwana in the region during early part of the Permian. Its status in time and space has to be understood for building the evolutionary history of the Kashmir Basin. The location of the plant beds between the Panjal Volcanics and the Zewan Formation does not necessarily indicate synchronous deposition of the 4 plant beds, as assumed by some earlier workers. Four members have been recognised in the Mamal Formation. Each of these members had a distinct depositional history and biota. It is clearly seen in Golabgarh section of Pir Panjal and Marahom section of Liddar Valley where the Risin and Marahom Members are exposed in ascending order. At Marahom these members are separated by a volcanic flow and contain distinct floral elements. The Dunpathri Member likewise has a distinct lithology and comparatively rich flora, most elements of which are not found elsewhere.

A synopsis on "Kshir Sagar, Tethys and the Perigondwana - Late Palaeozoic evolutionary history of the northern margin of the Gondwana Supercontinent" was displayed as a poster at the Himalayan Geology Seminar, Shimane, Japan.

[H.M. Kapoor], H. K. Maheshwari & 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 and Pahalgaon)

The spores, pollen and other associated units were studied in the Permian and Triassic sediments in Niti area for their state of preservation. For comparison on Indian peninsula, other than this, eight specific depositional environments have been identified in Gondwana Sequence. Occurrence of hyaline-glassy forms in Tethyan sediments and glacigene environment has contributed to real nature of palynoflora than the so far assessed. Varied degrees of thermal alteration had resulted in highly carbonised forms. On comparison it has been found that red beds generate different taphonomic situations than the coal suits.

R.S. Tiwari & 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*

Processing of samples from Chunabati - Chel Forest Road section, Lish River section and tunnel samples from Tindharia, Darjeeling District, West Bengal has been completed. The samples proved to be barren. The identification and photomicrography of the spore-pollen from Bomte to Tatamari, West-Siang District, Arunachal Pradesh is continued.

Suresh C. Srivastava & 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*

Morphotaxonomic study of Dali-Khargala-Sair palynofossils have been carried out partly. Twenty-five species of dinocyst taxa were identified. Some important taxa are *Homotryblium, Cordosphaeridium, Hystrichosphaeridium, Hystrichokolpoma, Spiniferites* and *Thalassiphora.* The assemblage is being evaluated for its correlative potential with other sections of Kalakot area. Only 25 samples from the new collection from the Beragua coal mine area were processed. An assemblage rich in dinoflagellate cysts and pteridophytic spores was recovered. Morphotaxonomic study of the recovered palynofossils is being carried out for further study. Processing of the remaining samples is in progress.

Samir Sarkar

Programme 5.5 : **Palynostratigraphy of the Tertiary sediments of Kargil Basin, Ladakh Himalaya**

Objective : *To systematically study spores and pollen*

: *To establish palynozonation*

: *To reconstruct the past vegetation, environment of deposition and palaeogeography*

Twenty-six Kargil Mollasse samples from Leh-Kargil Road section were processed for palynological analysis. Out of these, only 4 samples proved to be productive. An assemblage containing angiosperm pollen and fungal spores was recovered. Identification of the recovered palynofossils is being carried out.

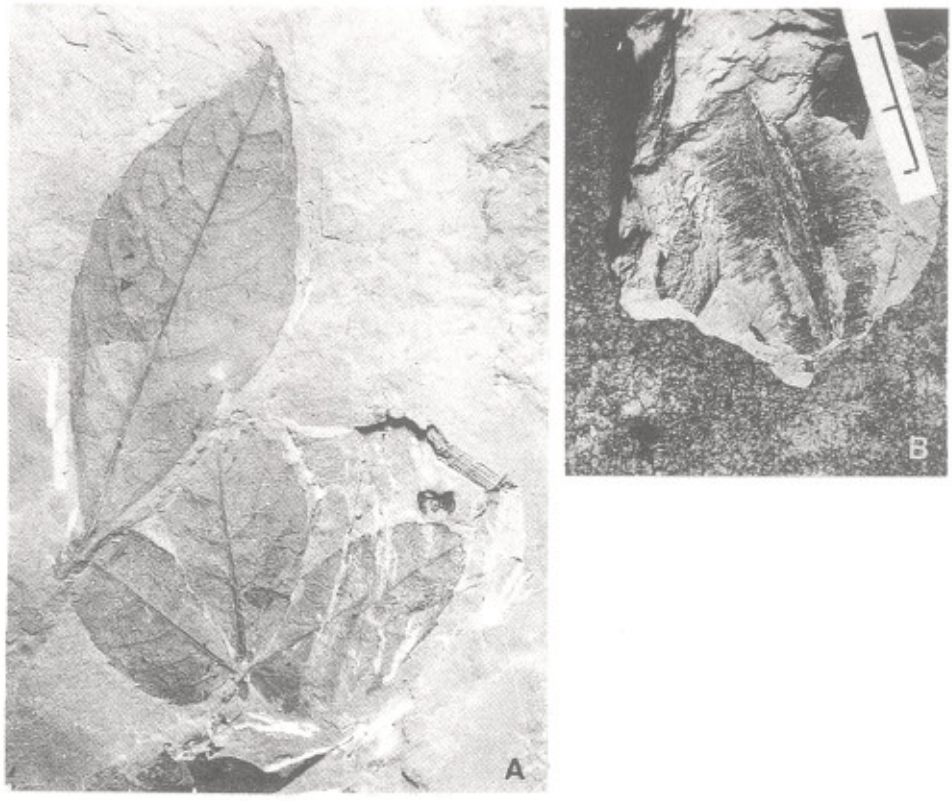
Samir Sarkar

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*

Investigations on megafossils from the Siwalik sediments of Surai Khola, Arjun Khola and Rehar, Nepal were carried out. Identification of leaf-impressions belonging to *Artocarpus, Lagerstroemia, Vitis, Filicium, Hydnocarpus, Randia, Cassia, Terminalia* and *Sterculia* from Surai Khola have been confirmed and their description completed. In addition, cuticular preparations of eight leaf-impressions from Arjun Khola were made for comparison and identification with the modern taxa. A fossil



Impressions of leaves and a fruit resembling modern–**A,** *Vitis bracteolata* Wall. and **B,** *Terminalia tomentosa* W. & A., respectively from Siwalik sediments of Arjun Khola, Nepal.

fruit resembling *Terminalia tomentosa* has also been identified.

Nilamber Awasthi & Mahesh Prasad

Leaf-impressions and fossil woods from the Siwalik sediments of Kathgodam and Kalagarh in Uttar Pradesh and Koilabas in Nepal have been investigated. About 20 fossil woods from Kalagarh were cut and studied in detail. Leaf-impressions of *Euphoria didyma, Terminalia belerica, Diospyros* sp.,*Hopea glabra,, Pongamia glabra, Dysoxylum* sp., *Atlantia monophylla, Bouea burmanica, Entada scandens, Anacolosa luzoniensis* have been identified from Kathgodam and Koilabas areas.

Mahesh Prasad

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

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

: *To carry out palynozonation and age determination of*

A fossil leaf resembling modern *Hopea glabra* from the Siwalik sediments of Koilabas, Nepal.

assemblages together with reflections on the past vegetation and environment of deposition

A paper on mega- and microfossil evidences from the Siwalik sediments exposed in the Surai Khola area, south of Dang Valley, western Nepal has been finalized. Processed 60 samples from Arjun Khola profile, out of which 32 samples proved to be productive. Detailed morphotaxonomic study of the palynofossils is being carried out.

Samir 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, Megha-*

laya and Arunachal Pradesh

: *To reconstruct Tertiary floral history, palaeoecology and phytogeography*

Identification of a fruit of *Mesua* was confirmed and the finding submitted in the form of a paper. A bamboo-like leaf-impression has been identified from the Makum Coalfield. In addition, a fossil leaf and a fruit belonging to family Fabaceae from the Garo Hills have been identified.

Nilamber Awasthi & R.C. Mehrotra

Programme 6.2 : **Palynostratigraphy of sedimentary rocks in Therria Ghat 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 different Tertiary formations exposed on the Umshoryngkew River around Therria Ghat were palynologically investigated and a comparison was made with their counterparts in northeast India. It was observed that the palynological assemblages of northeast and western India exhibit broad similarity. *Dandotiaspora dilata, D. telonata, D. auriculata* and *D. densicorpa* in the two regions are restricted to Palaeocene. Similarly, *Matanomadhiasulcites maximus, Kielmeyerapollenites syncolporatus, Tripilaorites triangulus, Triangulorites bellus, Spinizonocolpites echinatus* and *Neocouperipollis kutchensis* are found in Palaeocene - Lower Eocene. *Striatriletes* — the dispersed spores of *Ceratopteris*, appears in the Middle Eocene in northeast as well as in western India.

There are, however, some differences in the palynological constituents of the two regions. In northeast, pteridophytic spores are found in abundance throughout the Tertiary formations, whereas in west they are poorly represented. This disparity in palynofossils may perhaps be explained due to different physiographic features of the two regions. In northeast India, the palynoflora show high frequency in Palaeocene and Oligocene whereas in west, the flora is well represented in Palaeocene and Eocene

and starts dwindling in Oligocene and becomes scanty in Miocene.

Fossil spores resembling the extant spores of *Acrostichum aureum* Linn. were recovered from the Langpar Formation (Early Palaeocene) exposed at Therria Ghat on Umshoryngkew River, Meghalaya. To accommodate these fossil spores *Acrostichumsporites* gen. nov. is proposed.

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*

Forty rock samples from the coal-bearing section at Selsella, Garo Hills were macerated which yielded 16 genera and 18 species belonging to *Lycopodiumsporites speciosus, L. umstewensis, Lygodiumsporites tenuiexinus, Proxapertites emendatus, P. crassimurus, Neocouperipollis* spp., *N. brevispinosus, Spinizonocolpites echinatus, Matanomadhiasulcites kutchensis, M. maximus, Retitribrevicolporites* spp., *Kielmeyerapollenites syncolporatus, Tricolpites reticulatus, Psilastephanocolpites psilatus, Margocolporites planocolporatus, Triangulorites foveolatus* and *Laricoidites magnus*. The assemblage was compared with the palynoassemblages of Garo Hills. It suggests Upper Palaeocene age and indicates its lateral extension to the top seam of Rekmangiri Coalfield in Garo Hills.

Apart from this, a few spore/pollen of the above assemblage were subjected to X-ray micro-analysis. The elemental detection of these spore/pollen was done to study the depositional phenomenon related to their preservation.

Krishna 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*

The palynological investigation of four measured sections along Haflong-Silchar Road resulted poor palynofossil assemblage consisting mainly of pteridophytic spores. Angiospermic pollen are meagre. They are *Tricolpites, Palmaepollenites, Neocouperipollis* and *Spinizonocolpites*.

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 of each unit of rocks*

: *To infer palaeoclimate and depositional environment*

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

Late Cretaceous samples of Mahadek Formation and the overlying Danian samples of Langpar Formation from Pungtung area were chemically processed, which yielded a rich palynoassemblage. Late Cretaceous assemblage is dominated by *Araucariacites, Densoisporites, Cicatricosisporites, Appendicisporites, Klukisporites, Coptospora, Contignisporites, Minerisporites, Ariadnaesporites, Azolla* and some angiospermic pollen. The transitional Mahadek-Langpar sediments contain *Spinizonocolpites, Neocouperipollis* and *Matanomadhiasulcites*.

Samples from Garo Group were chemically processed; only the samples of Baghmara Formation were found to be palynologically productive. The following species are recorded : *Lycopodiumsporites abundans, Polypodiaceaesporites tertiarus, P. favus, Lygodiumsporites lakiensis, Striatriletes susannae, Surmaspora sinuosa, Malayaeaspora costata, Pinuspollenites foveolatus, Abiespollenites burmaensis, Trifossapollenites costatus, Bombacacidites inausus*. Pteridophytic spores dominate the assemblage and are comparable with other Miocene assemblage 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 Hills*

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

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

The pollen and spores recovered from the samples of Maibong Road and Lumding-Haflong road sections, North Cachar Hills, are characterized by the dominance of *Striatriletes* complex, *Tricolporopollis* and *Polyadopollenites*. The microfossils indicate Miocene age and are compared with similar extant taxa for the reconstruction of vegetation and palaeoenvironmental condition. The evidences suggest that tropical to subtropical humid condition was prevalent during the time of deposition.

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 entire Barail sedimentary succession*

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

Palynological investigation of Dilli colliery was continued. The assemblage consists of *Eximispora tuberculata, Biretisporites scabratus, Pteridacidites verrucatus, Polypodiaceaesporites tertiarus, Pellicieroipollis langenheimii, Meyeripollis naharkotensis, Retitrescolpites typicus, Striatriletes susannae, Polyadopollenites miocenicus*, etc. It is postulated that the sediments were deposited in a tropical humid condition with 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*

Fifty-seven samples of Kopili Formation near Kopili-Barail boundary on Shillong-Badarpur highway were macerated. Out of which, 26 samples were barren while 31 samples were productive. Important palynofossils recorded from the assemblage are *Striatriletes, Cyathidites, Lygodiumsporites, Dictyophyllidites, Polypodiaceaesporites, Monolites, Polypodiisporites, Retitribrevicolporites, Tricolpites, Densiverrupollenites*, dinoflagellate cysts, *Notothyrites, Podosporites, Callialasporites*. Important Oligocene (Barail) forms like *Crassoretitriletes, Meyeripollis, Polyadopollenites* were absent.

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 assemblage from bore-hole Pemba 5, Tanzania comprises *Cyathidites minor, Striatriletes susannae, Microverrucosus, Tsugaepollenites velatus, Bombacacidites triangulus* and *Crassoretitriletes vanraadshoovenii*, which indicate Miocene age for the samples.

Palynological investigations of bore-hole CM5, Senegal reveals the presence of a heterosporous pteridophyte abundant Campanian palynoassemblage. The Maastrichtian palynoassemblage is characterized by *Ariadnaesporites* complex with a feeble representation of heterosporous pteridophytic palynofossils. The Maastrichtian - Palaeocene transition zone is characterized by *Matanomadhiasulcites maximus,*

Proxapertites operculatus, P. cursus, Bacutriporites orluensis, Diporoconia sp., *Tercisus grandis* and *Periretisyncolpites magnosagenatus*.

B.S. Venkatachala & R.K. Kar

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*

Biopetrological, chemical, palaeobotanical and geological data on Upper Palaeocene coal deposits in Garo (West Daranggiri Coalfield) and Jaintia (Bapung, Rymbai, Sutunga, Jarain and Lakadong areas) hills of Meghalaya were synthesized. The coal of the Main Seam of West Daranggiri Coalfield is non-caking, attained a rank of high-volatile bituminous C stage (R_o max. 0.54-0.61%) and possess moderate to moderately high amounts of vitrinite (37-65%) and inertinite (18-34%) macerals. The coals of Jaintia Hills have relatively higher vitrinite (41-80%) and lower inertinite (4-22%) contents. These coals are also higher in rank (R_o max.0.64-0.86%) and strongly caking. The coal seams from both the areas have high contents of syngenetic pyrite and calcite, whereas clastic minerals are persistently low.

Under fluorescence mode, the coals contain appreciably high proportion of hydrogen-rich fluorescing microconstituents (Garo :70-81%, Jaintia :72-91% m.m.f.) represented chiefly by perhydrous vitrinite (38-56% and 25-78%), liptodetrinite (12-22% and 12-40%) and resinite (7-12% and 7-13%) macerals. It is because of this reason that these coals are generally perhydrous in nature.

It has been concluded that mangrove-mixed forest vegetation, mostly *in situ*, was responsible for the accumulation of peat in back-swamps around estuaries and peat growth (seam thickness) was controlled by the rate of basinal subsidence and fluctuations in sea-level.

B. K. Misra

PROJECT 7 : RECONSTRUCTION OF QUATERNARY VEGETATIONAL PATTERNS

Programme 7.1 : **History 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*

Pollen analysed one soil profile from Bombay Shola in Palni hills and prepared a pollen diagram showing palaeofloristic development since the time of 40,000 yrs B.P. Besides, 5 modern surface samples were pollen analysed.

Thirty soil samples from Berijam Lake profile, Palni hills were chemically processed. The study has revealed that the pollen of Shola trees are under represented. The presence of *Impatiens, Senecio,* etc., close associate herbs of Shola forest, provides useful information for the existence of Shola forest in time and space. However, palynology of surface samples from Berijam Lake has revealed good pollen/spores assemblage with higher values of Shola trees. *Acacia, Pinus, Alnus* and *Eucalyptus* are derived from recently introduced plants in the valley.

H.P. Gupta & S.K. Bera

Study of pollen morphology under light microscope of 22 tree taxa belonging to families Lauraceae, Leguminosae, Loganiaceae and Lythraceae from Silent Valley has been completed. Photography of about 20 species has been done

H.A. Khan

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

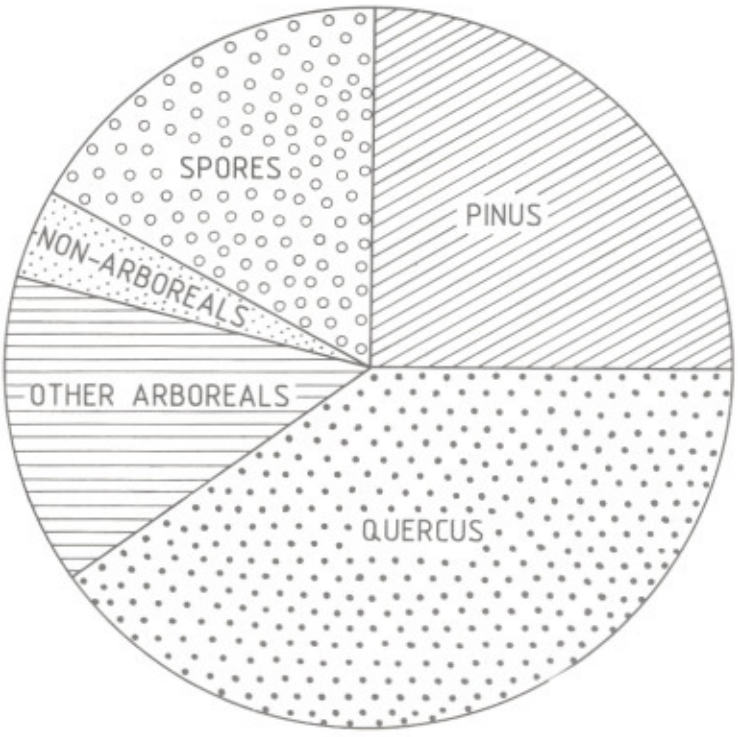
Objective : *To build up a fine resolution climatic sequence of Quaternary Period in the Himalayan region*

Pollen analysed 32 samples of a profile (GT-1) from Gola Tappar, Dehradun and prepared pollen diagram. The study has revealed the predominance of *Pinus* pollen. However, other arboreals, such as *Shorea robusta, Terminalia, Anogeissus, Emblica,* etc. are sporadic. The ground vegetation is composed largely of grasses, Chemo/Ams, *Artemisia*, Brassicaceae and Asteraceae. The pollen analysis indicates that the arboreals were indigenously sporadic but good frequency of Chirpine pollen denotes their drifted nature from the nearby provenance of pine throve.

Pollen analytical investigation of 20 samples of glacial dust from Dunagiri Glacier, Garhwal Himalaya was carried out. Most of the samples were found palynologically barren. However, a few samples are dominated by arboreal taxa, such as *Quercus, Betula, Alnus, Pinus*. Poaceae, Cheno/Ams, Ranunculaceae, etc., are also recorded.

Chhaya Sharma & M.S. Chauhan

Pollen analysis of a soil profile (NT-2) from Nachiketa Tal, Garhwal Himalaya reveals the dominance of arboreals as compared to non-arboreals. *Quercus* dominates and *Pinus, Alnus, Betula, Carpinus, Juglans, Rhododendron,* etc., codominates the arboreal vegetation indicating the mixed-Oak forest. The non-arboreals such as, Poaceae,



Pollen depositional model from Nachiketa Tal, Garhwal Himalaya.

Cyperaceae, Cheno/Ams, Caryophyllaceae, etc., are however, recorded in low values.

The pollen analysis of a profile (NT-1) from Nachiketa Tal, Garhwal Himalaya reveals the predominance of arboreals over non-arboreals. *Pinus, Quercus, Alnus, Betula*, etc. are the main constituents of arboreal vegetation, whereas the non-arboreals are chiefly represented by Cheno/Ams, Caryophyllaceae, Poaceae, etc.

Chhaya Sharma & 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*

The D.O.M. (Dispersed Organic Matter) analysis of four bottom samples from Rambha profile has been completed. The study has shown that a major part of organic matter deposited on southern flank of Chilka Lake is terrigenic in origin. The different stages of transformation of structured organic matter into semi-amorphous and amorphous states has been documented

H.P. Gupta & Asha Khandelwal

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

Objective : *To reconstruct climate (temperature and precipitation) from tree rings*

: *To study environmental factors determining the seasonality of cambium activity*

Preliminary growth/climate relationship of *Pinus gerardiana* and *Cedrus deodara* growing in Kinnaur, Himachal Pradesh and Harshil, Uttar Pradesh, respectively has revealed relationship between years of growth decline with the years of deficient rainfall.

Seventy tree-cores from *Abies pindrow, Taxus baccata, Pinus gerardiana, P. roxburghii* and *Cedrus deodara* were collected from near Pindari Glacier, Uttar Pradesh and Chamba, Dharamshala, Himachal Pradesh. Mounting and polishing of the cores of *Abies pindrow* have been completed and 9 of these cores have been dated through skeleton plot techniques. These dates range in between 1635 to 1992 A.D. Tree ring analysis from this site seems to be useful to study the glacier shifting in the recent past.

Ten tree core samples of *Picea smithiana* from Deoban, Uttar Pradesh were dated. Growth pattern analysis of trees has shown individualistic growth behaviour of these trees which could mainly be due to endogenous stand processes, such as competition and thining, etc.

R.R. Yadav & Amlava Bhattacharyya

Programme 7.5 : **Plant remains from pre- and proto-historic sites in northern and northwestern India**

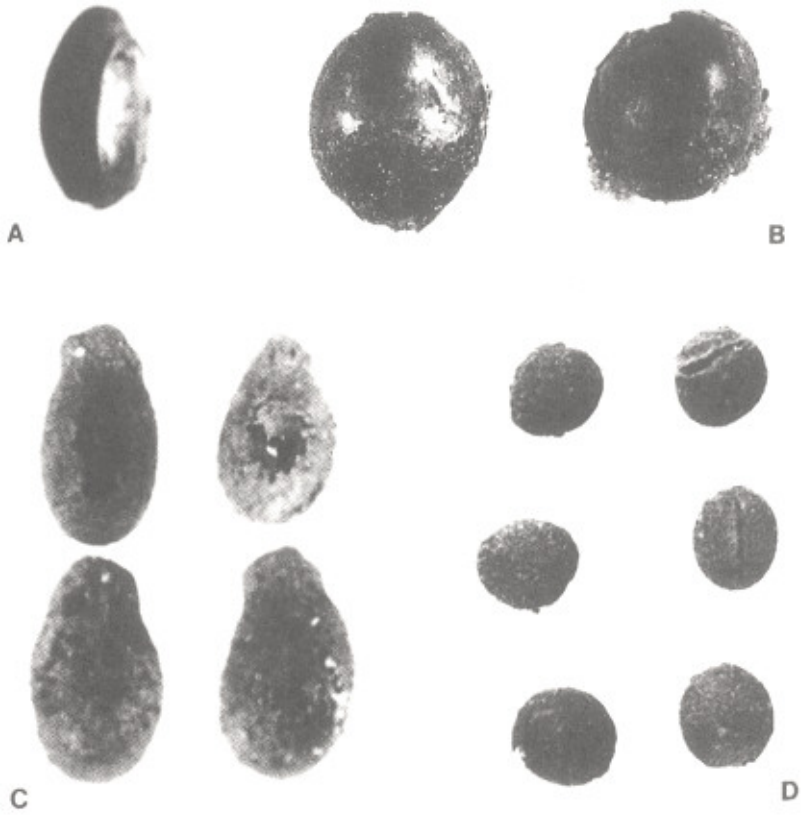
Objective : *To study agricultural practices in context of different cultures in time and space*

: *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*

In continuation of the work already carried out on the plant remains from Neolithic-Chalcolithic Senuwar (Ca. 2,000-600 B.C.), district Rohtas, Bihar, twenty additional



Carbonised seeds from Senuar, Bihar (Ca 1,200-600 B.C.) – A, Safflower *(Carthamus tinctorius)* x 5; B, Bhang *(Cannabis sativus)* x 11; C, Watermelon *(Citrullus lanatus)* x 4; D, Field-brassica *(Brassica juncea)* x 11.

samples of organic remains were analysed and the details of new information added are as under :

Neolithic-Chalcolithic (1,800-1,200 B.C)

Among the carbonised grains, most of which are of the same kind and already known, Kodon-millet (*Paspalum scrobiculatum*) and chick-pea (*Cicer arietinum*) in the crop plants and the weeds of *Melilotus* and *Euphorbia* species are new finds. As evidenced by wood charcoals the cultivation of fruit-trees of jack or Katahal (*Artocarpus heterophyllus*) and mango (*Mangifera indica*) is a newly established proclamation.

Chalcolithic (1,200 - 600 B.C.)

The pulse of moth-bean (*Vigna aconitifolia*), seeds of water melon (*Citrullus lanatus*) and oleiferous field-brassica (*Brassica juncea*) and safflower (*Carthamus*

tinctorius) constitute new finds. However, the occurrence of watermelon, a native of Kalahari Desert in Africa, is the first report from the Indian subcontinent. Weeds of *Chenopodium album, Eleusine indica* and *Mimosa pudica* have also been added. In addition to the wood charcoals, seeds of *Cannabis sativa* further suggest the use of "bhang" or "Ganja" for narcotic confection. Wood charcoals of castor plant (*Ricinus communis*) provide the evidence of its cultivation for oleiferous seeds.

K.S. Saraswat

The investigations carried out earlier on wood remains from Mahorana, a site of transitional phase of pre-Harappan to Baran Culture (Ca. 2,100 - 1,900 B.C.) in Sangrur District, Punjab have been finalized.

Plant economy has been built up at ancient Manjhi, Saran District, Bihar (Ca. 600 - 200 B.C.). The study reveals the occurrence of *Triticum aestivum* (bread wheat), *Triticum sphaerococcum* (short wheat), *Hordeum vulgare* (barley), *Oryza sativa* (rice), *Pisum sativum* (pea), *Vigna mungo* (black gram), *Lens esculenta* (lentil), *Lathyrus sativus* (khesari), *Vitis vinifera* (grape/raisin) and *Eleusine coracana* (ragi).

A rich and varied plant economy comprising cereals, pulses, fruits, millets and weeds indicates advanced agricultural practices and import of raisins by the ancient settlers.

Chanchala Srivastava

Programme 7.6 : **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*

Quantitative estimation of different chemical constituents in pollen of allergenic tree, e.g., *Holoptelea integrifolia* has been carried out. The pollen have exhibited maximum quantity of carbohydrates, followed by proteins, lipids, nucleic acid and traces of Ca, Mg, etc. The identification of specific component of protein/nucleic acid as allergen is yet to be established.

The indoor dust sample was collected from the house of a patient suffering

from perennial allergic rhinitis in Aliganj, Lucknow and was examined microscopically in order to note the allergenic constituents. Eleven types of fungal spores and ten types of pollen grains were recorded as under :

Fungal spores (in numbers) – *Alternaria* (420), *Aspergillus / Penicillium*(9,482), *Cladosporium* (389), *Curvularia* (48), *Helminthosporium* (26), *Nigrospora* (325), *Chaetomium* (210), *Pleospora* (440), Rust spores (25), Smut spores (18), *Rhizopus* (34).

Pollen grains (in numbers) – *Ricinus communis* (12), *Parthenium hysterophorus* (14), *Syzygium cumini* (40), *Xanthium strumarium* (4), *Azadirachta indica* (12), *Argemone mexicana* (13), Brassicaceae (15), Poaceae (12), Cyperaceae (14), *Holoptelea integrefolia* (12).

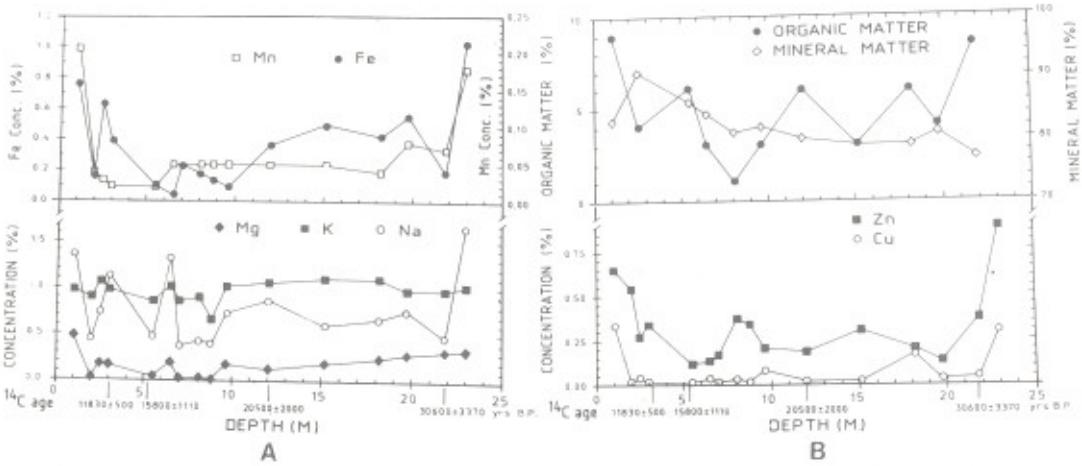
The other variable matter included vascular fragments, trichomes and hair, epidermal peels, insects and their body parts, algal filaments, diatoms, fungal hyphae, etc.

Asha Khandelwal

PROJECT 8 : GEOCHRONOMETRY OF INDIAN ROCKS

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

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



A. Concentration of Na, K, Mg, Fe, Mn, Cu, Zn and; **B.** Organic and mineral matter contents in a sediment core in Tsokar Lake, Ladakh showing climatic changes.

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

Eighty four samples were processed for radiocarbon dating which included 12 background and one standard preparations and Carbon determinations(6). Sixty six samples have been processed for C-14 age determination.

Four profiles of sediment cores from Andaman Sea were dated for a collaborative project with GSI Marine wing.The sedimentation rates of cores vary from 4 to 16 mm per 100 yrs.Ten samples relating to palaeoclimate projects based on palynological, geological and stable isotope studies from Kinnaur, Nilgiris and Eastern Himalaya were dated.Shell and kankar beds from Gangetic alluvium near Kalpi and Hamirpur and profiles of clay and marl deposits in abandoned channels of Mesa tal, Gosainganj and Barabanki have been dated.The C-14 age data indicate that the deposition of marl in Gangetic alluvium probably started at around 8,500 yrs B.P. in response to higher precipitation and sea level rise.Samples of shell , beach rock and sediment core from Kavaratti Island and Andamans were dated for collaborative projects with other agencies.

The liquid scintillation method for C-14 dating has been established. Dating of samples is to be carried out by liquid scintillation counting method wherever adequate material is available

G. Rajagopalan

The climatic changes around Tsokar Lake, Ladakh have been analysed on the basis of elemental, organic and mineral content variations in a 23.0 m depth sediment core covering a time span of 32,000 yrs B.P. in the past to beginning of Holocene. Nine zones identified for the interpretation show that climate was generally dry arid prior to 30,600 yrs B.P. and during the intervals of 28,450 - 18,890 yrs B.P., 17,070-16,730 yrs B.P., 16,040-11,830 yrs B.P. and 9,980-8,140 yrs B.P. followed by brief ameliorations during intervening periods.

G. Rajagopalan & B. Sekar

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*

Dr.A.P. Srivastava was on medical leave due to prolonged illness. Therefore no substantial work could be undertaken.

A.P. Srivastava

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

Objective : *To date the glauconitic sandstone collected from Vindhyan deposits in Uttar Pradesh and Rajasthan*

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

: *To develop data acquisition and reduction system*

Isotopic analysis of residual gases in the extraction and purification system were carried out. Potassium measurements on four glauconite and one Deccan trap samples were done.Glauconite was separated from 3 Vindhyan sandstone samples.Thin sections of 3 Deccan trap samples were also made.Turbomolecular pump is being tested. Further work to improve the analyser was continued.

C.M. Nautiyal

PROJECT 9 : ANNOTATED ATLASES, CATALOGUES, MONOGRAPHS AND BOOKS

Programme 9.1 : **Data bank for Palaeozoic-Mesozoic palynology, 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 databank for Palaeozoic and Mesozoic palynology and related aspects has been done.

(Group effort, Department of Pre-Gondwana and Gondwana Palynostratigraphy)

Detailed search and analysis of published literature has been made to gather knowledge about the occurrence, diversification and distribution of Organic Walled Microfossils of Doubtful Origin (OMIDOs) from the Permian and Triassic sequences in various basins on the Indian Peninsula. The morphography of the typical and characteristic forms has been examined to sort out the environmental significance. These OMIDOs have been found at restricted horizons in almost all the basins at various time planes in Talchir, Karharbari, Barakar, Kulti, Raniganj, Panchet and Dubrajpur formations. On the basis of their diversification, proliferation and distributional pattern, change in the salinity of the palaeodrainage system during the transgressive phases has been proposed, which had resulted in the increase in area of brackish water regime on the Indian Peninsula. There are indications that diversity of OMIDOs and other marine signatures may coincide with the major transgressive events.

R.S. Tiwari, Archana Tripathi & Vijaya

Programme 9.2 : **A catalogue of fossil dinoflagellates from India**

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

Subsurface dinoflagellate cysts assemblage described by Mehrotra and Sarjeant (1987) from Narsapur Well-I has been restudied. Several taxonomic comments have been based on study of type slides housed at KDMIPE, Dehradun and the dating of some bore-cores is revised due to the discovery of *Apectodinium augustum,* a topmost Palaeocene marker dinoflagellate cyst species. Implications of this data on the age of Traps/Volcanics encountered in the bore hole, is discussed.

K.P. Jain & Rahul Garg

Programme 9.4 : **Upper Cretaceous floristics of India**

Objective : *To select suitable geological sections*

: *To collect and process representative rock samples*

: *To recover organic remains*

: *To attempt qualitative / quantitative analyses*

: *To carry out ultrastructural studies*

: *To study form and function/evolutionary patterns, palaeoecology and phytogeographical pathways*

Detailed out a Maastrichtian palynofossil assemblage from the Kallamedu

Formation, Cauvery Basin. Stratigraphically important spore pollen genera include *Azolla, Ariadnaesporites, Bullasporis, Gabonisporis, Triporoletes, Cranwellia, Quadraplanus* and *Scollardia*. A near shore environment in a regressive phase at the depositional site has been inferred. Distribution pattern of *Aquilapollenites* pollen and its phytogeographical importance has been studied.

Collected and chemically processed samples from the intertrappean sediments of western Kutch, Gujarat. A preliminary observation indicates the presence of palynofossils akin to *Cyathidites, Osmundacidites, Ariadnaesporites, Azolla, Cicatricosisporites, Classopollis, Araucariacites* and other associated forms.

A. Rajanikanth

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*

A manuscript on selected tricolpate taxa has been prepared.

M.R. Rao & J.P. Mandal

A critical morphotaxonomical study of all known polycolpate and polycolporate pollen of the Indian Tertiary was carried out and a final manuscript was prepared.

R.S. Singh & B.D. Mandaokar

Selected some stratigraphically important palynotaxa of monocolpate and tricolporate pollen grains from the Indian Tertiary sediments. A manuscript on these pollen grains was prepared.

Madhav Kumar

Holotypes and other specimens of selected Indian Tertiary angiosperm pollen taxa available at the Birbal Sahni Institute of Palaeobotany, Lucknow were restudied and redescribed. Efforts were made to trace their affinities with extant taxa. A manuscript comprising this study was prepared.

B.S. Venkatachala, R.K. Saxena, H.P. Singh, R.K. Kar, S.K.M. Tripathi, M. Kumar, Samir Sarkar, J.P. Mandal, M.R. Rao, R.S. Singh, B.D. Mandaokar & 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 *Terminalia chebula* Retz., *T. belerica* Roxb., *T. arjuna* Bedd., *T. tomentosa* Wight & Arn. and *T. catappa* Linn. were collected, pressed and chemically processed. Slides of their cuticle and mounts of leaf venation pattern were prepared. Morphology, venation pattern and cuticular features were described. An atlas of leaves of the above species was also prepared.

D.C. Saini

Programme 9.8 : **Inventory of Type and Figured palaeobotanical specimens / slides (megafossils) available at the repository of BSIP-Museum**

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

Preparation of Inventory (Part II) of Type and Figured specimens and a guide to BSIP Museum is in final stage.

G.P. Srivastava

Sponsored Projects

S.P. : **Holocene palynostratigraphy and palyno-environment of Chilka Lake : an inter-disciplinary approach (DST NO. ES/44/019/90)**

Objective : *To build up data on palynology, sedimentology, C/N ratio and O^{18} isotope from in and around Chilka Lake for palaeoclimatic interpretation*

Consulted literature and collected information on sedimentology, geomorphology and palynology pertaining to Chilka Lake and prepared reference cards.

Consulted literature on pollen morphology, ecology and phytogeography of mangrove plants. Studied modern pollen slides of mangrove taxa

H.P. Gupta, Deepak Kohli & Sudhansu Sinha

Collaborative Projects

PROJECT : PALYNOLOGY OF THE MESOZOIC SEDIMENTS OF KUTCH BASIN (BSIP-ONGC)

The report of the project is ready for submission.

B.N. Jana

PROJECT : PRECAMBRIAN-CAMBRIAN BOUNDARY EVENTS (IGCP PROJECT - 303)

Studied Blaini siltstones exposed in Maldevta - Gopichand Ka Mahal section. Rich organic-walled microfossils are preserved demonstrating the complete cycle of cyanobacteria from endosporulation to germination and formation of a colony

P.K. Maithy & R. Babu

PROJECT : PREPARATION OF POLLEN ATLAS OF THE ARBORESCENT MONOCOTS OF INDIA WITH SPECIAL REFERENCE TO PALMS

SEM studies on the palm pollen for detailed observations on the aperture and exine patterns in *Ammandra decasperma* and *Phytalephas macrocarpa* were completed. A manuscript pertaining to the above work is in progress. Further, SEM studies of pollen morphology of *Kentia, Areca, Borassus, Arenga* and *Sclerosperma* are in progress.

K. Ambwani, R.N. Kapil & B.D. Sharma

Work other than Programmes

Biopetrological preparations of 10 coal and shale samples from newly explored Gondwana sequence in Tamil Nadu, supplied by Mineral Exploration Corporation Limited, Nagpur were completed for assessment of microconstituents and rank measurements

Anand-Prakash, B.K. Misra & B.D. Singh

Pollen analytical investigation of 15 samples of glacier dust collected from Dokriani Bamak Glacier, Garhwal Himalaya, in a traverse ranging between 4,000 to 4,500 m a.s.l. has revealed the dominance of *Pinus, Abies, Cedrus* and *Juniperus* followed by broad leaved taxa like *Quercus, Betula, Alnus, Celtis, Corylus*, etc. Poaceae along with Asteraceae, Ranunculaceae, Rosaceae and Apiaceae are the prominent herbaceous elements.

S.K. Bera

Pollen analysis of a section on (BMT/GJR-II) from Bilaspur, Kumaon Himalaya has revealed the dominance of non-arboreals over arboreals. Among arboreals *Quercus* followed by *Pinus roxburghii, Alnus, Betula* and *Juglans* are the chief constituents. Whereas non-arboreals are represented by high values of grasses followed by sedges, Tubuliflorae, Cheno/Ams, Ranunculaceae and *Artemisia*.

M.S. Chauhan & Chhaya Sharma

Palynology of 20 samples from Andaman and Nicobar Islands has been completed. The samples exhibit poor occurrence of pollen and spores. The core mangrove taxa such as *Rhizophora, Avicennia, Heritiera*, etc., are poorly represented as compared to peripheral and hinterland taxa. Microforaminiferal tests and dinoflagellate cysts showed good variation in terms of quality and quantity

H.P. Gupta & Asha Khandelwa

Late Maastrichtian - Danian calcareous nannofossils were studied from classic section of Lattengebirge (southern Germany) and Andaman Islands and compared with major K/T boundary sections of the world. A manuscript (with 7 figures) entitled Late Maastrichtian calcareous nannofossils from Lattengebirge (Germany) and Andaman Nicobar Islands (India) : Remarks on events around the Cretaceous-Tertiary boundary, was submitted for publication

S.A. Jafar

A hypothesis was put forward on the functional biology of Devonian spores

with bifurcate processes. It was observed that aquatic heterosporous ferns may have grapnel like glochidia as found in *Azolla* specialized for anchoring a microspore mass to a megaspore. In this way, the free floating glochidia and megaspores are held in close proximity. Same structures are known from the Cretaceous and Tertiary megaspores and microspores such as *Azollopsis* and *Ariadnaesporites* and are considered to have functioned in fertilization. A parallel evolution event can also be witnessed in the initial radiation of heterosporous plants during the Upper Devonian. Megaspores and microspores with probable lycopodian affinities possess grapnel-like processes which we suggest were perhaps similar to the functional/structural elements known from the Cretaceous aquatic ferns. From this it may be concluded that many of the Middle and Late Devonian heterosporous plants were aquatic. Both the evolutionary events are characterized by similar functional/structural elements in the megaspores and microspores.

R.K. Kar, D.L. Dilcher & M.E. Dettmann

Studied Archean organic - walled microfossils in the stromatolite of the Iron Ore Supergroup exposed at Bhadrasai, Orissa. Cyanophycean remains were also recorded.

P.K. Maithy & Rupendra Babu

An araucarian seed-scale was identified from the Deccan Intertrappean beds of India

R.C. Mehrotra & Rashmi Srivastava

Associated in the synthesis and evaluation of data on the geological age of the *Ptilophyllum*- bearing plant beds of India.

Associated in the critical assessment of data on the Indian Gondwana sediments and a new concept Gondwana Supergroup, has been proposed.

A. Rajanikanth

Imlidih-Khurd (26°30'30"N; 83°12'5"E) excavation on the left bank of Kuwano River in Gorakhpur District, Uttar Pradesh has revealed Cord-impressed Red Ware tradition datable to about 1,500 - 1,600 B.C., preceding the so far known Black and Red ware culture (1,300 - 800 B.C.) in Ghaghra Valley. The study of the remains of rice (*Oryza sativa*), barley (*Hordeum vulgare*), Wheat (*Triticum sphaerococcum* and *T. aestivum*), jowar-millet (*Sorghum bicolor*), pearl-millet/bajra (*Pennisetum typhoides*), lentil (*Lens culinaris*), field-pea (*Pisum arvense*), grass-pea (*Lathyrus sativus*), field-brassica (*Brassica juncea*), til/sesame (*Sesamum indicum*), etc., from this early culture has brought to light the introduction of Harappan nutritional trait in the Middle Ganga Valley during mid second millennium B.C. and its transmission into the agriculture of subsequent cultural periods

K.S. Saraswat

Ten spore-pollen species already described from the Indian Tertiary sediments were recognized to be the later homonyms of the previously published valid palynotaxa. A manuscript to propose their names replacement was prepared and finalized.

R.K. Saxena

Palaeobiological and geological (including sedimentological) studies of Mesoproterozoic sediments exposed around Rohtas have been completed. In this study rich organic walled microfossils belonging to 44 morphotypes were identified in the Jaradag Fawn Limestone Formation. The assemblage belongs to Chroococcaceae, Entophysalidaceae, Oscillatoriaceae and Nostocaceae. Associated stromatolites with them were studied, using three dimensional reconstructions. The stromatolites show low heights.

Mukund Sharma

Study on 11 samples of Tal sequence, Chipar-Kauriyala - Singtali section of the Garhwal Syncline, Lesser Himalaya is completed. Two acritarch assemblage zones are recognised. Zone I contains mainly smooth-walled sphaeromorphs and few sculptured sphaeromorphs of Late Precambrian (Vendian) age and is dominated by *Kildinosphaera, Bavlinella, Granomarginata*. Zone II is dominated by *Baltisphaeridium* and *Microhystridium* which are found in the Argillaceous Member of Tal Formation. Significantly the boundary between Acritarch assemblage Zone I and II in the present study lies at the base of Argillaceous Member of Tal Formation.

Stratifera undata has been recorded in the Blaini Formation of Mussoorie Syncline. On the basis of carbonate lithology it is inferred that the stromatolite was deposited in an upper intertidal region in subtropical climate.

Manoj Shukla & Mukund Sharma

International Geological Correlation Programmes

IGCP Project No. 216 : **Global biological events in Earth history**
K.P. Jain,
Member, National Working Group

IGCP Project No. 237 : **Floras of Gondwanic continents**
H.K. Maheshwari & R.S. Tiwari
Co-convener, National Working Group
Member, National Working Group

IGCP Project No. 245 : **Non-marine Cretaceous Correlation**
K.P. Jain
Member, National Working Group

IGCP Project No. 261 : **Stromatolites and their biostratigraphic signifi cance**
P.K. Maithy & Manoj Shukla
Member, International Working Group
Member, National Working Group

IGCP Project No. 303 : **Precambrian - Cambrian events stratigraphy**
P.K. Maithy
Member, National Working Group

IGCP Project No. 320 : **New Proterozoic events and resources**
B.S. Venkatachala & Manoj Shukla
Member, International Working Group
Member, International Working Group

Global Sedimentary Geology Programme (IUGS)

Cretaceous Resources / Events and Rhythms (CRER)

K.P. Jain : Member, National Working Group

Doctoral Degree Awarded

Name	University	Title of Thesis
Sanjay Khare	Jabalpur	Palynological investigation of the Neyveli Formation of Tamil Nadu and its stratigraphical and palaeoecological utility

Papers Submitted

Agarwal, A. – A fossil wood of *Bischofia* from Neyveli Lignite deposits, India. *J. Indian bot. Soc.*

Ambwani, K. – Palynological investigation of coal-bearing sediments of Rekmangiri coal mine, Garo Hills, Meghalaya, India. *Phytomorphology.*

Awasthi, N., Sarkar, S. & Prasad, M. – Vegetation and palaeoenvironment of Siwalik succession in Surai Khola area, Nepal. *Himalayan Geol.*

Baksi, A.K., Tiwari, R.S., Tripathi, A. & Farrar, E. – Geochronology, geochemistry and palynology of Trap-Intertrappean sequence in the subsurface of the Rajmahal Basin, northeastern India. *Elsevier Science Publications.*

Bande, M.B., Mehrotra, R.C. & Awasthi, N. – Revision of *Callistemonites indicus* Bande *et al.* from the Deccan Intertrappean beds of Mandla District, Madhya Pradesh. *Palaeobotanist.*

Bande, M.B. & Srivastava, R. – *Grewia* type of wood with tile-cells and radial gum canals from the Deccan Intertrappean beds of India. *Geophytology.*

Jafar, S.A. – Late Maastrichtian calcareous nannofossils from Lattengebirge (Germany) and the Andaman Nicobar Islands (India) - Remarks on events around Cretaceous-Tertiary boundary. *N. Jb. Geol. Palaeont. Abh., Stuttgart.*

Kar, R.K. – Occurrence of *Dipterocarpus* type of pollen from the Miocene sediments of Kerala, south India. *J. Palynol.*

Kar, R.K. – Occurrence of *Normapollis* pollen from the Miocene sediments of Kerala, India. *J. Palynol.*

Kar, R.K.– Development of some of the pteridophytes in India during Tertiary. *Geophytology.*

Khan, H.A. – Studies in the pollen morphology of Indian Ranunculaceae. *J. Palynol.*

Khandelwal, A. – Acromycological survey at Lucknow. *Geophytology.*

Khandelwal, A. & Gupta, H.P. – Palynological evidence of mangrove degradation during mid-late Holocene at Rambha, Orissa. *Geophytology.*

Khandelwal, A. & Gupta, H.P. – Organodebris analysis of Chilka Lake at Balugaon, Orissa, India: An assessment of depositional environment. *Holocene*, Cambridge.

Khowaja-Ateequzzaman – Some new dinoflagellate cyst taxa from Dalmiapuram Formation, Cauvery Basin, southern India. *Geophytology.*

Kumar, P. – Palynodating of Changaon beds exposed near Khatama caves, Hoshangabad,

Madhya Pradesh (India). *Biological Memoirs*.

Mandaokar, B.D. – Palynological investigation of Jeypore colliery, Tikak Parbat Formation, Oligocene, Assam, India. *Alcheringa*

Maithy, P.K. & Babu, R. – Organic- walled microfossils from the Ganurgarh Shale Formation, Hoshangabad District, Madhya Pradesh. *J. palaeont. Soc. India*.

Mehrotra, R.C. & Srivastava, R. – Araucarian seed scale from the Deccan Intertrappean beds of India. *Curr. Sci.*

Misra, B.K. & Singh, B.D. – Spontaneous combustion susceptibility of Indian coals and lignites : an organic petrographic autopsy. *Int. J. Coal Geol.*

Prasad, M. – Investigations on the Siwalik (Middle Miocene) leaf-impressions from the foot-hills of the Himalaya, India. *Tertiary Res.*

Rao, M.R. – Palynostratigraphic zonation and correlation of the Eocene-Early Miocene sequence in Alleppey District, Kerala, India. *Rev. Palaeobot. Palynol.*

Saini, D.C. – Two new records for Upper Gangetic Plains from Lucknow District, Uttar Pradesh. *Proc. natn. Acad. Sci. India*.

Saini, D.C. – Ethnobotany of Tharus of Basti District, Uttar Pradesh. *Ethnobotany*.

Saraswat, K.S. – Plant economy of Late-Harappans at Ancient Hulas (Ca. 1,700-1,000 B.C.), Uttar Pradesh . *Puratattva*.

Saxena, R.K. – New names for some palynofossils later homonyms from India. *Geophytology*.

Saxena, R.K. & Khare, S. – Palynostratigraphic zonation and age of the Neyveli Formation of Jayamkonda-Cholapuram, Tiruchirapalli District, Tamil Nadu. *Palaeobotanist*.

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Sharma, C. & Chauhan, M.S. – Pollen analytical interpretation of vegetation and climate during 4,000 years B.P. in Kumaon Himalaya. *Proc. XIII INQUA Congr.*, Beijing, China.

Sharma, C. & Chauhan, M.S. – Vegetation and climate since last glacial maximum in Darjeeling (Mirik Lake), eastern Himalaya. *Proc. 29th Int. geol. Congr.*, Japan.

Sharma, M. – Microbialite (stromatolite) from Mesoproterozoic Jaradag Fawn Limestone Formation of Semri Group, Rohtas, Bihar: Their systematics and significance. *(Spl.Publ.) Group Discussion on Vindhyans, Jadavpur University, Calcutta*.

Sharma, M., Mathur, V.K. Srivastava, M.C. & Shukla, M. – Systematics and significance of Microbialite (stromatolite) *Stratifera undata* from Mussoorie

Syncline, Lesser Himalaya, India. *J. geol. Soc. India*.

Sharma, M., Shukla, M. & Venkatachala, B.S. – Metaphyte and Metazoan fossils from Precambrian sediments of India : A critique. *Palaeobotanist*.

Srivastava, Shyam C. & Manik, S.R. – Taxonomic diversity of Triassic seeds from India. *8th Int. Gondw.Symp., Hobart, Australia*.

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Sukumar, R., Ramesh, Pant, R.K. & Rajagopalan, G. – 13 C of tropical peats in southern India records Post-Glacial climatic change. *Nature*.

Tripathi, S.K.M. – New angiosperm pollen from subsurface Early Palaeogene sediments of Barmer District, Rajasthan, India. *Palaeobotanist*.

Venkatachala, B.S. & Rajanikanth, A. – Geological age of the *Ptilophyllum* Flora in India: a critical reassessment. *Proc. IV Int. Organiz. Palaeobot. Conf., Paris, Rev. Palaeobot. Palynol.*

Venkatachala, B.S., Sharma, M. & Shukla, M. – Age and life of Vindhyans: Facts and conjectures. *Spl. Publ., Group Discussion on Vindhyans, Jadavpur University, Calcutta*.

Venkatachala, B.S., Tiwari, R.S. & Vijaya – Diversification of spore-pollen "Character States" in the Indian Permian. *Rev. Palaeobot. Palynol.*

Yadav, R.R. & Bhattacharyya, A. – Tree ring chronologies from western Himalaya and modelling of ring with fluctuations for short range prediction. *Forest Ecology and Management*.

Yadav, R.R. & Bhattacharyya, A. – Dendroecological assessment of Spruce growth in Deoban, Uttar Pradesh, India. *Proc. Indian natn. Sci. Acad.*

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Ambwani, K. & Kumar, M. (1992). Occurrence of viscian threads in *Daemorphs ruber* Bl. Palmae. *Phytomorphology* **41**(1-2) : 95- 97.

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Chandra, S. & Singh, K.J. (1992). The genus *Glossopteris* from the Late Permian beds of Handapa, Orissa, India. *Rev. Palaeobot. Palynol.* **75** : 183-218.

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Chauhan, M.S, Khandelwal, A., Bera, S.K. & Gupta, H.P. (1992). Palynology of Kathauta Tal, Chinhat, Lucknow. *Geophytology* **21** : 191-194.

Dilcher, D.L., Kar, R.K. & Dettmann, M.E. (1992). The functional biology of Devonian spores with bifurcate process : a hypothesis. *Palaeobotanist* **41** : 67-74.

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Field Excursions

Ambwani, Krishna

An excursion was undertaken to collect palm pollen from south India. Collected Tertiary samples for palynological investigation from Garo Hills, Meghalaya.

Awasthi, N. and Mehrotra, R.C.

An excursion to Makum Coalfield, Assam was undertaken for collection of Tertiary megafossils.

Bera, S.K.

Collected about 60 glacier dust samples from Uttarkashi, Uttar Pradesh (sponsored by DST and organised by WIHG, Dehradun) in order to study the pollen/vegetation

Miocene sediments on the West Coast section of Anderson Island, Andaman-Nicobar Islands.

relationship in the area. Besides, slides were also exposed to study the aerospora of the region.

Bhattacharyya, A.P.

An excursion to collect Permian sediments from Tindharia and Lish River section in Darjeeling District, West Bengal was undertaken.

Chandra, Anil

An excursion jointly with G.S.I. was undertaken to Anderson, Interview, Bennet and Mask Islands of Andaman-Nicobar region. Rock samples were collected from these Islands for diatom study.

Jafar, S.A.

Field data and samples collection for calcareous nannofossil studies from John

Nipple Hill Section at Neill Island, Andaman-Nicobar Islands.

Miocene sediments exposed along Jamnagar-Dwarka Road, Gujarat.

Lawrence, Henry Lawrence and Inglis Islands of Andaman-Nicobar Islands were done.

Jana, B.N.

Collected rock samples from bore-cores as well as outcrop sections from Mand-Raigarh Coalfield area in Madhya Pradesh.

Kar, R.K.

Visited Pondicherry in connection with the atlas work. A field excursion was also undertaken in Assam and Tripura for collection of palynological samples.

Kar, R.K., Mandal, J.P., Mandaokar, B.D. & Trivedi, G.K.

Visited Gujarat and Rajasthan for collection of palynological samples.

Kumar, Pramod

Collected rock samples from Shahpur, Bijori, Almod, Binora, Dodhra Mohar, Kesla and Pachmarhi areas in Satpura Basin, Madhya Pradesh.

Madhav-Kumar

A field trip was undertaken in Bharuch, Gujarat to collect palynological samples.

Maithy, P.K.

Collected samples of Blaini Krol-Tal sequences exposed in Dhurmala, Rishikesh, Maldevata and Gopichand Ka Mahal.

Misra, B.K. & Singh, B.D.

A visit to Gauhati University, Guwahati (Assam) for discussion on works carried out on coals of northeastern India and a field excursion to the Changki Valley Coalfield, Mokokchung District of Nagaland were undertaken. Systematic sampling was made from exposed faces of the various coal seams.

Rajanikanth, A.

Collected samples from the Intertrappean beds of western Kutch, Gujarat.

Ram-Awatar

Collected bore-core as well as out crop samples from Sohagpur and Umaria coalfields of Madhya Pradesh.

Saini, D.C.

Collected about 700 plant specimens from forest of Bahraich District, Uttar Pradesh.

Deoria Tal, a high altitude lake (3,000 m.a.s.l.) in Garhwal Himalaya, Uttar Pradesh.

Bore-cores showing conglomeratic bed at the base of Barakar Formation, Talcher Coalfield, Orissa.

Saini, D.C. & Pradhan, D.

Collected about 150 plant specimens from Kukrail Forest, Lucknow District, Uttar Pradesh.

Saraswat, K.S.

Collected carbonised plant remains through archaeological excavations at ancient Imlidih-Khurd (Ca. 1500 - 800 B.C.), Gorakhpur District, Uttar Pradesh.

Sarkar, Samir

A field trip was undertaken in Uttarbaini, Mansar and Kalakot areas of Jammu to collect stratigraphically located palynological samples from Palaeocene-Eocene sequence of Mohgola, Metka, Tattapani and Kalakot coal mine areas and Siwalik sequence (Mio-Pliocene) of Uttarbaini and Mansar.

Sharma, Chhaya

Participated in the field excursion to Neogene shallow marine sequence at Miyoshi, Taishaku limestone plateau (Carboniferous to Permian) and Neogene sub-marine volcanic sequence at Shimane Peninsula, Japan during September, 1992.

Sharma, Chhaya, Chauhan, M.S. & Gupta, Asha

Undertook excursion to the temperate belt of Garhwal Himalaya and collected 22 surface samples from different forest stand and 4 soil profiles, three from Deoria

Tal and one from Dewar Tal (Chamoli District) for palynological investigation.

Singh, R.S.

Visited Meghalaya to collect palynological samples.

Tripathi, Archana & Vijaya

An excursion to Talcher Coalfield, Mahanadi Basin was undertaken for the collection of subsurface material for palynostratigraphic studies.

Yadav, R.R. & Bhattacharyya, Amalav.

Seventy tree cores from *Abies pindrow, Taxus baccata, Pinus gerardiana, Pinus roxburghii* and *Cedrus deodara* were collected during two field excursions in the forest sites adjacent to Pindari glacier, Uttar Pradesh and Chamba, Dharamshala, Himachal Pradesh.

Papers presented at Symposia/Conferences/Meetings

Bajpai, U. & Maheshwari, H.K.–Late Palaeozoic plant geography of the Perigondwana and evolution of Kashmir Basin. *29th Int. geol. Congr.*, Kyoto, Japan, August 1992.

Bhattacharyya, A. & Yadav, R.R.–Dendroclimatic studies over the monsoon region. *Meeting to identify thrust/gap areas in palaeoclimatology (DST, Govt. of India)*, IITM, Pune, January 1993.

Guleria, J.S.–Occurrence of *Chlorophora excelsa* (Welw.) Benth. & Hook., an African member of Family Moraceae in the Neogene of western India. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Guleria, J.S. & Bande, M.B.–History of Indian fossil palms. *Natn. Sem. Recent studies on palms in India*, Kaul Science Foundation, N.B.R.I., Lucknow, February 1993.

Kapoor, H.M., Maheshwari, H.K. & Bajpai, U.–Kshir Sagar, Tethys and the Perigondwana : Late Palaeozoic evolutionary history of the northern margin of the Gondwana Supercontinent. *Int. Symp. Himalayan Geol.*, Shimane, Japan, September 1992.

Kar, R.K.–On the occurrence of *Dipterocarpus* and *Normapolles* pollen from the Miocene sediments of Kerala. "*Contemporary Research Trends in Palaeobotany*, The Palaeobotanical Society, from Lucknow, January 1993.

Khan, H.A.–Automotives air pollution and its control. *Nat. Sem. Environ. Pollution*, Lucknow.

Maithy P.K. & Babu, R.–Occurrence of endosporulating cyanobacteria in the Lower Bhander Limestone Formation, Bhander Group exposed around Narsinghgarh, Madhya Pradesh. *Group Discussion on the Vindhyans*, Jadavpur University, Calcutta, March 1993.

Nautiyal, C.M. & Venkatesan, T.R. –Age of Deccan Traps and some implications. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Rajagopalan, G. & Maithy, P.K.–Physical data and biotic evidences on the age of Vindhyan sediments. *Group Discussion on the Vindhyans*, Jadavpur University, Calcutta, March 1993.

Rajanikanth, A.–Limestone building algae from the Cauvery Basin, India. *80th Indian Sci. Congr.*, Goa, January 1993.

Rajanikanth, A.–Modern trends in Upper Cretaceous palynology. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Saxena, R.K.–Palynostratigraphy of the Neyveli Formation in Tamil Nadu, India. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Sekar, B. & Rajagopalan, G.–Chemical analysis and C-14 dating of a sediment core from Tsokar Lake, Ladakh and its implication on lake succession and climate. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Sharma, Chhaya–Vegetation and climate since last glacial maximum in Darjeeling, eastern Himalaya. *29th Int. geol. Congr.*, Kyoto, Japan.

Sharma, Chhaya –Vegetation dynamics and palaeoclimate of Quaternary lacustrine sediments in Himalaya : a palynological assay. *Int. Symp. Himalayan Geol.*, Shimane, Japan.

Sharma, Chhaya & Chauhan, M.S.–Recent past of eastern Himalaya – based on palynological studies. *"Contemporary Research Trends in Palaeobotany"* (Poster), The Palaeobotanical Society, Lucknow, January 1993.

Sharma, Chhaya & Gupta, Asha–Palynology of Indian Alangiaceae. *"Contemporary Research Trends in Palaeobotany"* (Poster), The Palaeobotanical Society, Lucknow, January 1993.

Sharma, Mukund–Microbialite (stromatolites) from Mesoproterozoic Jaradag Fawn Limestone Formation of Semri Group, Rohtas, Bihar: their systematics and significance. *Group Discussion on the Vindhyans*, Jadavpur University, Calcutta, March 1993.

Sharma, Mukund, Mathur, V.K., Srivastava, M.C. & Shukla, Manoj.– Systematics and significance of microbialite (stromatolite) *Stratifera undata* from Mussoorie Syncline, Lesser Himalaya, India. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Sharma, M. & Shukla, M.–Mesoproterozoic microbial assemblage of Jaradag Fawn Limestone, Rohtas, Bihar, India : an ancient analog of Sabkha ecosystem. *29th Int. geol. Congr.*, Kyoto, Japan, August 1992.

Singh, B.D.–Role of fluorescence microscopy in the assessment of Gondwana coals. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Srivastava, C.–Harappan evidences of floristic remains in Gujarat : an ecological perspective. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Srivastava, Shyam C. & Banerji, Jayasriital–*Pentoxylon* plant : a reconstruction and interpretation. *4th IOP Conf.*, Paris, France, August 1992.

Tewari, R.–Importance of cuticular features in speciation. *4th IOP Conf.*, Paris, France, August 1992.

Tiwari, R.S., Tripathi, A. & Vijaya –Palaeoenvironmental significance of Organic-walled Microfossils of doubtful origin in Permian and Triassic sequences of peninsular India. *Birbal Sahni Birth Centenary Natn. Symp. Gondwana of India*, Nagpur, January, 1993.

Tripathi, A.–Early Cretaceous magmatism and palynoassemblagesof Rajmahal Basin. *Birbal Sahni Birth Centenary Natn. Symp. Gondwana of India*, Nagpur, January 1993.

Tripathi,A.–Antiquity ofangiospermous pollen in Indian Mesozoic. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Srivastava, Suresh C. & Jha, N.–Palynological dating of coal seams in Sattupalli area, Chintalpudi sub-basin, Andhra Pradesh, India. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Venkatachala, B.S., Jain, K.P. & Rajanikanth, A.–Late Maastrichtian palynological assemblage from Kallamedu Formation, Cauvery Basin, India. *8th Int. Palynol. Conf.*, Aix-en-Provence, France, September 1992.

Venkatachala, B.S. & Rajanikanth, A.–Occurrence of *Aquilapollenites* pollen in India. *15th Bot. Conf.*, Aurangabad.

Vijaya–The organic-walled microfossils of doubtful origin and their diversity through Permian of Indian Peninsula. *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 1993.

Lectures Delivered

S.A. Jafar –*"Calcareous nannofossil distribution and facies of Mesozoic rocks of north-western Indian basins"* at Geology Department, University of Wuerzburg, Germany.

K.P. Jain –*"Plant life through the ages"*,U.G.C. sponsored Refresher Course in Botany for College and University Teachers, Department of Botany, Lucknow University, Lucknow.

P.K. Maithy – *The oldest traces of life and the advancing organisation*", U.G.C. sponsored Refresher Course in Botany for College and University Teachers, Botany Department, Lucknow University, Lucknow.

P.K. Maithy –*"Indian Palaeozoic fossils"*, U.G.C. sponsored Refresher Course for College and University Teachers, Botany Department, Lucknow University, Lucknow.

P.K. Maithy –*"Earliest life on Earth"*at National Botanical Society, Calcutta.

C.M. Nautiyal –*"Isotope Ratio Mass Spectrometry"* at 4th National Workshop on Mass Spectrometry, Indian Society for Mass Spectrometry, C.D.R.I., Lucknow.

C.M. Nautiyal – Compered three Science Programmes for Lucknow Doordarshan.

C.M. Nautiyal –*"Clouds, energy and seismic events"*, Radio Talks.

G. Rajagopalan –*"Mass Spectrometry applications in Palaeobotanical studies"* at 4th National Workshop on Mass Spectrometry, Indian Society for Mass Spectrometry, C.D.R.I., Lucknow.

K.S. Saraswat –*"Plant Taxonomy in archaeobotanical studies : Problems and perspectives"* at National Seminar on Prospects and Problems of Angiospermic Taxonomy in India, School of Botany, Jiwaji University, Gwalior.

R. Saxena –*"Coal petrology and palynology of the Permian coal seams susceptible to spontaneous combustion"* at Staff Training College, C.M.P.D.I., Ranchi.

Chhaya Sharma –*"Palaeovegetation and palaeoclimatic inferences from Quaternary lacustrine deposits in eastern Himalaya"* at Shimane University, Matsue, Japan.

Chhaya Sharma –*"Palynostratigraphy of Quaternary lacustrine sediments from Himalaya"* at Kyoto University, Kyoto, Japan.

Shyam C. Srivastava –"Gondwana palaeofloristics from India" at Department of Botany, J.A. University, Szeged.

Technical Assistance rendered to other Agencies

Technical Assistance to Agencies/Universities/Institutes

Coal Wing, Geological Survey of India, Calcutta.
Regional Research Laboratory, Bhopal.
Mineral Exploration Corporation Limited, Nagpur.
Research Wing, Public Works Department, Lucknow.
Agharkar Research Institute (MACS), Pune.
Geology Department, Punjab University, Chandigarh.

Radiocarbon dating of samples

Marine Geology Wing, Geological Survey of India, Calcutta.
Geological Survey of India, Mangalore.
Physical Research Laboratory, Ahmedabad.
Geology Department, Banaras Hindu University, Varanasi.
Wadia Institute of Himalayan Geology, Dehradun.
Geology Department, Kumaon University, Nainital.
Anna University, Madras.
S.P. College, Pune.
Centre for Earth Science Studies, Trivandrum.
Indian Institute of Science, Bangalore.
Indian Institute of Technology, Kharagpur.

Others

Cine India International, New Delhi (Ministry of Agriculture, Government of India) — T.V. Serial "Krishi Katha" (Commentry and material evidences by Dr K.S. Saraswat).

Deputation/Training/Study Abroad

S.A. Jafar

Under re-invitation programme of the German Academic Exchange Service, Bonn, visited Geology Department, University of Tubingen (2 months) and Geology Department, University of Wuerzburg (1 month).

Shyam C. Srivastava

Visited the Micropalaeontology Laboratory, Department of Botany, J.A. University, Szeged. Discussed the latest trend in palynology with Professor M. Kedves.

Visited Budapest where carbonized specimens of *Thinnfeldia* were examined from the Liassic sediments of Hungary.

R.S. Tiwari

Visited Palynosurvey Company, Tokyo, Japan in September, 1992.

Deputation to Conferences/Symposia/Seminars/Workshops

S.K. Bera	· *"Dokriani Bamak Glacier Expedition"*, Uttarkashi (Sponsored by DST and organised by WIHG, Dehradun, August 8 to September 8, 1992.
R.S. Tiwari **Chhaya Sharma** **Usha Bajpai** **Mukund Sharma**	· *"29th International Geological Congress"* held at Kyoto, Japan from 24th August - 3rd September, 1992.
B.S. Venkatachala **Shyam C. Srivastava** **Rajni Tewari**	· *"4th International Organisation Palaeobotany Conference"* held at Paris, France from 30th August -3rd September, 1992.
Chhaya Sharma **Usha Bajpai**	· *"International Symposium on Himalayan Geology, 92"* held at Shimane, Japan from 3rd - 9th September, 1992.
B.S. Venkatachala	· *"8th International Palynological Conference"* held at Aix-en-Provence, France From 6th - 12th September, 1992.
All the Scientific Staff of B.S.I.P.	· Group Discussion on *"Thrust Areas in Palaeobotany"* held at B.S.I.P., Lucknow, October, 1992.
P.K. Maithy	· 2nd Meeting of the National Working Group, IGCP Project No. 303. *"Precambrian - Cambrian Events Stratigraphy"*, at Dehradun, October, 1992.
A. Rajanikanth	· *"15th Botanical Conference"*, Aurangabad, December, 1992.
	· *"80th Indian Science Congress"*, Goa, January, 1993.
All the Scientific Staff of B.S.I.P.	· *"Contemporary Research Trends in Palaeobotany"*, The Palaeobotanical Society, Lucknow, January 12, 1993.
R.S. Tiwari **Archana Tripathi** **Vijaya**	· *"Birbal Sahni Centenary National Symposium on Gondwana of India"*, Nagpur, January 16-17, 1993.
G. Rajagopalan **R.R. Yadav** **A. Bhattacharyya**	· Meeting to identify *"thrust/gap areas in palaeoclimatology"*, (D.S.T., Govt. of India) I.I.T.M., Pune, January 21-22, 1993.
J.S. Guleria **M.B. Bande**	· Seminar on *"Recent Studies on Palm in India"*, Kaul Science Foundation, N.B.R.I., Lucknow, February 12, 1993.

G. Rajagopalan **C.M. Nautiyal**	· *IV National Workshop on Mass Spectrometry*, C.D.R.I., Lucknow, March, 1-5, 1993.
H.A. Khan	· National Seminar on *"Environmental Pollution"*, Lucknow.
P.K. Maithy **R. Babu** **Mukund Sharma**	· *"Group Discussion on the Vindhyans"* held at Jadavpur University, Calcutta, 15-17 March, 1993.
G.P. Srivastava	· *" All India Museum Conference"*, National Museum, New Delhi, March, 1993.

Representation in Committees/Boards

Anand-Prakash	· Treasurer, Indian Association of Palynostratigraphers
	· Treasurer, The Palaeobotanical Society, Lucknow
N. Awasthi	· Chief Editor, Geophytology
	· Editor, News Letter, The Palaeobotanical Society, Lucknow
Usha Bajpai	· Member, Managing Council, Indian Association of Palynostratigraphers
	· Member, Executive Council, The Palaeobotanical Society, Lucknow
Anil Chandra	· Member, Executive Council, Palaeontological Society of India, Lucknow
	· Editor, Geophytology
H.P. Gupta	· Business Manager, Indian Association of Palynostratigraphers, Lucknow
S.A. Jafar	· Organizing Secretary, Lucknow Chapter, Zaheer Science Foundation, New Delhi
	· Associate Secretary, Birbal-Savitri Sahni Foundation, Lucknow
K.P. Jain	· Secretary, Indian Association of Palynostratigraphers
	· Member, Executive Council, The Palaeobotanical Society, Lucknow
	· Member, National Working Group, IGCP - 216, 245 and CRER (IUGS)
	· Editor, Proceedings of the Birbal Sahni Birth Centenary Palaeobotanical Conference, *Geophytology*, Vol. 22
	· Editor, The Palaeobotanist
H.A. Khan	· Editor, Indian Journal of Bio-Research
Asha Khandelwal	· Member, Executive Council, Indian Aerobiological Society
Hari K. Maheshwari	· Editor, The Palaeobotanist
	· Editor, Indian Association of Palynostratigraphers

	· Coeditor, Asian Journal of Plant Science
	· Member, Committee for Fossil Plants, International Association of Plant Taxonomy
B.K. Misra	· Joint Secretary, Indian Society of Geoscientists
A. Rajanikanth	· Joint Secretary, The Palaeobotanical Society, Lucknow
Rakesh Saxena	· Associate Member, International Committee for Coal Petrology
	· Coordinator, Birbal-Savitri Sahni Foundation, Lucknow
	· Member, National Round Robin Analysis Group, Ranchi
R.K. Saxena	· Secretary, Indian Society of Geoscientists
	· Member, Editorial Board, Indian Society of Geoscientists Bulletin
Manoj Shukla	· Councillor, The Palaeobotanical Society, Lucknow
A.K. Srivastava	· Treasurer, Indian Society of Geoscientists
	· Member, Editorial Board, Indian Society of Geoscientists Bulletin
	· Corresponding Member, Botanical Society of China
Shyam C. Srivastava	· Secretary-Convener, Birbal-Savitri Sahni Foundation, Lucknow
	· Member, International Organization of Palaeobotany Medal Selection Committee
	· Affiliate Member, Palaeobotany Section, Botanical Society of America
R.S. Tiwari	· Chief Editor, The Palaeobotanist
	· Secretary, The Palaeobotanical Society, Lucknow
	· Member, Editorial Board, "Geophytology"
	· Member, Executive Committee, The Palaeontological Society, Lucknow
	· Co-editor, Asian Journal of Plant Sciences
	· Member, Non-Marine Triassic Stratigraphy
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, France
- Chief Editor, The Palaeobotanist (till 31.01.93)
- Chairman, Programme Advisory and Monitoring Committee of the Palaeoclimate and Palaeoenvironmental Research, DST
- Member, National Committee on National Core and Drill Cutting Sample Library, DST, 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

Vijaya

- Editor, "Geophytology"
- Corresponding Member, Subcommission on Triassic Stratigraphy

Honours and Awards

Anand-Prakash	· Elected, Fellow of The Palaeobotanical Society
Shaila Chandra	· Elected, Fellow of The Palaeobotanical Society
H.P. Gupta	· Man of Achievement, 16Ed. 1993, International biogeographic Centre, Cambridge, England
D.C. Saini	· Elected, Fellow of Society of Ethnobotanists
Archana Tripathi	· Fellow, Geological Association & Research Centre

Publications of the Institute

The Palaeobotanist

The remaining number 3 of volume 39 of The Palaeobotanist was processed and published.

The next volumes 40 and 41 of the journal were published as the Special Volumes to mark a tribute to Prof. Birbal Sahni Birth Centenary Celebrations.

Volume 40 — Proceedings of Four Decades of Indian Palaeobotany (editors : Drs B.S. Venkatachala and H.P. Singh), comprises 33 articles in about 552 printed pages.

Volume 41 — Essays in Evolutionary Plant Biology (editors : Drs. B.S. Venkatachala, David L. Dilcher & Hari K. Maheshwari) contains 29 contributions from India and abroad in about 250 printed pages.

Both these volumes were released on November 14, 1992 by Dr. S. Varadrajan.

Sir Albert Charles Seward Memorial Lecture

Thirtyseventh Sir Albert Charles Seward Memorial Lecture entitled "Links with the past in the plant world : cuticles as recorders of diversity, kerogen formation and palaeo-atmospheric CO_2 level" delivered by Prof. H. Visscher, University of Utrecht, The Netherlands was edited and processed for publication.

Annual Report

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

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

The Type and Figured specimens/slides of megafossils available with the repository of Museum of the Institute of publications between the years 1971-1980 have been documented.

This year the publications of the Institute netted an income of Rs. 2,63,087.00 out of which about Rs. 97,050.00 were earned in foreign exchange which is approximately equivalent to US $ 3,235.00.

Library

The services of the library were also made available to scientists of other organisations and universities. The total number of registered borrowers is 124. Fifty-nine current periodicals are being procured on exchange basis. Seventy-six current periodicals are subscribed by the library.

The holdings of the Library are :

Particulars	Additions during 1992-1993	Total
Books	77	4,524
Journals	213	9,864
Reprints	343	34,238
Microfilms/Fisches	-	294
Theses	-	83
Reports	-	46
Maps & Atlases	1	59
Reference Books	4	188

Reprint Section

Reprints of research papers purchased	32
Reprints sent out in exchange	1,422
Institutions on exchange list	56
Individuals on exchange list	394
Professor Sahni's papers sent out	206
Institute publication sent out	3

Library Facility Provided To

Agarkar Research Institute (MACS), Pune
Department of Botany, University of Allahabad, Allahabad
Department of Geology, University of Lucknow, Lucknow
Department of Archaeology, University of Bihar, Bihar
Jawaharlal Nehru University, New Delhi
Environmental Resources Research Centre, Kerala
Department of Geology, University of Kumaon, Nainital
University of Osaka, Japan

Computerisation of Library Working

A programme has been developed for data retrieval. All the journals subscribed by our library have been loaded on to the computer. All the addresses of individual scientist as well as Institutions on our exchange mailing list have been entered on to the computer and data regarding the Precambrian biology literature in Birbal Sahni Institute of Palaeobotany Library has also been entered on to the computer and floppy was released on 14th November, 1992.

Herbarium

An inventory of Herbarium holdings (wood blocks) is being prepared. Rearrangement of pollen slides is in progress. About 500 herbarium sheets were checked for their correct identity and name change. About 450 plant specimens, 6 wood samples, 110 samples of seeds and 150 samples of polleniferous material have been collected. About 15 pollen slides and 7 wood slides have been prepared. Nearly 600 plant specimens have been identified and mounted on Herbarium sheets.

The holdings of the herbarium materials are :

Particulars	Additions during 1992-1993	Total
Herbarium		
Herbarium sheets of plant specimens	600	12,975
Herbarium sheets of leaf specimens	10	200
Xylarium		
Wood blocks	6	3,952
Wood discs	-	29
Wood core samples	63	240
Wood slides	7	4,728
Sporothek		
Polleniferous material	150	1,370
Pollen slides	15	11,419
Carpothek		
Fruits/Seeds	110	2,201
Photo negatives	-	5

Herbarium Facility Provided to scientists from :

Geological Survey of Bangladesh,
Pioneer Road,
Segunbagicha,
Dhaka - 1000,
Bangladesh

Botanical Survey of India,
Northern Circle,
Gangtok,
Sikkim

Department of Botany,
Darrang College,
Tezpur,
Assam

Museum

The work of preparing Inventory - Part II of the Type and Figured specimens/ slides (megafossils) was completed and its computer printout was released during the concluding ceremony of Birbal Sahni Birth Centenary Celebrations. It includes data of papers published between 1971-1980. The work of preparing Inventory-Part III is also in progress. A poster session on recent achievements was also organized as a part of the concluding ceremony.

The National Science Day was celebrated on February 28th, 1992 and for the benefit of students and of general public, educational films on themes pertaining to Palaeobotany and allied subjects were also shown. The response of students was very encouraging.

Under the educational programme of the Museum, sets of palaeobotanical specimens were gifted to 23 educational Institutions in order to make the students familiar with fossils of their country.

Preparations for an exhibit on the activities and achievements of the Institute, to be displayed in the DST's lounge, are in progress.

Delegates attending Annual Conference of the Orthodontic Society of India, Teachers of refresher course at Advance Centre of Botany, Botany Department, Lucknow University and Scientists of Bangladesh and Russia visited the Institute's Museum. Besides, fellow citizens of the country visited the Museum.

Type and Figured specimens/slides/negatives

Type and Figured specimens/slides/negatives of 17 research papers were deposited by the scientists to the repository of the Institute.

	Additions during 1992-1993	Total
Type and Figured specimens	75	5,035
Type and Figured slides	200	10,597
Negatives of the above	250	13,515

New Collections

Specimens/samples collected from 82 localities of the country were submitted to the Museum by the Institute staff as a result of their field excursions.

Department	Specimens	Samples
Pre-Gondwana and Gondwana Palynostratigraphy	—	80
Planktonology	—	107
Biodiagenesis	—	94
Post-Gondwana Palynostratigraphy of Peninsular India	—	1,515
Quaternary Biogeography and Archaeobotany	—	275
Post-Gondwana Palynostratigraphy of Extra-Peninsular India	—	261
Cenophytic Evolutionary Botany	205	—
Mesophytic Evolutionary Botany	120	—

Samples received for investigation

Drill Core Library of ONGC		69
Division Forest Officer	(Wood) 4	
K.A. West Division, Diphu,Assam		
West Coast Division		2
Marine Wing, G.S.I.,Mangalore		
Mineral Exploration Corporation Limited,Nagpur		12
Department of Geology, Lucknow University		12
Mineral Exploration Corporation Limited, Hyderabad		62

Presentation of fossil specimens within the country

Department of Botany, S.S.V.P.S.L.K. Dr P.R. Ghogre Science College, Dhule
Department of Botany, Jai Hind College of Arts, Science and Commerce, Dhule
Government M.A.M. College, Jammu
Department of Botany, Bejoy Narayan Mahavidyalaya, Hooghly
Department of Botany, Amravati University, Amravati
Department of Geological Sciences, Gauhati University, Guwahati
Department of Botany, A.S.R. Government College, Santi Nagar, Khammam, Andhra Pradesh
Department of Geology, S.G.R.R. College, Dehradun, Uttar Pradesh.
Department of Botany, B.V. Bhoomaraddi College of Arts, Science & Commerce, Bidar
College of Arts and Science, Ponda, Goa
Department of Botany, Government College, Port Blair, Andaman-Nicobar
Department of Botany, Government Saharia College, Jaipur, Rajasthan
Department of Botany, Pratap College, Amalner, district Jalgaon, Maharashtra
Department of Botany, Science, Arts and Commerce College, Nampur, Nasik
S.P.D.M. College, Shirpur, Maharashtra
Maharaja College, Chatterpur, Madhya Pradesh
Kanoria Mahila Mahavidyalaya, Jaipur, Rajasthan
Department of Bio-Sciences, Himachal Pradesh University, Shimla, Himachal Pradesh

Government College, Jind, Haryana
Department of Botany, Institute of Science, Bombay
Department of Geology, Chitrakut Gramoday Vishwavidyalaya, Chitrakut, Madhya Pradesh
Department of Botany, Sri Sivaji Arts and Science College, Chikhli, district Buldana, Maharashtra
Department of Botany, Dahiwadi College, Dahiwalli

Technical Assistance

Facilities were provided to Research Wing, Public Works Department, Lucknow.

Institutional Visitors

St. Andrews College, Gorakhpur, Uttar Pradesh.
Magadh University, Bodh Gaya, Bihar
M.L.K. College, Balrampur, Uttar Pradesh.
D.K.D. College, Deragaon, Aligarh, Uttar Pradesh.
Ranchi University, Bihar
Amaravati University, Amaravati, Maharashtra
I.T. College, Lucknow, Uttar Pradesh.
Colvin College, Lucknow, Uttar Pradesh.
Springdale College, Lucknow, Uttar Pradesh.
Christ Church College, Kanpur, Uttar Pradesh.
H.N.B. Garhwal University, Tehri, Uttar Pradesh.

Distinguished Visitors

Ms Afia Akhatar
Geological Survey of Bangladesh
Dhaka, Bangladesh

Sri P.S. Srivastava
Secretary, S.Q.S.T.
New Delhi

Sri A.P. Trivedi
Karauli
Rajasthan

Dr G.K. Sunindan,
CESS, Trivendrum
Kerala

Dr A.J. Singh
Bhabha Atomic Research Centre
Bombay, Maharashtra

Professor T.B. Batygina & Dr Q.E. Titova
Komarov Botanical Institute
St. Peterburg
Russia

Dr A.B. Tripathi
Jawaharlal Nehru University
New Delhi

Professor M.R. Vijayaraghvan & Mrs S. Vijayaraghvan
Department of Botany
University of Delhi, Delhi

Lt. Colonel A.K. Tiwari
Army Medical Centre, Lucknow

Dr M.V. Kapadia
Rajkot, Gujarat

Professor O.P. Joander
Rajashahi University
Bangladesh

Dr Aziz Ballouche
Institut National des Science

Archcologic (Morocco)
University of Franc Fort
Germany

Dr S.S. Singh
Garhwal University, Tehri Campus,
Tehri, Uttar Pradesh.

Dr S. Vardarajan
New Delhi

Dr Harsh K. Gupta
Director, National Geophysical Research Institute
Hyderabad

Professor S.C. Shah
Department of Geology
Jammu University
Jammu, J & K

Scientists

Director

Ram S. Tiwari, Ph.D., F.Pb.S., F.I.A.P., F.P.S., F.S.G. (w.e.f. 29.03.1993)
B.S. Venkatachala, Ph.D., F.N.A.Sc., F.G.S., F.B.S., F.Pb.S., F.Pn.S. (Retired w.e.f.31.01.1993)

Distinguished Scientist

Hari P. Singh, Ph.D., F.Pb.S. (Retired w.e.f. 30.06.1992)

Deputy Director

Govindraja Rajagopalan, Ph.D., F.Pb.S., F.S.G. (w.e.f. 01.04.1992)

Assistant Directors (Special Grade)

Anand-Prakash, Ph.D., F.I.A.P. (w.e.f. 01.04.1992)
Nilamber Awasthi, Ph.D., F.Pb.S., F.I.A.P.
Anil Chandra, Ph.D., F.P.S., F.S.G.
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. (Acting Director w.e.f. 01.02.1993 to 28.03.1993)
Ranajit K. Kar, Ph.D., F.Pb.S.
Hari K. Maheshwari, Ph.D., F.Pb.S., F.I.A.P., F.P.S.
Prabhat K. Maithy, Ph.D., F.Pb.S.
Suresh C. Srivastava, Ph.D., F.I.A.P., F.Pb.S.

Assistant Directors

Mohan B. Bande, Ph.D. (Retired w.e.f. 01.03.1993)
Jayasri Banerji, Ph.D.
Syed A. Jafar, Dr. phil.nat., F.P.S.
Chandra M. Nautiyal, Ph.D. (w.e.f. 01.04.1992)
Kripa S. Saraswat, Ph.D., F.B.S.
Chhaya Sharma, Ph.D., F.I.A.P.
Jaswant Singh, Ph.D.
Ashwini K. Srivastava, Ph.D.
Shyam C. Srivastava, Ph.D.

Senior Scientific Officers

Anil Agarwal, Ph.D. (w.e.f. 01.04.1992)
Krishna Ambwani, Ph.D.
Usha Bajpai, Ph.D.
Rahul Garg, Ph.D., F.P.S., F.S.G.
Jaswant S. Guleria, Ph.D.
Brijendra N. Jana, Ph.D.
Neerja Jha, Ph.D.
Hafiz A. Khan, Ph.D.
Asha Khandelwal, Ph.D.
Pramod Kumar, Ph.D.
Jagannath P. Mandal, Ph.D.
Basant K. Misra, Ph.D., F.S.G.
Mulagalapalli R. Rao, Ph.D.
Samir Sarkar, Ph.D.
Rakesh Saxena, Ph.D.
Ramesh K. Saxena, Ph.D., F.S.G., F.P.S.
Manoj Shukla, Ph.D., F.G.S.
Rama S. Singh, Ph.D.
Gajendra P. Srivastava, Ph.D.
Archana Tripathi, Ph.D., F.P.S.
Surya K.M. Tripathi, Ph.D. (w.e.f. 01.04.1992)
Vijaya, Ph.D., F.L.S.,F.P.S.
Ram R. Yadav, Ph.D.

Junior Scientific Officers

Rupendra Babu, Ph.D.
Samir K. Bera, Ph.D.
Amalava Bhattacharyya, Ph.D.
Anant P. Bhattacharyya, 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.
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., LL.B.
Mukund Sharma, M.Sc., F.G.S.
Alpana Singh, Ph.D.
Bhagwan D. Singh, Ph.D., F.S.G.
Kamal J. Singh, Ph.D.
Abhay P. Srivastava, Ph.D.
Chanchala Srivastava, Ph.D.
Rashmi Srivastava, Ph.D.
Rajni Tewari, Ph.D.
Gyanendra K. Trivedi, Ph.D., F.P.S.

Emeritus Scientists

Hari P. Singh (w.e.f. 01.07.1992)
B.S. Venkatachala (w.e.f. 01.02.1993)

Sponsored Project (DST)

Deepak Kohli, M.Sc. (JRF)
Sudhansu Sinha, M.Sc. (JRF)

Technical and Administrative Personnel

Publication

Rattan L. Mehra, D.P.T. (Proof Reader)

Library

Jagendra N. Nigam, B.A., B.Lib.Sc. (J.T.O.)
Kavita Kumar, B.Sc., B.Lib.Sc. (J.T.A.)
Shail S. Rathore (L.D.C.)

Museum

Prem Prakash, B.Sc. (S.T.A.)
Sant R. Yadav, B.A. (Temp. J.T.A. on adhoc basis)

Herbarium

Jagdish C. Srivastava, M.Sc. (J.T.O.)
Diwakar Pradhan, B.Sc. (S.T.A.)

Laboratory Services

Hirendra N. Boral, B.Sc. (T.O.)
Balasubramanian Sekar, B.Sc., A.I.C. (T.O.)
Madhabi Chakraborty, M.Sc. (J.T.O.)
Kamla M. Chhabra, B.Sc. (J.T.O.)
Indra Goel, B.Sc. (J.T.O.)
Asha Guleria, B.Sc. (J.T.O.)
Tapan K. Mandal, B.Sc. (J.T.O.)
Sunita Khanna, B.Sc. (S.T.A.)
Eknath G. Khare, M.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.)
Keshav Ram, B.A. (J.T.A.)
Vijay P. Singh, B.Sc. (J.T.A.)
Avinesh K. Srivastava, B.Sc. (J.T.A.)

Technical Services

Madhukar Arvind, B.Sc. (J.T.A.–Computer)
Chandra Bali (Mechanic)

Alok K. Ghosh (Electrician), G.I.T.I., N.C.T.V.T.
Chhotey Lal (Mechanic)
R. Nandhagopal, B.Sc., PBDCA (J.T.A.–Computer)
Vijay S. Panwar (Glass Blower)
Purshottam S. Saluja (Mechanic), S.T.S.C.T.I.

Photography and Drawing

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

Sponsored Project

Jagdish Prasad (T.A.)

Administration

Suresh C. Bajpai, M.Sc., LL.B., F.I.E.T.E. (Registrar w.e.f. 31.12.1992)
Surendra B. Verma, M.A., B.Com., D.P.A., LL .B. (Registrar retired w.e.f.30.12.1992)
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)
Radhaballabh Kukreti, B.A. (Jr. Assistant)
V. Nirmala (U.D.C.)
P. Thomas (U.D.C.)
Usha Chandra (U.D.C.)
Hari Lal (U.D.C.)
Koshy Thomas (L.D.C.)
Gopal Singh, B.A. (L.D.C.)
S. Murukan Pillai, B.A. (L.D.C.)
N. Unnikannan, B.A. (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 Acharyya, B.A. (L.D.C.)

Stores

Baresh K. Jain, B.A. (S.O.[S & P])
Inder J. Mehra, B.A. (S.O.[S & P])
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)
Mohammad Shakil (Binder)
Raja Ram (Attendant)
Satruhan (Attendant)
Sunder Lal (Attendant)
Prem Chandra (Attendant)
Ram Singh (Attendant)
Rajendra Kumar (Attendant)
K.C. Chandola (Attendant)
Chhange Lal (Attendant)
Haradhan Mahanti (Attendant)
Shree Ram (Peon)
Kedar Nath Yadav (Peon)
Bam Singh (Peon)
Kailash Nath (Peon)
Ram Kishan (Peon)
Munni (Peon)
Maya Devi (Peon)
Mani Lal Pal (Peon)
Ram Ujagar (Peon)
Ram Dheeraj (Peon)
Krishna K. Bajpai, B.A. (Peon)
Dhan Bahadur Kunwar (Peon)
Mahadev Prasad (Peon)
Hari Kishan (Peon)
Subhash C. Mishra (Peon on adhoc)
Prem Shanker (Chowkidar)
Ram Dhari (Chowkidar)
Vishnu Kumar (Chowkidar)

Ram Deen (Chowkidar)
Kesho Ram (Chowkidar)
Bishnu Dutt (Chowkidar)
Rameshwar Prasad Pal (Mali)

Appointments and Promotions

Appointments

Dr R.S. Tiwari, Assistant Director (SG) appointed as Director w.e.f 29.03.1993.
Shri S.C. Bajpai appointed as Registrar w.e.f. 31.12.1992.
Shri Kamal Narang appointed as Programmer (Computer) w.e.f 01.12.1992.
Shri Vijay Kumar Nigam appointed as Junior Technical Assistant (Library) w.e.f. 19.06.1992.
Shri Sant Ram Yadav, Fossil Cataloguer appointed as temporary Junior Technical Assistant (Museum) on adhoc basis w.e.f. 29.06.1992.
Shri Avanish Kumar appointed as Console Operator w.e.f. 19.06.1992 (AN).
Shri Ajay Kumar Srivastava appointed as Console Operator w.e.f 19.06.1992 (AN).
Shri Madan Singh Rana appointed as Generator Operator w.e.f 25.05.1992 (AN).
Shri Subhash Chandra Singh appointed as Mechanic-cum-Section Cutter w.e.f 25.05.1992 (AN).
Shri D.K. Mishra appointed as Driver w.e.f 01.06.1992.
Shri Keshav Ram, Lab. Assistant appointed as Junior Technical Assistant w.e.f 23.10.1992 (AN).

Promotions

Dr G. Rajagopalan, AD(SG) promoted as Deputy Director w.e.f. 01.04.1992.
Dr Anand Prakash, AD promoted as Assistant Director (SG) w.e.f. 01.04.1992.
Dr C.M. Nautiyal, S.S.O. promoted as Assistant Director w.e.f. 01.04.1992
Dr S.K.M. Tripathi, J.S.O. promoted as Senior Scientific Officer w.e.f. 01.04.1992.
Dr Anil Agarwal, J.S.O. promoted as Senior Scientific Officer w.e.f. 01.04.1992.
Shri J.C. Srivastava, S.T.A. promoted as Junior Technical Officer w.e.f. 01.04.1992.
Shri T.K. Mandal, S.T.A. promoted as Junior Technical Officer w.e.f. 01.04.1992.
Shri Vishnu Kumar, Chowkidar promoted to next higher grade w.e.f. 19.11.1992.
Shri Ram Deen, Chowkidar promoted to next higher grade w.e.f. 19.11.1992.
Shri Kesho Ram, Chowkidar promoted to next higher grade w.e.f. 19.11.1992.
Shri Ram Kishan, Peon promoted to next higher grade w.e.f. 19.11.1992.

Retirements

Dr H.P. Singh, Distinguished Scientist, retired on 30.06.1992
Shri S.B. Verma, Registrar, retired on 30.12.1992
Dr B.S. Venkatachala, Director, retired on 31.01.1993
Dr M.B. Bande, Assistant Director, retired on 01.03.1993
Shri Chhange Lal, Attendant, retired on 31.03.1993

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

Secretary or his Nominee,
Department of Science and Technology, Technology Bhavan,
New Mehrauli Road,
New Delhi 110 016

Shri S.B. Krishnan
Joint Secretary & Financial Adviser,
Department of Science and 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

Shri S.N. Chaturvedi
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. F.R.I.,
Dehradun 248 001

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

Member-Secretary

Director,
Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Assistant Secretary (Non-member)

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

Shri S.B. Krishnan
Joint Secretary & Financial Adviser,
Department of Science and Technology, Technology Bhavan,
New Mehrauli Road,
New Delhi 110 016

Shri 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

Director,
Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Assistant Secretary (Non-Member)

Registrar
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Research Advisory Council

Chairman

Director,
Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Members

Dr S.C.D. Sah
Vikaspuram Enclave,
General Mahadeo Singh Road,
Ballupur, P.O. F.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,
P-8, Brabourne Street,
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
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

Deputy Director,
Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Secretary (Non-Member)

Registrar
Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Departments

Department of Non-Vascular Plants
Department of Palaeophytic Evolutionary Botany
Department of Mesophytic Evolutionary Botany
Department of Cenophytic Evolutionary Botany

Department of Quaternary Biogeography & Archaeobotany
Department of Pre-Gondwana and Gondwana Palynostratigraphy
Department of Post-Gondwana Palynostratigraphy of Peninsular India
Department of Post-Gondwana Palynostratigraphy of Extra-Peninsular India
Department of Planktonology
Department of Biodiagenesis
Department of Radiometric Dating

Internal Committees

Research Programming and Evaluation Committee w.e.f. 08.02.1993

B.S. Venkatachala -Convener - K.P. Jain
H.P. Singh G. Rajagopalan
K.P. Jain H.K. Maheshwari
R.S. Tiwari R.S. Tiwari
H.K. Maheshwari P.K. Maithy

Excursion Equipment Committee

P.K. Maithy - Convener - H.P. Gupta
N. Awasthi A.K. Srivastava
I.J. Mehra

Instrument Maintenance Committee

Suresh C. Srivastava - Convener -
Anil Chandra

Quality Control Committee

M.B. Bande - Convener - P.K. Maithy
Bhagwan Singh Suresh C. Srivastava
B.K. Jain B.K. Jain

Purchase Committee

B.S. Venkatachala - Convener - K.P. jain
H.P. Singh P.K. Maithy
Suresh C. Srivastava Registrar
M.B. Bande Accounts Officer
Registrar S.O.(S&P)
Accounts Officer
Section Officer (S & P)

Maceration Committee

K.P. Jain - Convener - Suresh C.Srivastava
Suresh C. Srivastava Pramod Kumar
R.K. Saxena
J.P. Mandal
H.N. Boral

Building Construction and Maintenance Committee

H.K. Maheshwari	- Convener -	H.K.Maheshwari
Anand Prakash		Anand Prakash
Registrar		Registrar
S.O.(A)		Accounts Officer
P.K. Bajpai		S.O. (A)

Vehicle Allotment and Maintenance Committee

Anand Prakash	- Convener -	Anand Prakash
Registrar		Registrar
R.K. Takru	- Vehicle Incharge -	R.K. Takru

Garden Maintenance Committee

G.P. Srivastava	- Convener -	G.P. Srivastava
D.C. Saini		D.C. Saini

Canteen Committee

M.B. Bande	- Convener -	Anil Chandra
P.K. Bajpai		S.C. Bajpai
Indra Goel		H.S. Srivastava
K.J. Singh		P.K. Bajpai
V. Nirmala		Swapna Acharyya

Museum and Displays Committee

	- Convener -	R.S. Tiwari
		N. Awasthi
		Shaila Chandra
		Shyam C. Srivastava
		Rahul Garg

Library and Information Committee

	- Convener -	H.K. Maheshwari
		Chhaya Sharma
		J. Banerji
		J.S. Guleria
		B.K. Misra

Herbarium Committee

	- Convener -	N. Awasthi
		K.S. Saraswat
		H.A. Khan

SEM, Computer and Telephone Committee

- Convener -	G. Rajagopalan
	H.K. Maheshwari
	S.A. Jafar
	C.M. Nautiyal
	K. Ambwani

Photography Commitee

- Convener -	Shaila Chandra
	Archana Tripathi
	M. Shukla

Electrical Maintenance Committee

- Convener -	G. Rajagopalan
	R.K. Saxena
	A.K. Ghosh

Accounts for the year 1992-93

BIRBAL SAHNI INSTITUTE OF

Balance Sheet as at

LIABILITIES	UP TO LAST YEAR 1991-92	TOTAL UPTO 1992-93
Capital	4,25,56,888.52	4,69,56,888.52
Escess of income over expenditure	31,53,665.63	32,04,830.13
Donations/Gifts	4,37,258.15	4,48,735.10
G.P.F. Deposits	83,13,021.16	90,69,582.00
Deposit under Security/Earnenst Money	42,936.90	33,483.90
Group Insurance	4,375.00	250.00
TOTAL Rs.	5,45,08,145.36	5,97,13,769.65

Place : Lucknow
Date : 3-7-1993

PALAEOBOTANY, LUCKNOW

31st March, 1993

ASSETS	UPTO LAST YEAR 1991-92	TOTAL UPTO 1992-93
Land and Building	69,47,566.88	69,76,509.88
Apparatus & Equipments	2,52,07,693.45	2,95,69,984.17
Vehicles	6,51,398.57	6,51,398.57
Furniture & Fixtures	22,65,730.55	23,38,107.35
Books & Journals	22,46,404.36	24,88,674.34
Founders Fossils	50,000.00	50,000.00
Investments (Donations)	1,04,600.00	1,20,100.00
Maps & Toposheets	13,142.00	13,142.00
UNESCO Book Coupons	543.12	543.12
Advances	25,86,556.73	13,29,861.33
Deposits with (CPWD)	21,95,385.00	21,66,442.00
Security Money	6,100.00	8,100.00
Loans (HBA/CONV/FEST)	24,22,773.00	24,47,387.00
GPF Accumulations	83,13,021.16	90,69,582.00
Closing Stock	5,830.00	–
Closing Balance		
i) Cash in hand	28.55	102.45
ii) Cash in Bank	14,91,371.99	24,83,835.44
TOTAL Rs.	5,45,08,145.36	5,97,13,769.65