Annual Report
1993-94

BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY
LUCKNOW

ANNUAL REPORT
1993-94

Front Cover Photo : A fossil dicot flower from the Eocene sediments of Kutch, Gujarat.

Back Cover Photo : Pure formation of *Phoenix paludosa* at Dangmal - a conserved mangrove throve in Orissa.

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Acknowledgement

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Foreword

The research activities of the Birbal Sahni Institute of Palaeobotany are planned to achieve the following broader objectives :

- To develop palaeobotany in all its botanical and geological aspects;
- To constantly update data for interaction with allied disciplines;
- To co-ordinate with other palaeobotanical and geological research centres in the areas of mutual interest, such as diversification of early life, exploration of fossil fuels, vegetational dynamics, climatic modelling, conservation of forests, and
- To disseminate palaeobotanical knowledge in universities, educational institutions and other organizations.

During the year, the research activities of the Institute have been steered in the direction of thrust areas identified by scientists and the Research Advisory Council. Attempts have been made to facilitate and encourage multi-disciplinary collaborations, initiation of new horizons in researches and the sponsored projects with their well-defined objectives.

The research programmes of the Institute have been formulated to generate knowledge, expertise and techniques related to the study of fossil plants through geological time. The research activities are organised under following ten Projects:

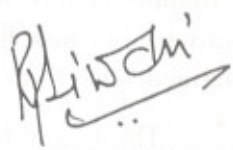
1. Antiquity, radiation and evolutionary patterns of early life.
2. Gondwana coals and associated sediments : genesis, floral evolution and biostratigraphy
3. Cenozoic plant biogeography of peninsular India
4. Phytoplankton biostratigraphy of marine sedimentaries of India
5. Palaeofloristic diversification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

9. Annotated atlases, catalogues, monographs and books

10. Application of geobotanical analysis in (i) mineral prospects, and (ii) reconstructing the history of modern vegetation through Cenozoic Era.

During the year 1993-94, the target of each Project has been achieved and several other scientific activities were undertaken to fulfill the commitments of the Institute. In the present Annual Report, details of each programme with next year's targets and all other related efforts have been given. The text is also supplimented by few photographs and graphics.

The members of Scientific Programming Committee of the Institute — Drs G. Rajagopalan, K.P. Jain, Hari K. Maheshwari, P.K. Maithy, R.K. Kar and Suresh C. Srivastava have helped in preparing this document. I am grateful to the Research Advisory Committee and the Governing Body of the Institute for giving useful suggestions and advice while discussing this report for approval. Drs Suresh C. Srivastava, Archana Tripathi and B.D. Singh, and Sri B.K. Jain and Smt. Nirmala of Co-ordination Unit for Scientific Activities and Dr J.S. Antal of Publication Unit rendered immense help in bringing out this report. The support in providing some data by Sri S.C. Bajpai, Registrar and several colleagues in the scientific, technical and administrative staff is thankfully acknowledged.



(R.S. TIWARI)
Director

Overview

Some of the outstanding research achievements and activities of the Institute during the year are summarised as under :

Research Achievements

Microfossil analysis of the argillaceous sediments of Sirbu Shale Formation, Bhander Group in central and western India has revealed the dominance of leiosphaerids, viz., *Leiosphaeridia, Kildinellosphaera* and *Origmatosphaeridium*. These forms are associated with the acanthomorph acritarchs and the remains of Chroococcaceae and Oscillatoriaceae. The assemblage supports Late Proterozoic age of this formation.

The presence of Entophysalidaceae mat in the siliceous oncolite bed of the Nagod Limestone Formation exposed at Khemri-Kotar Hill, Satna District, Madhya Pradesh indicates shallow water condition of deposition. In the Yargatti region of Kaladgi

Professor P. Rama Rao, Secretary D.S.T., taking keen interest in the Institute's Museum.

Sri S.B. Krishnan, Joint Secretary & Financial Adviser, D.S.T., viewing a coal pellet under MPV-Microscope.

Basin it has been observed that 18 cycles of simple cyclicity from *Stratifera* to small digitate stromatolites are present in a single measured section.

Independence Day – Shri P.K. Bajpai throwing the shot put.

Let us see who wins !

Circular to oval and rod-shaped bacteria-like structures with distinct pits/plaques over the marred surface of cuticular pieces of *Scutum* type of glossopterid fructifications from Bhatdih Colliery, Jharia Coalfield (Late Permian) have been reported. This is an additional evidence of bacterial degradation in Glossopteris flora.

The plant/animal association recovered from Talchir sediments (Early Permian) exposed near Sarang Village, Talcher Coalfield, Orissa suggests terrestrial environment of deposition. Further, the preservation of animal fossils in silty shale suggests very slow rate of deposition in the shallow lake.

A 'large shrub-thicket model' for glossopterid plant has been suggested on the basis of analogy of leaf morphology/ultrastructure of extant pantropical fern—*Acrostichum aureum* Linn. with the glossopterid leaf. It is envisaged that the plant was adapted to varied wetland habitats, viz., coastal/estuarine, mangrove and

lacustrine/fluvial swamps throughout Permian.

The petrological studies of coal seams from Rajmahal (Chuperbhita) and Singrauli (Moher sub-basin) coalfields revealed that fluorescing semifusinite (5 - 10%) may be treated as reactive maceral for assessing coking/blending potentiality of Gondwana coals. Well preserved vegetal matter—seeds, sporangia, megaspores, resins and algal matter in coals of Rajmahal, Singrauli and Talcher coalfields indicates hypoautochthonous to autochthonous nature of coal genesis. The syngenetic pyrite in the Gondwana coals of Tamil Nadu indicates reducing environment during the deposition of vegetal matter. These coals are comparable to the Cretaceous coals of Kutch, Gujarat.

Children in a Painting Competetion during Science Day Week celebrations.

The little winner receiving the First Prize in the Painting Competition.

The spore-pollen analysis of subsurface samples from bore-holes KBH-20, KBH-23, KBH-28, Ranjit Purwa, Kutchaur and Bemoa of Bikaner District, Rajasthan suggests an Early Eocene age for the sequence. The palynological studies of bore-hole MK 207 near Kapurdi, Rajasthan exhibited rich representation of angiosperm pollen. The high frequency of dinoflagellate cysts in bore-hole MK 207 and MK 313 at 80-90 m and 110-115 m depth, respectively indicates a marine transgression in this area during the deposition of these sediments. The palynoflora recorded is similar to those described from Palaeocene-Eocene sediments of Kutch (Gujarat) and Barmer (Rajasthan). Biopetrological studies of Tertiary lignites from Panandhro (Gujarat) and Kapurdi (Rajasthan) fields have revealed the dominance of fluorescing (hydrogen-rich) macerals in these lignites.

The palynological assemblage recovered from Pecharthal area, Tripura shows dominance of pteridophytic spores followed by angiospermous and gymnospermous pollen. The assemblage is placed in *Striatriletes susannae* Cenozone. Moraceae from the Siwalik sediments exposed in Arung Khola and Binai Khola formations of Churia Group, Nepal indicates the existence of tropical evergreen forests during the time of deposition.

Pushpanjali at Birbal Sahni's Samadhi.

The pollen analysis of soil samples from Berijan Lake dating back to 16,000 yrs B.P. revealed poor occurrence of Shola trees, namely *Elaeocarpus, Symplocos, Osbeckia* and *Ilex* in the assemblage. The associated herbs in the Shola Forest are *Senecio* and *Impatiens*.

Pollen analysis of soil profile from Deoria Tal, Garhwal Himalaya show that the vegetation sequence begins with mixed oak-pine forests with sporadic occurrence of *Alnus, Betula, Rhododendron, Ulmus, Viburnum, Berberia* and Rosaceae. The reduced values of arboreals against the surface samples reveal that the forest became sparse subsequently, and thereafter, open mixed oak-pine forest flourished once again.

The presence of mixed oak-pine forest is evidenced in the Nachiketa Tal profile

Professor C.V. Subramanian, Chairman, Governing Body accepting the flowers from Dr R.S. Tiwari.

Chief Guest–Professor M.S. Sodha, Vice-Chancellor, Lucknow University lighting the lamp on 14 November, 1994.

Professor T. Viswanathan of INSDOC, New Delhi delivering the 23rd Birbal Sahni Memorial Lecture.

(NT1) represented by high percentage of *Quercus* followed by *Pinus* associated with other arboreals, viz., *Rhododendron, Betula, Ulmus* and *Celtis*. The vegetation suggests warm and moist climate in the region; subsequently the decline in *Quercus* and other broad-leaved elements and increase in pines and grasses reveal less humid climate than before. The appearance of *Plantago* together with increase in *Cerealia* type and other culture pollen reveals increased anthropogenic activities in the region.

The chronology of tree ring samples of *Pinus wallichiana* from Aggora in Uttarkashi has revealed the signatures of 1991 Uttarkashi earthquake.

Other Activities and Achievements

During the year 1993-94 fifty five research papers and sixty two abstracts have been published and one hundred three papers and thirty nine abstracts were submitted for publication. Fifty six research papers were presented in National and International conferences.

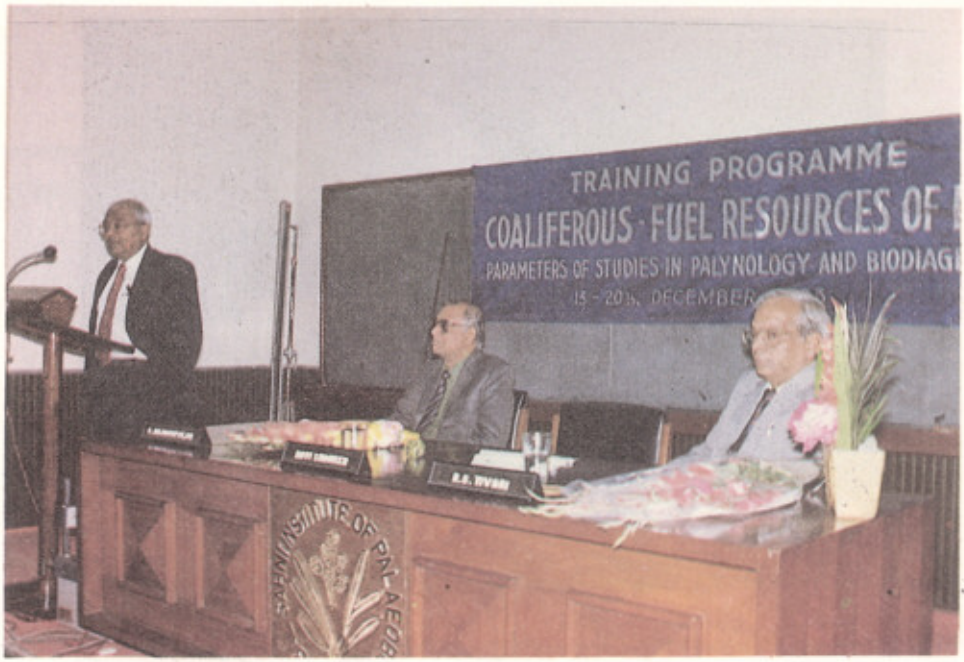
During the year, thirty eight scientists have been deputed to National and six scientists to the International conferences. Eight scientists of the Institute have

Dr V. M. Meher-Homji delivering the 39th Sir Albert Charles Seward Memorial Lecture.

delivered lectures in the Institute, while five lectures were delivered by the scientists from other institutions.

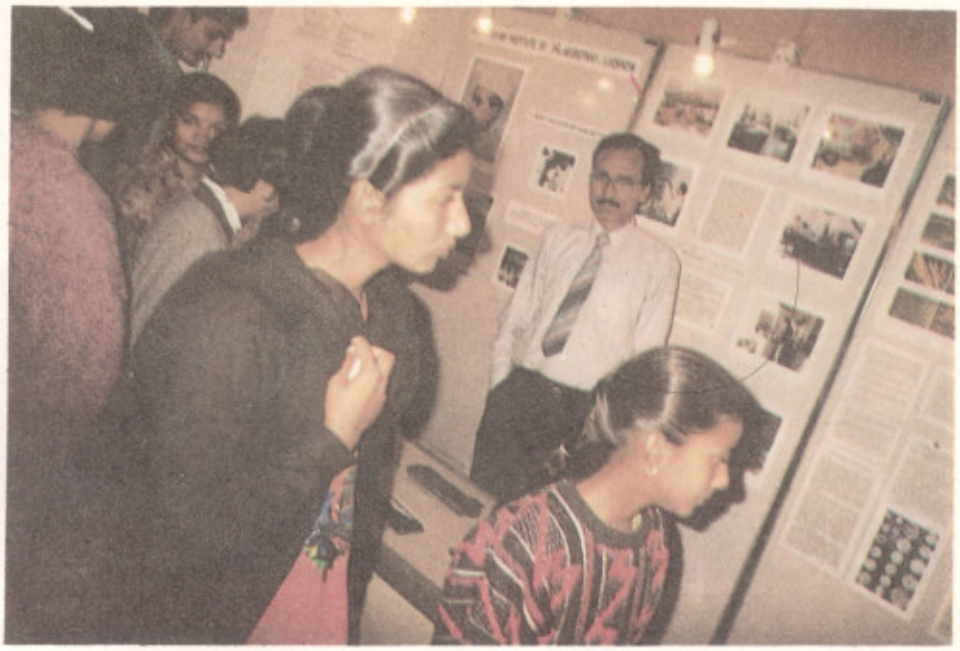
On the occasion of 9th International Gondwana Symposium held at Hyderabad in January, 1994, the Institute has organised a Group Discussion on "Contribution of Palaeobotany to Gondwana Geology" in which 3 scientists from abroad and 40 scientists from India participated and presented their papers. An open Training Course and three In-House Training Programmes were organised which included lectures as well as practical demonstrations by the Institute scientists and technical personnels. Participants from about fifteen organisations and universities and the Institute, too have attended these courses.

Technical assistance has been provided to various institutes, agencies and universities for palynological dating of samples, Scanning Electron Microscopy and Radiocarbon Dating. The herbarium facilities have been provided to various scientists from other universities and organisations in India and abroad. Library services were made available to scientists / teachers / students of several organisations and universities. The total number of borrowers is 134. Sixty seven periodicals are being procured on exchange basis and seventy nine current periodicals are subscribed by



Shri Ravi Shankar, Deputy-Director General, G.S.I. inaugurating the Training Programme on 'Coaliferous Fuel Resources of India'.

A view of Science and Technology Exhibition held at Jaipur.

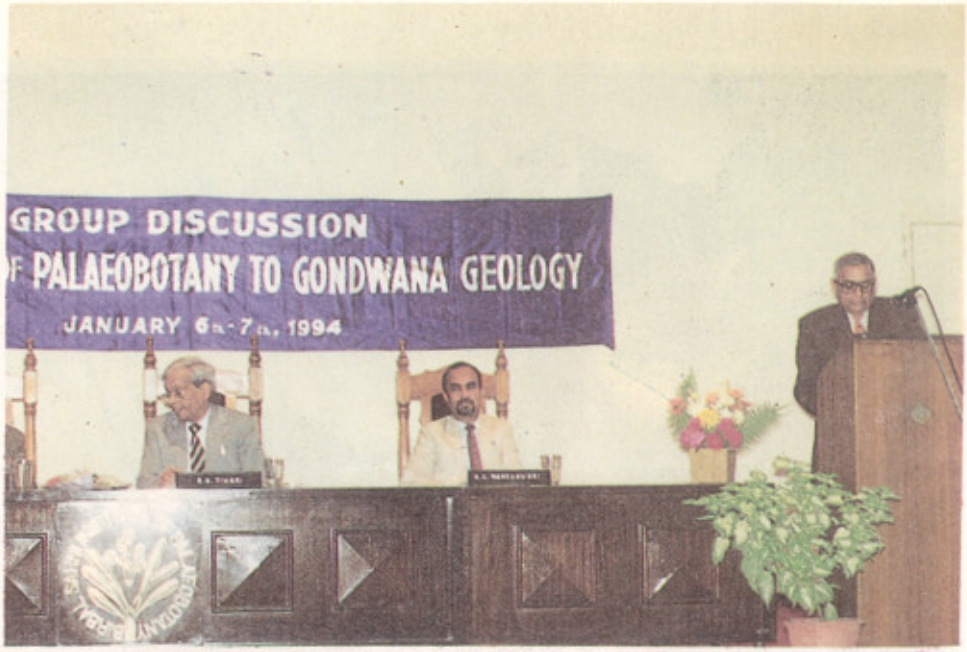


Visitors taking keen interest in the Institute's exhibits.

the Library. Computerisation of Library is also being done.

A number of distinguished visitors, scientists and teachers of various organisations, institutions, universities and D.S.T., New Delhi have visited the Museum. Seventeen sets of fossil specimens were gifted or sent on exchange basis to educational institutions in the country, Nepal and Argentina. Inventories of the Type and figured specimens / slides (megafossils) have been prepared. Fossil specimens and samples from 151 localities have been collected by various scientists during their field excursions. Exhibitions were arranged during 81st Indian Science Congress, Jaipur; 9th International Gondwana Symposium, Hyderabad and Regional Science Centre, Lucknow. On the occasion of National Science Day about 1500 students of 55 educational institutions of Lucknow visited the Institute's Museum. Popular lectures were delivered by the young scientists of the Institute and short science films were also screened. A painting competition was also organised for children in which two hundred and fifty children participated. On this occasion awards were also given to the children for best paintings.

The Consultancy Services on different specialisation such as — palynology, biodiagenesis, radiometric dating, archaeobotany, etc. have been started at the Institute to provide facilities to other organisations/agencies.



Dr G. Rajagopalan giving vote of thanks in the Group Discussion–Contributions of Palaeobotany to Gondwana Geology.

Professor Thomas Kreuser, University of Koln, Germany delivering a lecture on Lower Permian deposits in East Africa.

Professor K. Nakazawa, Kyoto University, Japan delivering his lecture on the Permian-Triassic boundary in the shallow Tethys.

The Founder's Day was celebrated in the Institute on November 14, 1994 with floral tributes to Professor Sahni at his *"Samadhi"*. On this occasion the "23rd Birbal Sahni Memorial Lecture" and "39th Sir Albert Charles Seward Memorial Lecture" were delivered by Professor T. Viswanathan, Director, INSDOC, New Delhi and by Dr V.M. Meher-Homji, French Institute, Pondicherry, respectively.

A National Organising Committee for celebrations of the Golden Jubilee has been formed to plan for important issues related to the scientific activities during Fiftieth Year and Golden Jubilee Celebrations on 10 September, 1996.

The total strength of the Institute staff is one hundred and eighty eight; out of these eighty one are scientists and the rest include technical and administrative members. Fifteen appointments and fifteen promotions have been made during the year. Six Birbal Sahni Research Scholars have joined the Institute. Two staff members retired from the service.

The Institute has published Number 1 of Volume 42 of the journal "The Palaeobotanist" during the year. 37th Sir Albert Charles Seward Memorial Lecture has also been published. An Inventory (Part II) of 'Type and figured specimens

Director, B.S.I.P., welcoming the Chief Guest-Shri Balram Singh Yadav at the Institute's Exhibition stall at 9th International Gondwana Symposium, Hyderabad.

at the repository' and two volumes of "Annotated Synopses" of Abstracts of papers published so far on Palynology, Biopetrology and Palaeobotany concerning Indian Gondwana have also been published. Annual Reports of the Institute for the year 1992-93, both in Hindi and English, were published.

In the Electronic Data Processing Unit a Laser Printer was acquired for high resolution printing of textual and graphical matter. New custom softwares for Account Section and a bilingual database management system were procured. Library Management System has been developed in UNIFY RDBMS Software under Unix Operating System.

The Rajbhasha Karyanvayan Samiti was constituted in March, 1993. This samiti has made efforts for use of Hindi in day-to-day working of the Institute. It has been decided to introduce cash prizes for promoting the use of Hindi and also to publish research articles in Hindi in the journal -- The Palaeobotanist. Hindi Parishad, New Delhi has awarded Third Prize and Appreciation Certificates to three scientists of the Institute for two popular science articles in Hindi.

Besides scientific activities, the Institute celebrated Independence Day with great enthusiasm. On this occasion, indoor and outdoor games were organised in which the staff and their family members participated, and several prizes were distributed to the winners.

The Institute has lost an young scientist, Dr A.P. Srivastava, Junior Scientific Officer after long ailment and Sri Lallan, Driver a very sincere worker after prolonged illness.

On-going Efforts : 1994-95

The quest for discovering the early life forms would be continued around Maihar, and in Nagod Limestone, Rewa (Madhya Pradesh). Similarly, organic-walled microfossils would be searched in Kaladgi and Bhima basins. Study of calcareous algae would be undertaken from Bagh beds and Trichinopolly areas. The efforts will be made to look for evolutionary and biostratigraphical significance of plant fossils from Koel Valley and Rajmahal basins; palynodating in Raniganj, Mahanadi, Sohagpur, Pali-Parsora, Godavari Graben and Satpura Basin; biopetrological studies from Hura and Pachwara coalfields. Two new programmes in Tatapani-Ramkola Coalfield, Deocha-Pachami area of Birbhum District and also Tamil Nadu have been added where standard palynosequences would be developed which could be utilised for prospecting of coal reserves in these areas.

Studies on Cenozoic plant biogeography would be continued in Deccan Intertrappean sediments from Nawargaon, Shahpur and Mohgaon Kalan areas in Madhya Pradesh and Tertiary sediments from Gujarat, Rajasthan and Kerala Coast. Phytoplankton biostratigraphic studies of marine sediments will be continued in East Coast petroliferous basins. A new programme of similar persuit is planned on Palaeogene-Neogene (65 Ma) sediments of Kutch and Saurashtra from this year. Calcareous nannoplankton and diatom biostratigraphy would be continued in Andaman and Nicobar Islands.

Palaeofloristic studies on the diversification of flora in Himalayan sediments would be continued in the Tethyan realm, and Lesser Himalayan sediments. Biostratigraphy of Tertiary sediments in Assam, Meghalaya and Nagaland would also be continued.

Quaternary vegetational patterns would be reconstructed in Silent Valley, Annamalai Hills and Palni Hills in Tamil Nadu. Studies on the history of mangroves and depositional history of Quaternary sediments in subsurface sediments of Chilka

Lake, Orissa are to be continued. Tree ring chronology of Pine and Deodar trees would be studied in Garhwal Himalayas. Pre-Harappan and Harappan deposits at Banawali, district Hissar (ca 2500 - 1700 B.C.) would be continued. Studies on the botanical remains from Kushana Culture (1st-3rd Century A.D.) at Sanghol in Ludhiana District, Punjab have been taken up from this year.

Radiocarbon dating of Kankar deposits from Gangetic alluvium will be continued. Setting up of an additional Radiocarbon Dating System using liquid scintillation method is planned. State-of-the-art report on geobotany shall be compiled.

A new Project on palaeobiochemistry of plant fossils, coal and lignites has been undertaken in addition to three new Sponsored Projects and one Collaborative Project during 1994-95 of the VIII Five Year Plan.

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 organo-sedimentary structures found in association of metaphytes and metazoans and to decipher environmental conditions*

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

Large-sized sphaeromorph acritarch associated with acanthomorph acritarch have been recorded in the argillaceous sediments of Sirbu Shale Formation (Bhander Group) exposed in central and western India. The assemblage is dominated by leiosphaerids, belonging to *Leiosphaeridia, Kildinosphaera* and *Orygmatosphaeridium.* Few remains of Chroococcaceae and Oscillatoriaceae are also associated. The overall assemblage supports Late Proterozoic age.

Microbial mat belonging to the family Entophysalidaceae was recorded in the siliceous oncolite bed of the Nagod Limestone Formation exposed at Khemri-Kotar Hill, Satna District. Presence of Entophysalidaceae mat indicates shallow condition of deposition. Some oncolites show only tubular sheaths of Oscillatoriaceae belonging to autochthonous benthic microbiota.

Problematic macrofossils studied from the Rohtas Formation, Semri Group exposed around Murlipahar, Bihar include linear, branched carbonaceous filament-bearing rounded structures (? fruiting bodies). The other carbonaceous tubular fossil is a new record showing some resemblance with calcareous form *Cloudina* known from the Nama Group. Six samples from the Vindhyans exposed at Rohtasgarh yielded

organic-walled microfossils belonging to algae and acritarch of Middle Proterozoic age.

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*

Stromatolites collected from Lokapur region of Kaladgi Basin have been studied in thin section for microstructure and microtexture. Three-dimensional reconstruction of three stromatolites have been completed using serial sectioning method. Field observation in Yargatti region indicates the presence of simple cyclicity from *Stratifera* to small digitate stromatolites. In all, 18 such cycles have been recorded in a single measured section. Presence of Psilomelane (manganese nodules) in Niralkeri chert breccia has been observed in the type area.

Samples collected from Kaladgi Basin were processed for organic-walled microfossils, but all of them proved barren.

Manoj Shukla & Mukund Sharma

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

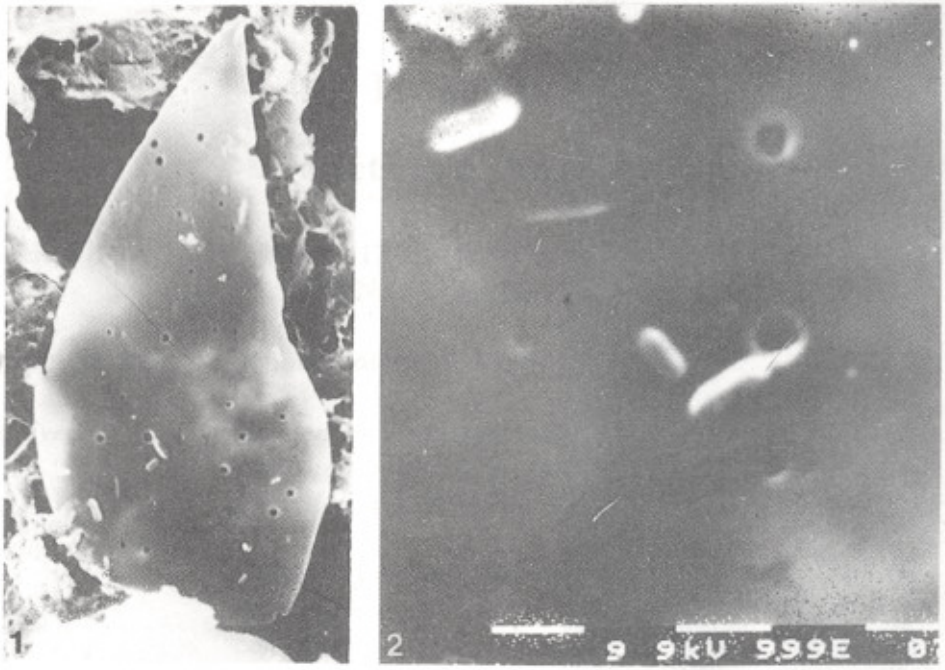
Programme 2.1 : Morphotaxonomy, floristics, evolution and stratigraphic significance of plant fossils in Koel Valley and Jharia Coalfield

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

: *To decipher ecological and climatological regimes*

Plant fossils collected from the Banhardi area of Auranga Coalfield were investigated. Taxonomic resolution and comparison of the flora indicate different species of *Neomariopteris, Noeggerathiopsis, Gangamopteris, Glossopteris, Senotheca, Samaropsis, Cordaicarpus* and *Vertebraria*. The assemblage is comparable with the known flora of Early Barakar Formation. However, in the absence of ginkgopsid remains it is distinct from the flora of adjoining Tubed area.

A.K. Srivastava



1, Ovule-like structure showing pit/plaque and bacteria-like structures over the surface x 800; **2**, a magnified view.

Morphological and cuticular investigations of plant fossils recovered from the Raniganj Formation of Jharia Coalfield were finalised. The flora is represented by 14 species of *Glossopteris*, one species each of *Neomariopteris, Schizoneura* and a number of *Scutum*-type of glossopterid fructifications.

Rajni Tewari

Cuticular pieces prepared from *Scutum*-type of glossopterid fructifications were subjected to SEM study. The examination revealed the presence of circular to oval and rod-shaped bacteria-like structures with distinct pit/plaque over the marred surface of cuticle and highly damaged and degraded cellular tissues indicating the possible evidence of bacterial degradation in Glossopteris flora.

A.K. Srivastava & 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*

Gangamopteris cyclopteroides from Talchir Formation exposed near Sarang Village, Talchir Coalfield, Orissa.

: *To study fructifications in order to understand the evolutionary aspect of pteridophytes and gymnosperms*

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

Study of plant megafossils collected from near Sarang and Tehranpur villages in Talcher Coalfield revealed typical Glossopteris flora comprising ?Bryophytic remains, *Gangamopteris cyclopteroides, G. clarkeana, G. major, Gangamopteris* sp., *Noeggerathiopsis hislopii*, equisetalean leaflets and stems, several types of stem axes, *Ottokaria bengalensis, Arberia* mat of the axes, insects, acicular and tubular impressions, ichnogenus *Talchirichnus* and some unidentified structures.

The plant/animal coexistence, damage caused by this association and their possible mutual benefits are studied. This is the first record of plant/animal association from the Talchir Formation (Early Permian) of Indian Gondwana. The plant/animal

association suggests terrestrial environment and preservation of animal fossils in the fine grained siltstone and shales suggests very slow rate of deposition in shallow lake during Talchir.

Cuticular preparations of the genus *Euryphyllum* from South Belanda Colliery, Talcher Coalfield and also from Ib-River Coalfield were made for the first time. The epidermal features are being studied.

Shaila Chandra & K.J. Singh

A collection of Middle Permian plant fossils from the Ib River Coalfield yielded a few good specimens of a female fructification of *Glossopteris*, i.e., *Senotheca* Banerjee. A detailed study of these carbonised compressions revealed several important features in addition to the morphology of the fructification. Combined study of all the hitherto known specimens of *Senotheca* from India and Australia has enabled us to propose a reconstruction model of this less-known female fructification.

K.J. Singh & Shaila Chandra

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

Objective : *To carry out fine resolution, morphotaxonomical investigations and to decipher affinities and inter-relation of different plant- organs*

: *To attempt whole plant reconstructions*

A new sporophyllous organ *Nidiella cuneata* has been described from the Triassic sediments of Nidpur. The nature of sporophylls are not yet known because no attachment of polleniferous or ovuliferous structure could be marked on any side of the sporophyll but in general appearance due to its helicoid arrangement, it looks like a cone.

Study of a detached megasporophyll has shown its affiliation with cycads, more particularly with *Zamia, Microcycas* and *Ceratozamia* because these extant forms bear peltate megasporophyll consisting of scale-like organs, each possessing two ovules/seeds. It appears that differentiation of such peltate nature of megasporophyll started during Triassic. So far this kind of feature has not been observed amongst the cycads recorded from the strata older than Triassic.

Shyam C. Srivastava & Neeru Prakash

Programme 2.4 : Palynostratigraphy of Gondwana sequence in Son-Mahanadi graben

Objective : *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*

Palynological analysis of samples of bore-hole TP-8 (1004 m depth) drilled by MECL near Tentuloi Village in Talcher Promotional Block, Talcher Coalfield, Orissa shows rich assemblage at 515.00 m which is comparable to the Late Permian palynological composition of Damodar Basin. The presence of species composition, viz., *Lunatisporites pellucidus, Lundbladispora microconata, L. brevicula, Playfordiaspora playfordii* at 350.00 m depth reveals Early Triassic affinity of the palynoflora.

Most of the material from bore-hole TCC-19 (10.75 - 318 m depth) near Chendipada, Talcher Coalfield is rich in wood fragments and only few samples are polleniferous. The assemblage shows dominance of nonstriate bisaccates at 65.60 - 118.35 m representing Early Barakar age. Smooth organic-walled microfossils are also present.

Study of palynoassemblage recovered from Late Permian sediments exposed in Madalia River near Patrapara Village in Talcher Coalfield has revealed the presence of marker species for Late Permian *Gondisporites raniganjensis* Assemblage-Zone and *Densipollenites magnicorpus* Assemblage-Zone of Damodar and Rajmahal areas.

Archana Tripathi

The palynological study of bore-hole TCC-21 near Chendipada in Talcher Coalfield showed that most of the samples are poor in spore-pollen content but rich in tracheidal elements. The Karharbari and Barakar palynoassemblages were found in this bore- hole. The Karharbari assemblage (194.65 to 208 m) shows the dominance of the genus *Parasaccites*. The genus *Scheuringipollenites* is the dominant form in Barakar assemblage (74.29 to 181 m) along with the presence of *Microbaculispora, Indotriradites, Leiotriletes* and *Brevitriletes,* etc.

The palynological content in the bore-hole RT-11 of Mand Raigarh Coalfield is very rich. In this bore-hole palynoassemblages of Talchir, Barakar and Raniganj type have been found. The Karharbari assemblage, encountered at 466 m depth, shows the dominance of *Callumispora*. The Barakar assemblage found from 151 to 360 m shows the dominance of *Scheuringipollenites*. The Raniganj type of assemblage up to 30 m depth shows a variety of striate bisaccate forms.

B.N. Jana

Qualitative analysis of 30 productive samples (out of 95) from bore-hole SPB-14 of Sohagpur Coalfield reveals that the palynotaxa recovered from Middle

Pali Member (27.50-280.0 m) are equivalent to Raniganj having the dominance of non-striate and striate bisaccate, viz., *Scheuringipollenites, Faunipollenites, Crescentipollenites* and *Striatopodocarpites*, along with *Guttulapollenites, Lunatisporites* and *Gondisporites*. Compilation of the result of bore-hole SPB-18 has been completed.

Ten outcrop samples from Late Pali Member, south of Tetki Village, Sohagpur Coalfield have also been macerated. Only one sample has yielded few taeniate and monosaccate pollen indicating Late Permian age.

Ram-Awatar

The age of the strata in the bore-hole IBSH-5 collected from Belpahar area, Ib River Coalfield has been determined. In addition, 80 samples of bore-hole IBT-7 collected from the same area were macerated. Slides of the productive samples have been prepared. Qualitative study of the palynomorphs along with scanning of good specimens and photography of significant taxa has been completed.

K.L. Meena

Programme 2.5 : Morphological study of plant megafossils from Raniganj and Rajmahal coalfields and ultrastructure of megaspores, seeds and *in situ* pollen/spores

Objective : *To make extensive and exhaustive collections of Gondwana gymnosperms, study their morphology, make cuticular preparations, establish relationship between morphography and epidermal features, objectively identify each pecies, based on cuticles of extant gymnosperms*

: *To study ultrastructure of in situ pollen / pores for fine resolution taxonomy and affinities*

Through bulk maceration of shales associated with the Nega Seam in the Raniganj Coalfield, some pieces of cuticles were recovered. For investigation under the optical microscope the cuticles were mounted in canada balsam. Surface architecture was examined under the SEM. For TEM studies few pieces of cuticles were fixed in OsO_4 and then dehydrated in a graded ethanol series, ending with changes in 100 per cent ethanol and 100 per cent acetone. After dehydration the cuticles were placed in acetone and Spurr's mixture and rotated. The cuticles were then placed in 100 per cent "Spurr" and rotated, transferred to resin and placed in a vacuum oven. Specimens selected for sectioning were cut from plastic oriented blocks trimmed, cut on an ultramicrotome using a glass knife, collected on copper grids, and stained. The ultrathin sections so prepared were examined under a Phillips TEM and a couple of

preliminary photographs were taken. Same method was also tried for some megaspores.

Hari K. Maheshwari & Usha Bajpai

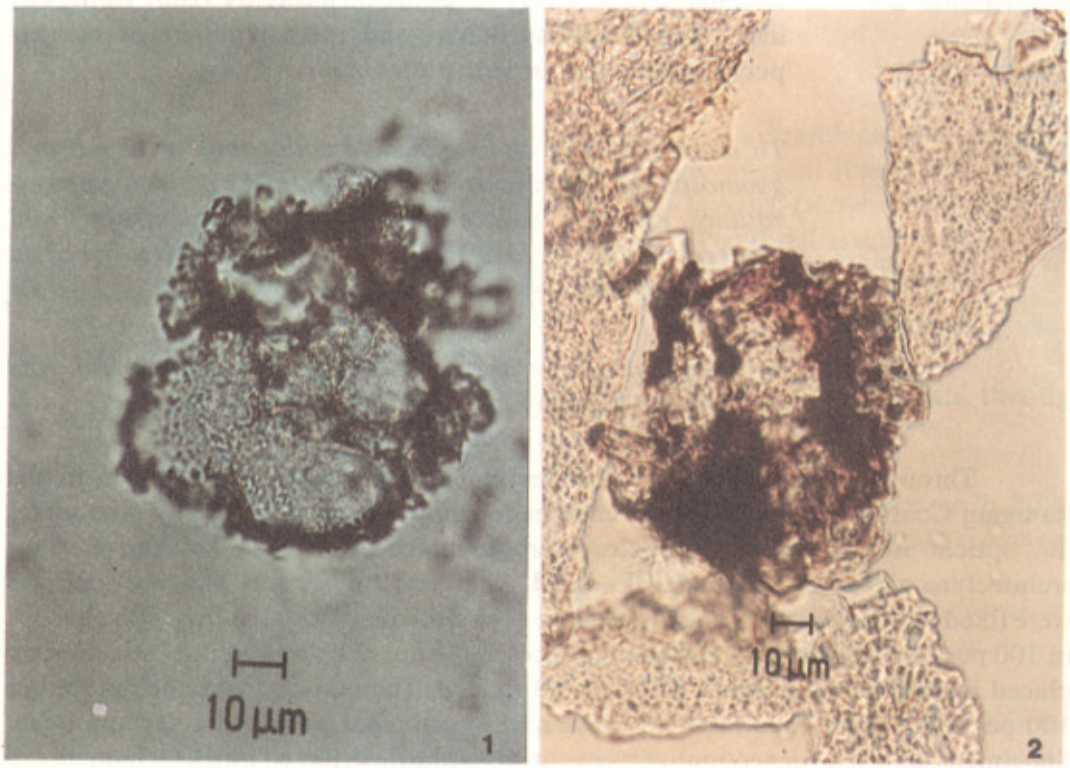
Literature on the plant fossils from the Permian Gondwana of India has been consulted. Plant fossils and samples have been collected from the North and South Karanpura coalfields.

S.M. Singh [BSRS]

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 marker species of spores and pollen and the associated characteristic



Effect of taphonomic factors leading to the distortion of palynomorphs in glacigene environment during Early Permian, Talchir Formation.

biostratigraphic evidences are evaluated to identify palynoevents in Gondwana sequence from peninsular India. In total, ten such palynoevents are recognised.

R.S. Tiwari

The available palynological information about Talchir palynoflora and the geological details of Talchir deposits have been critically reviewed to interpret the impact of existing palaeoclimate on vegetation at the advent of Gondwana sedimentation. The richness of palynoflora, as evidenced from taphonomic studies, has supported the proposition of a relatively more open land for the then growing vegetation and the glaciers were isolated ice-lobes instead of ice-sheets.

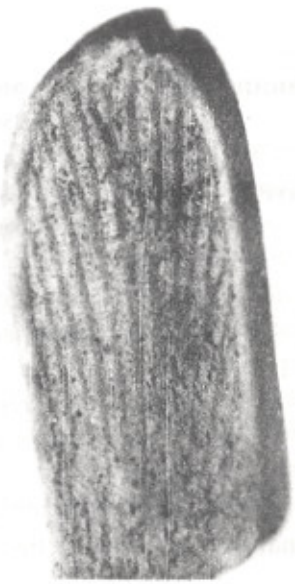
About 50 specimens of a monosaccate pollen *Playfordiaspora* have been studied under light microscope and SEM as well for their detailed morphography. The specimens are sorted out from the samples of bore-holes PGD-2 and RAD-11. Eusaccate nature of saccus has been observed in this monosaccate pollen group; it is a significant character among saccate pollen at P/Tr transition.

Vijaya

Further observations of distinct spore-pollen species and their distribution in bore-hole RPA-2 of Raniganj Coalfield are continued.

K.L. Meena

Programme 2.7 : Composition, relationship and age of the megafossil flora of Rajmahal Formation



Ptilophyllum chilgojuriensis sp. nov. from Rajmahal Formation, Rajmahal Hills, Bihar.

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*

The megafloral assemblage recovered from Chilgojuri locality, Rajmahal Basin, Bihar comprises 10 genera, viz., *Cladophlebis, Ptilophyllum, Dictyozamites, Anomozamites, Williamsonia, Nipaniophyllum, Brachyphyllum, Araucarites, Elatocladus* and a ? fruit. The assemblage shows its similarity with Amarjola flora of Rajmahal Hills.

The cherts of Sonajuri locality have been sectioned and examination of each chert pieces is continued for the preparation of slides and identification of various taxa on the basis of morphological and anatomical features.

Jayasri Banerji

Morphotaxonomic study of the plant megafossil assemblage from Amarjola has been completed. Detailed morphotaxonomic study of plant fossils of Kalkipara locality has been done. The recorded taxa are *Todites indicus, Dictyozamites falcatus, Brachyphyllum rhombicum* and *Araucarites minutus*. The floral assemblage has been compared with the other known plant assemblage of Rajmahal Formation.

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*

Palynological assemblages of Late Permian sediments of Rajmahal Basin have been analysed to observe the marker species identified for the species assemblage-

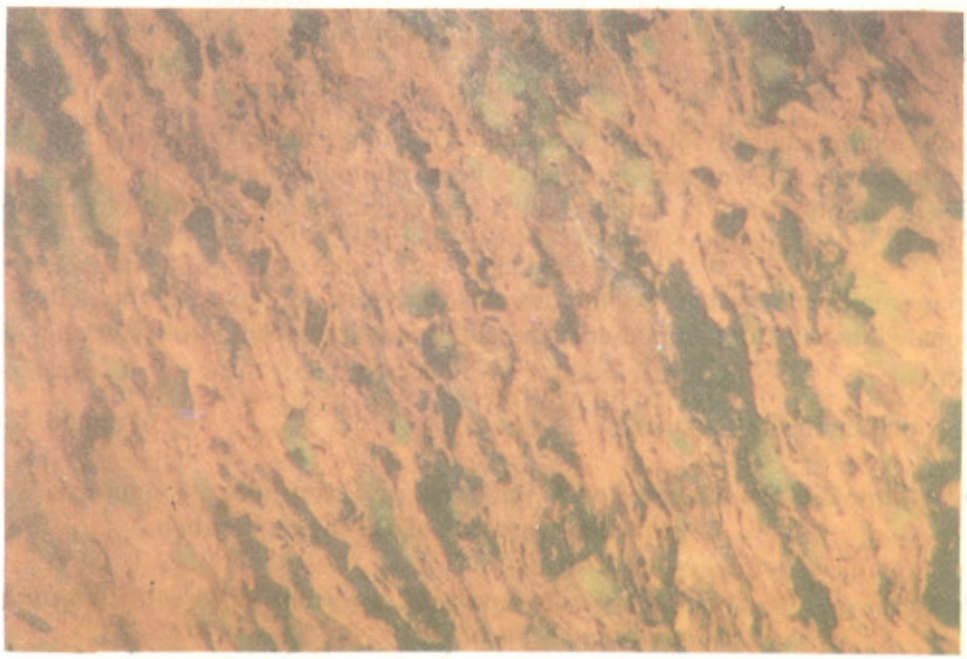
zone by Tiwari and Tripathi (1992). The results reveal that *Densipollenites magnicorpus* Assemblage Zone could be traced in Rajmahal area in its lateral extent.

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*

Reflectance measurements and quantitative assessment of microconstituents of 42 coal samples from two bore-holes (HRC-CM/107 and HRC-CM/109) of the Hura Coalfield have been carried out. The vitrinite reflectance (Ro max. o.40-0.57% in oil) suggests that these coals are of sub-bituminous A to high volatile bituminous C rank. The study under normal incident mode revealed that the coals contain variable proportions of macerals of vitrinite (10-58%) and inertinite (20-55%) groups. Whereas, liptinite macerals are poor in amount (4-10%). The ratio between various reactive and non-reactive contents indicates that the Hura coals are of inferior quality,



Alginite (lamalginite) in complexly layered structure from Jhingurdah seam, Singrauli Coalfield.

as compared to Chuperbhita coals, because of the predominance of mixed (fusovitric + vitrofusic) coal types associated with dispersed inorganic (mineral) matters.

B.D. Singh & B.K. Misra

During a comparative study of coals from Rajmahal (Chuperbhita) and Singrauli (Moher sub-basin) it was observed that 5 to 10 per cent semifusinites (of the total inertinite contents) showed moderate to weak fluorescence intensities with dull reddish-brown todark brown colours. Though fluorescing inertinites of Australian, Canadian and German coals are already known, the present record is the first from India. Fluorescing semifusinite indicates that it may be treated as reactive maceral (reactivity depending upon fluorescence intensity) when assessing coking/ blending potentiality of Gondwana coals.

In addition, presence of another alginite (other than *Botryococcus*) `lamalginite' almost similar to that reported from Australian Permian coals (Taylor *et al.*,1989) and well-preserved seeds (700-1200 microns from Rajmahal coals) in cut-sections were also recorded.

B.K. Misra & B.D. Singh

Programme 2.10 : Palynology of the Gondwana sequence in Satpura Basin

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

Good specimens of spores and pollen from Talchir Formation exposed in Sitarewa River at Mohpani area have been photodocumented, of which radial monosaccate pollen are in dominance. A few cingulate and apiculate trilete spores and striate bisaccates have also been identified.

Employed various techniques for recovery of spores-pollen from the carbonised matrix from Almod area and slides were prepared. Further work is under 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*

Kamthi Formation has been reclassified on the basis of lithological and palynological attributes. Megafloral and faunal records have also been discussed. In its revised form, Kamthi Formation, divisible into two members, represents Early Triassic (= Scythian) overlying the Raniganj equivalent sediments with a gradational contact. Palaeogeographic significance of Late Permian palynoflora of Godavari Graben has been discussed during compilation and interpretation of data on Kamthi Formation, which shows close proximity of Godavari Graben with that of Amery Basin in Prince Charles Mountains in Antarctica.

Compilation of palynodata from Budharam area reveals presence of Talchir, Early and Late Karharbari, Early Barakar, Raniganj and Early Triassic palynofloras in the area.

Processing of samples from bore-holes GSP-9 and GKY-10 was done. Study of 10 samples from bore-hole GKY-1 from Koyagudem area shows the presence of Talchir (253 m), Late Karharbari (206 m) and Barakar (197-13.95 m) palynofloras.

In bore-core MWCK-2, Upper Permian palynoflora has been identified having dominance of striate disaccates and occurrence of younger forms, viz., *Lunatisporites, Falcisporites, Klausipollenites, Chordasporites*, etc.

Suresh C. Srivastava & Neerja Jha

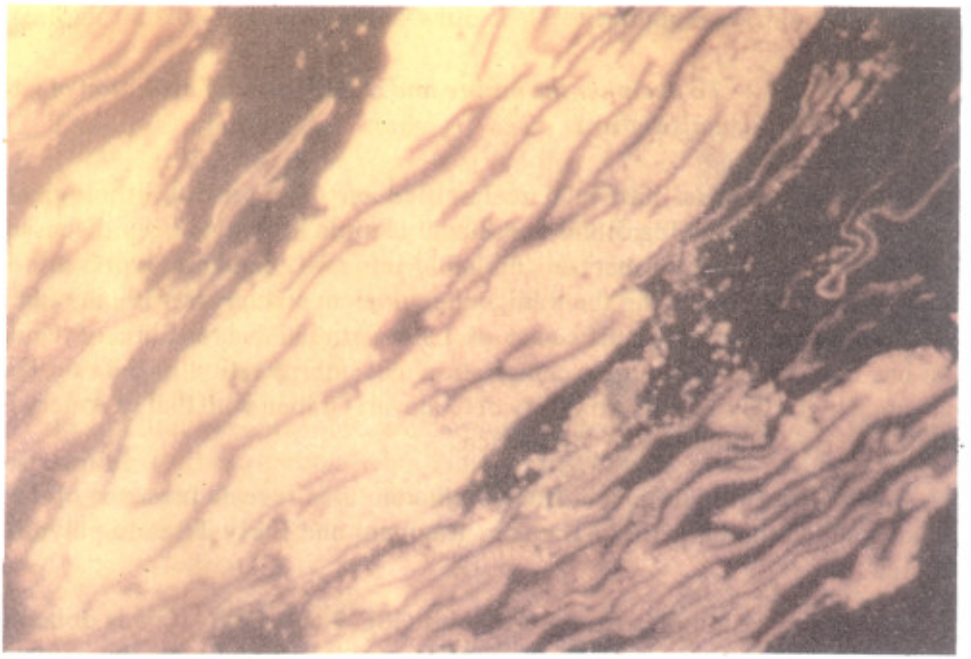
The study of bore-core DGW-6 from Bazargaon area near Nagpur has been finalised; 3 palynoassemblage zones have been marked. At 182 m depth *Falcisporites, Osmundacidites, Lundbladispora*, etc., have been identified. At 236 to 273 m depth *Lunatisporites* assemblage has been described. At 273 to 523 m depth *Striatopodocarpites, Faunipollenites* and *Densipollenites magnicorpus* have been identified. The palynoflora shows Late Permian and Early Triassic affinity.

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*

Microlithotype analysis of 50 coal samples from Ramagundam area was



Sporinite and infilled resinous matter in Early Permian coals from Ramagundam Coalfield, Godavari Basin.

completed. The data processing and finalization of manuscript regarding petrography of Ramagundam and Mulug coals were also finalized. The petrological study of Ramagundam coals revealed that the coals are distinctly divisible into vitric, fusic and mixed (fuso-vitric and vitro-fusic) coal types comprising lesser amount of mineral matter as compared to the coals from other areas of the basin. Qualitative evaluation under fluorescence mode revealed that the coals of the lowermost seam contain well-preserved sporangia, seeds, cuticles and resins. Framboidal pyrite was also frequently recorded.

O.S. Sarate

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

Objective : *To assess coal characterisation in Talcher Coalfield*

The coal micro-constituents were studied from lower and upper seams of Barakar Formation from South Belanda, Ananta and Bharatpur quarries of Talcher Coalfield. Diverse forms of liptinite maceral have been observed and photomicrographed under blue-light excitation in fluorescence mode. Well-preserved seeds (up to 2000 microns) were reported for the first time from Indian Lower Gondwana coals in cut-sections under reflected light. In addition, various forms of sporangia, megaspores,

microspores, resins and algal matter have also been observed. It indicates that the coals are autochthonous in nature.

Anand Prakash, Rakesh Saxena & Jyotsana Rai

Programme 2.14 : Palynostratigraphy of recently explored subsurface Gondwana sequence in Tamil Nadu and Pondicherry

Objective : *To establish palynological succession in the subsurface Gondwanasediments, their palynodating and correlation*

Preliminary palynological analysis of recently explored subsurface coal-bearing sediments of bore-holes TC-1 (184 m) and TC-2 (178 m) in Kandmanglam Marakkanam area, Tamil Nadu has been done. The qualitative analysis of the assemblage reveals the presence of *Cyathidites, Cicatricosisporites, Appendicisporites, Densoisporites, Matonisporites, Dictyophyllidites, Lycopodiumsporites, Dandotiaspora, Klukisporites, Aequitriradites, Balmeisporites, Microcachryidites, Podocarpidites* and *Callialasporites*. The assemblage is dominated by pteridophytic spores. The gymnosperm pollen are very rare. The overall composition of palynoassemblage reveals a late Early Cretaceous age.

R.S. Tiwari, Archana Tripathi & Vijaya

Programme 2.15 : Palynostratigraphy of Gondwana Sequence in Tatapani-Ramkola Coalfield, Madhya Pradesh (New Programme commencing from 8.3.1994)

Objective : *To develop lithostratigraphic set up from various surface and subsurface sequences*

: *To reconstruct standard palynological succession, age determination and correlation with special reference to coal-bearing horizons*

: *To recognise range of stratigraphically significant taxa and evolutionary trends of various palynofloras*

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

: *To document phytogeographic and palaeoenvironmental events*

Literature pertaining to the relevant subject was consulted with special

emphasis on the coaliferous Gondwana basins of the Son-Mahanadi Valley. Geological maps and toposheets of the Tatapani-Ramkola Coalfield were studied in detail for field excursion.

Chemical processing of samples from Ledho Nala, Tatapani Ramkola Coalfield (old collections present in the Museum) was undertaken. Slides were prepared from productive samples and scanned. The palynoflora is dominant in striate bisaccate pollen grains and reflects Late Permian affinity. Detailed study is continued. Permanent slides of Talchir, Karharbari and Barakar palynoassemblages from other localities were also examined.

Suresh C. Srivastava & Ratan Kar [BSRS]

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*

About 50 thin sections of silicified woods from the Nawargaon area were studied. They have been identified with the woods of the genera belonging to Flacourtiaceae, Hernandiaceae, Simaroubaceae, Burseraceae, Anacardiaceae, Tiliaceae, Meliaceae, Sapindaceae and Euphorbiaceae.

N. Awasthi

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 in detail from different Neogene localities of Rajasthan and Gujarat. Genera representing the following families have been identified : Fabaceae *(Cynometra, Dialium, Tessmannia)*, Dipterocarpaceae *(Dipterocarpus)*, Ebenaceae *(Diospyros)*, Sonneratiaceae *(Duabanga)*, Combretaceae *(Terminalia)* and Myrtaceae *(Syzygium)*. In addition, fossil leaves of *Terminalia, Syzygium* and a dicot flower have also been identified from the Eocene sediments of western India.

A fossil leaf resembling an evergreeen plant *Terminalia coriacea* from Rajpardi lignite (Eocone) of Gujarat.

Manuscripts on : (i) occurrence of Dipterocarpaceae in the Late Tertiary sediments of Bikaner, Rajasthan, (ii) occurrence of *Chlorophora excelsa*, an African member of family Moraceae in the Neogene of western India, and (iii) antiquity of some common plants in India, have been finalized.

J.S. Guleria

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

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

: *To deduce palaeoenvironment*

Morphotaxonomic studies on palynofloras recorded from well section (MK 213, MK 207 and MJ 104) samples, drilled near Kapurdi and Jalipa, Barmer District were completed. Frequency distribution of stratigraphically significant palynotaxa in these well sections was also studied. Samples representing Well MK 207 exhibit rich representation of angiosperm pollen like *Tricolporopollis, Proxapertites, Assamialetes, Kielmeyerapollenites* and *Matanomadhiasulcites*. Pteridophytic spores, *Dandotiaspora* and *Scantigranulites* dominate in the middle part of this well section. It is observed that 80-90m and 110-115m depths in wells MK 207 and MK 213 respectively are marked by very high frequencies of dinoflagellate cysts. This indicates a marine transgression in this area during deposition of sediments. Palynofloras recorded from the studied well sections are similar to those described from Palaeocene-Eocene sediments of Kutch (Gujarat) and Barmer (Rajasthan).

S.K.M. Tripathi

Programme 3.4 : Neogene plant megafossils of West Coast

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

About 50 carbonised woods from Payangadi, Varkala and Kundara, Kerala Coast were sectioned and 25 blocks prepared for anatomical study. Out of them, some woods seem to be new to the area and show resemblance with *Chukrassia* (Meliaceae), *Diospyros* (Ebenaceae), *Homalium* (Flacourtiaceae), ?*Dipterocarpus* (Dipterocarpaceae) and two types of fabaceous genera, one having banded parenchyma and the other possessing aliform parenchyma.

Rashmi Srivastava

Programme 3.5 : Palynological investigation of the Tertiary sediments of Kerala Basin with reference to their biostratigraphy, palaeo-ecology 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 Padappakara and Varkala sediments have been completed. The palynoflora consists of 35 genera and 50 species belonging to pteridophytic spores and angiospermous pollen. Angiosperm pollen register dominance over pteridophytic spores. A manuscript dealing with morphotaxonomy of spore-pollen from the area and data interpretation has been finalized.

Morphotaxonomy of spore-pollen, palaeoenvironmental interpretations and age determination of Cannanore lignite and associated sediments, Kerala Basin have been completed and documented.

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*

Sixty one carbonised woods collected from Neyveli Lignitefield were investigated. Most of them are duplicate specimens of already known species. Identification of two previously studied woods with more anatomical features was done. These are *Euphorioxylon deccanense* of Sapindaceae and *Sonneratioxylon preapetalum* of Sonneratiaceae.

Anil Agarwal

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

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

: *To find out relationship of the Neyveli Formation with other lignite-bearing formations, 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, photodocumentation and interpretation of the palynoflora obtained from the Neyveli Formation of Neyveli Mine-I have been completed. Morphotaxonomic study of palynoflora from the Neyveli Formation of the Neyveli Mine-II has also been completed.

R.K. Saxena

Programme 3.8 : Organic petrological study of Rajasthan lignites

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

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

The study of lignite constituents from Kapurdi area under blue light excitation (fluorescence mode) has been carried out. Well-preserved liptinite material has been observed and photomicrographed. It indicates that the lignite has formed by the accumulation of vegetal matter growing in and around the basin of deposition under autochthonous condition.

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*

Quantitative estimation of fluorescing macerals on 55 particulate pellets of lignite samples from new mine section (20 from top seam and 35 from bottom seam) and 12 samples from bottom seam of old mine section was carried out under blue light excitation (fluorescence mode). The study revealed that samples of new mine section contain high proportions of fluorescing (16-72%) and non-fluorescing (20-77%) huminite followed by liptinite (6-33%) and inertinite (0.2-4%) macerals. The resinite content ranges between 0.2-21 per cent. Alginite, though commonly present throughout the seam section, is generally recorded in low frequency (up to 1%), but in one sample its content is as high as 5 per cent.

The proportion of fluorescing huminite is comparatively low (7-47%) in bottom seam of old mine section. Alginite (*Botryococcus*) is also present but not in recordableamount.

B.K. Misra & Alpana Singh

Programme 3.10 : Palynostratigraphy of the Tertiary sediments of Gujarat

Objective : *To correlate the Tertiary formations of Kutch with Bharauch and adjacent areas*

: *To decipher the palaeoecological condition of deposition*

: *To compare the fossil pollen with the living ones*

Processed 39 samples from the Matanomadh Formation, out of which 20 samples proved to be productive. Morphotaxonomic study revealed the presence of characteristicforms like *Dandotiaspora dilata, D. telonata, Proxapertites cursus, Triporopollenites kutchensis*, etc.

Eleven samples, out of 24, from Naredi Formation yielded well-preserved palynofossils.

J.P. Mandal

Palynological analysis of the samples collected from Rajpardi lignite (Tarkeshwar Formation – Eocene) of Bharauch District shows diverse and well-preserved palynotaxa of spores, pollen grains and fungal fruiting bodies. The overall assemblage is dominated by angiospermic pollen followed by pteridophytic spores. The gymnospermous pollen are completely absent. The important palynotaxa are : *Polypodiaceaesporites, Todisporites, Cyathidites, Arecipites, Matanomadhiasulcites, Palmidites, Retimonosulcites, Thymelipollis, Lakiapollis, Pellicieroipollis, Retipollenites, Tricolpites, Angulocolporites, Tricolporopilites*, etc. which are similar to those recorded earlier from the Eocene sediments of Kutch.

Madhav Kumar

Approximately 100 samples collected from Bet Dwarka, Gopi, Kuranga, Bhatia from Saurashtra were chemically processed; but none of them yielded any palynological fossil.

B.D. Mandaokar

Thirty seven surface samples (20 from Karjan Nala and 17 from Ghala Nala) of Late Eocene age from Bodhan Formation around Tarkeshwar District, Surat were macerated. All of them turned barren.

G.K. Trivedi

Programme 3.11 : Palynological investigation of the Tertiary formations of Rajasthan (other than Kapurdi area)

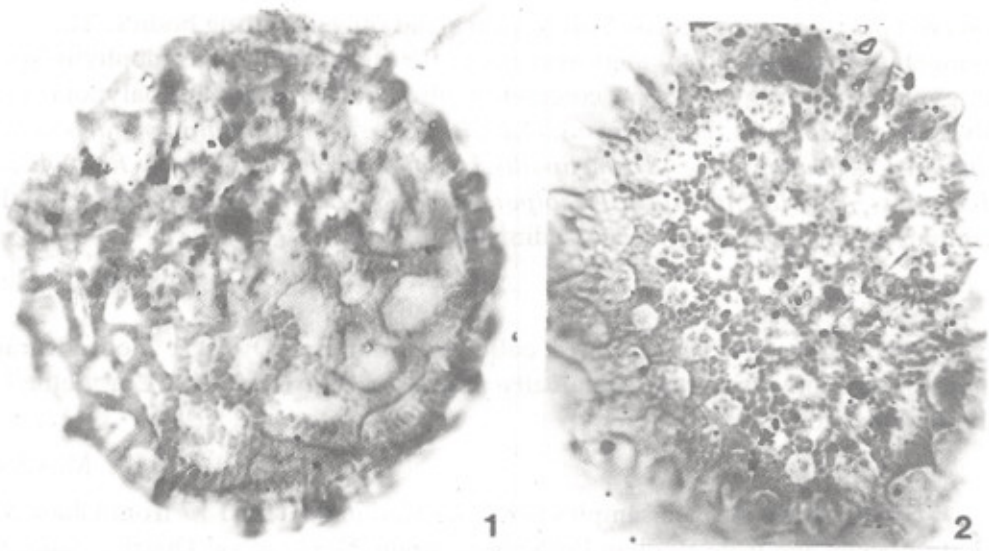
Objective : *To build up the palynostratigraphy of different Tertiary formations*

: *To correlate the different Tertiary formations of Rajasthan with Gujarat*

: *To infer palaeoecological condition of deposition*

Samples collected from three bore-hole cores drilled by the MECL in Ranjit Purwa, Kuchaur and Benia of Bikaner District were macerated. Important palynological taxa obtained are : *Cyathidites minor, Todisporites flavatus, Dandotiaspora plicata, Osmundacidites kutchensis, Lygodiumsporites lakiensis, Arecipites bellus, Palmaepollenites kutchensis, Matanomadhiasulcites baculatus, Umbelliferoipollenites ovatus, Margocolporites tsukadai, Lakiapollis ovatus, Retitribrevicolporites matanomadhensis, Pellicieroipollis langenheimii, Meliapollis ramanujamii, Striacolporites striatus* and *Dermatobrevicolporites dermatus*. On the basis of spores and pollen grains, an Early Eocene age is ascribed to the assemblage.

R.K. Kar



Polycolpate pollen resembling pollen of modern *Ocimum* from Early Eocene of Rajasthan.

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*

Photodocumentation and taxonomic identification of Lower Palaeocene dinoflagellate cysts from Therriaghat area have been carried out. Phytoplankton productive levels through the sequence have been identified.

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

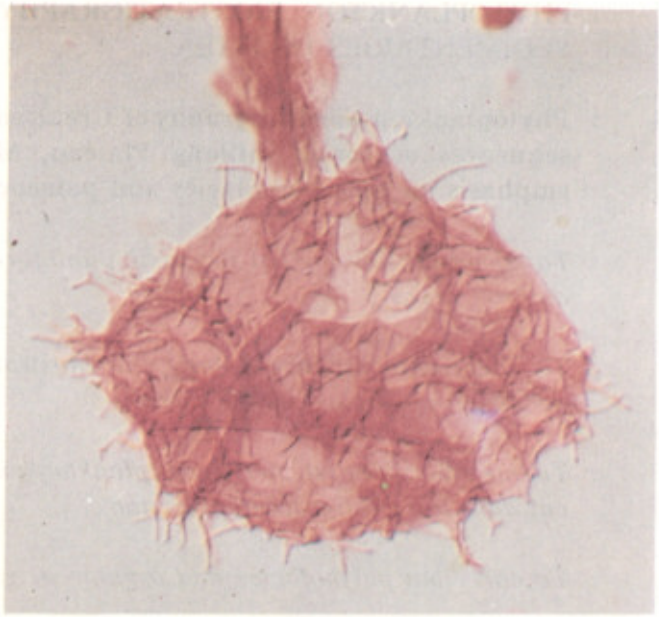
Dinoflagellate cysts are recovered from Lakadong Sandstone exposed at the head of the Nongpriang Valley, Cherrapunji area. Occurrence of a rich suite of marker *Apectodinium* species indicates uppermost Thanetian age.

Rahul Garg

A manuscript on Late Maastrichtian calcareous nannoplankton documented from Umshoryngkew section has been finalized. Charts and figures of a poster paper on dinoflagellate cysts and calcareous nannoplankton recovered across K/T boundary event at Umshoryngkew were finalized for presentation at the International DINO5 Conference, The Netherlands.

Rahul Garg & K.P. Jain

Photodocumentation and detailed taxonomic study of some characteristic dinoflagellate cysts recovered from ca 1.5 m above the K/T boundary at Umshoryngkew section have been carried out. These ellipsoidal to fusiform proximochorate cysts are



Dinoflagellate cyst *Apectodinium* from the Late Palaeocene of Meghalaya.

considered to belong to a new genus comparable with the Danian marker dinoflagellate cyst *Kenleyia*.

Rahul Garg & Khowaja-Ateequzzaman

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 and document plankton-rich levels*

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

: *To attempt palaeoceanography modelling*

Well cutting samples representing 1232-2208 m depth interval of bore-hole MON-4, Mahanadi Basin were chemically processed and the slides were thoroughly scanned for dinoflagellate cysts.

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

Photomicrography of dinoflagellate cyst taxa recovered from the outcrop sections of Trichinopoly Formation exposed in Tappy, Chittali, Kunnam, Annapadi and Kullakanatham areas has been completed and final plates for the paper on dinoflagellate cyst biostratigraphy of Trichinopoly Formation are being prepared.

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

Some interesting proximate dinoflagellate cysts characterised in having autocyst without horns and with intercalary archaeopyle, type 31 are recovered from calcareous sandstones from a dugwell near Kunnam, Trichinopoly Formation, Cauvery Basin. These cysts are described under a new genus *Jainiella*. Genus *Trivalvadinium* Islam 1983 has been emended and *T. plenum* Islam 1983 is transfered to the new genus. A manuscript has been finalized for publication.

Khowaja-Ateequzzaman & Rahul Garg

Charts and figures of a poster paper on dinoflagellate cyst biostratigraphy and palaeoenvironment of Trichinopoly Formation and Albian-Turonian bioevents were finalized for presentation at the International DINO5 Conference.

Khowaja-Ateequzzaman

Programme 4.3 : 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*

A map showing the collection localities and the islands, earlier yielding calcareous nannofossils of Neogene, was finalized. Samples were prepared from selected islands of Archipelago group. Lithologs showing sampling points were

finalized from Car-Nicobar Island. Late Miocene samples of Car-Nicobar Islands lacking dark ceratoliths and yielding a variety of birefringent ceratoliths, appearing for the first time is an important find.

S.A. Jafar

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*

Rock samples collected from Anderson and Interview Islands have been found to be rich in diatoms and silicoflagellates in addition to the presence of sponge spicules. The diatom assemblage is represented by various species of *Coscinodiscus, Actinocyclus, Thalassiosira, Actinoptychus, Paralia, Aulacodiscus, Hemidiscus, Arachnoidiscus, Triceratium, Asterolampra, Stictodiscus, Asteromphalus, Azpeitia, Gephyria, Mastogloia, Grammatophora, Campyloneis, Navicula, Diploneis, Nitzschia, Cocconeis* and *Isthimia. Dictyocha, Distephanus, Mesocena* and *Naviculopsis* form the silicoflagellate group in the assemblage. Diatoms and silicoflagellates indicating a Miocene age are reported for the first time from these Islands. Three types of sponge spicules, viz., Tylostyle, Strongyle and Triod are recorded. Samples from Mask and Bennet Islands have been found barren.

EDX (Energy Dispersive X-ray micro-analysis) of both cleaned diatoms and diatom-bearing rock chips of two samples each of Interview and Anderson Islands was done at Chandigarh. EDX was also done of matrix and infillings. EDX computer printouts and SEM photographs of these specimens were prepared.

Anil Chandra

Programme 4.5 : Palaeogene-Neogene phytoplankton biostratigraphy and palaeoceanographic set up of Kutch and Saurashtra basins, India (New Programme commencing from 1.3.1994)

Objective : *To study dinoflagellate cyst morphology and biostratigraphy and to document phytoplankton rich levels*

: *To integrate dinoflagellate cyst, calcareous nannoplankton and palaeontological data for stratigraphic precision*

: *To document palaeoenvironmental events*

Literature on Tertiary geology of Kutch Basin was consulted and reference cards are being prepared.

K.K. Pandey [BSRS]

PROJECT 5 : PALAEOFLORISTIC DIVERSIFICATION IN THE HIMALAYA

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

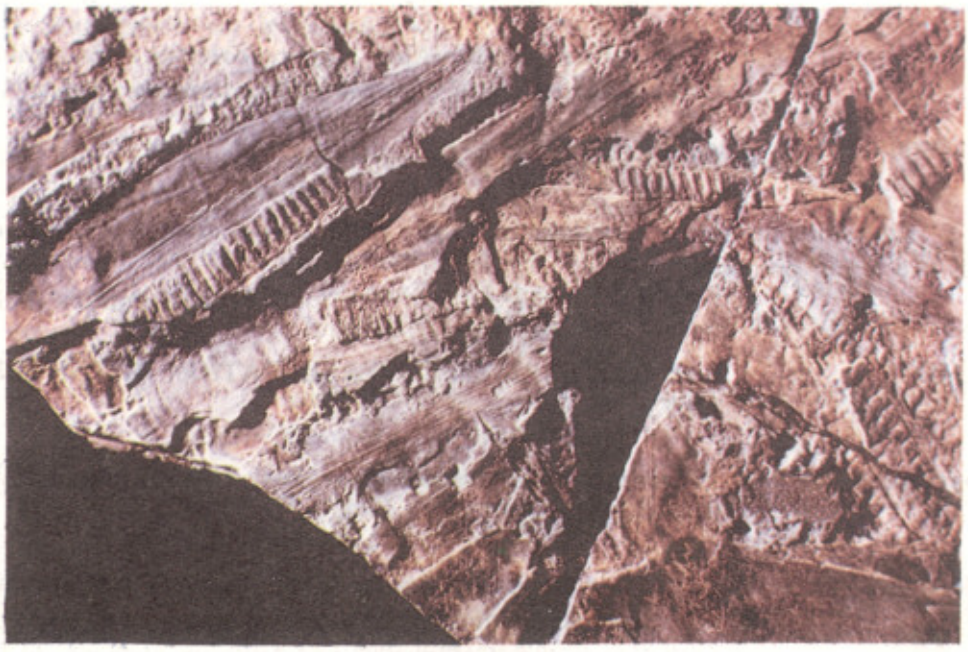
Objective : *To study collections of plant fossils from the Perigondwana stratigraphical sequences, their identification and comparison with Gondwana, Cathaysian and Angaran elements to trace their origin*

The paper "Kshir Sagar, Tethys and the Perigondwana - Late Palaeozoic evolutionary history of the northern margin of the Gondwana Supercontinent", read at the International Himalayan Geology Seminar, was finalized and submitted. The paper deals in particular with the Kashmir Region, and illustrates Late Palaeozoic lithological and biotic changes related to different orogenies of the eastern and western Tethys. The region also provides evidences to decipher palaeogeographic changes on the northern margin of the Gondwana Supercontinent due to epeirogeny, caused by the mobility of magma and extrusive volcanism. The Tethyan Himalayan belt reveals many tectonic pulsations, apparently without structural deformations, break in sedimentation and environmental changes.

The floral elements that show some Cathaysian affinity may have developed either due homoplasy/parallel evolution, or, may be the sea to the north of the Gondwana Supercontinent in the region was dotted with a series of ephimeral islands that provided a pathway for movement of the Cathaysian elements to the northern region of the Gondwana Supercontinent.

[H.M. Kapoor], Hari K. Maheshwari & Usha Bajpai

Sterile fronds of probable marattialean fern, so far described in the genus *Rajahia*, have been recorded from the Dunpathri Member of the Mamal Formation.



A new taxon of marattilean fern from the Mamal Formation of Kashmir.

The fertile fronds of this taxon have now been identified and found to be different from that of *Rajahia*. These have been placed under a new genus, viz., *Kashmiria*. Two species have been identified, viz., *K. falcata* sp. nov. and *K. mamalensis* (Singh, Maithy & Bose) comb. nov.

Hari K. Maheshwari, [H.M. Kapoor] & Usha Bajpai

The paper "Late Palaeozoic plant-geography of the Perigondwana and evolution of the Kashmir Basin" was finalized. A typical Gondwana flora comprising species of the genera *Trizygia, Glossopteris, Vertebraria*, etc. is known from the Kashmir Basin. At certain levels, however, the flora contains some exotic elements, such as, *Lobatannularia, Sphenophyllum, Kashmiropteris* (*Protoblechnum/Comsopteris*). All these elements are important constituents of the Cathaysian Flora. In southern Xizang, too, a plant-bearing bed contains elements of both the Gondwana and Cathaysian floras.

Kashmir region, thus, seems to have been connected with parts of China as well as with the Indian peninsula. But did these areas form a continuous land-mass – the Greater India – extending up to the southern margin of the Kun Lun Fold Belt? The available evidence negates the idea! If, there were land continuity at any point of time in the region, the intermixing of the Gondwana and Cathaysian elements would

have been on a comparatively more uniform pattern. The view that the Kshir Sagar (Gondwana Tethys) was dotted with a series of ephemeral islands seems to be plausible.

Usha Bajpai & Hari K. Maheshwari

A paper "Late Palaeozoic floral succession in the Perigondwana" was prepared. Plant mega- and palyno-fossils of Late Palaeozoic age are most known from the Salt Range, Spiti, Kashmir, Xizang and Arunachal Pradesh. The oldest plant fossils known from the area probably belong to the Late Devonian age. The Early Carboniferous had a Rhacopteris-Lepidodendropsis Flora. The flora which is known only from Spiti and Kashmir is presumed to have had a cosmopolitan look. A comparatively younger palynoassemblage has been recorded from Spiti.

No flora of Late Carboniferous age is known from the region. The succeeding Early Permian flora having basically Gondwanan composition is known from the Salt Range, Kashmir and southern Xizang. Certain levels in Kashmir and Xizang also contain a few elements of Cathaysian affinity. Palynoassemblages of Late Permian age are known from the Salt Range and Kumaon. Late Permian plant megafossils are, however, known from South Sikkim, Darjeeling and Arunachal Pradesh, and have a typical Gondwanan aspect.

Usha Bajpai, [H.M. Kapoor] & Hari K. Maheshwari

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)*

About 135 rock samples collected from Spiti area have been chemically processed for palynological studies. The study of productive samples is continued. The spores and pollen are fairly well preserved in certain samples but in most of the samples they are dark brown to black.

Search for spore-pollen has been made in the spore-bearing 25 samples of Niti area. Further work is under progress.

R.S. Tiwari, Vijaya & Ram-Awatar

Morphotaxonomic study of the spores and pollen, recovered from the Niti Pass section and Rawly Bagar Section in Niti area, Tethys Himalaya has been done. The totality of the palynocomposition in this Permian and Triassic sequence reveals close similarity with the palynoflora of peninsular India of the respective age, and also contain few northern elements, viz., *Cordaitina, Klausipollenites, Falcisporites*, etc.

The qualitative assessment of palynoassemblage recovered from Upper Lapthal section, Jurassic Sequence in Niti area indicates the dominance of genus *Callialasporites*. The other significant palynotaxa found to be present are *Kraeuselisporites, Podosporites, Podocarpidites, Alisporites*, etc.

R.S. Tiwari, Vijaya, [V.D. Mamgain & R.S. Misra]

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 palaeo-environment during the deposition of the Permian sediments in Siang District*

Three palynoassemblages have been recorded from Bomte to Tatamari in West Siang District, Arunachal Pradesh. Talchir assemblage consisting of *Callumispora-Plicatipollenites*, Karharbari assemblage consisting of *Parasaccites-Indotriradites* and Barakar assemblage with dominance of *Rhizomaspora-Primuspollenites* along with *Scheuringipollenites* have been reported.

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*

Palynostratigraphical study of the Early Tertiary sediments of Kalakot and adjoining areas of Jammu was carried out. The assemblage recovered from the Eocene sediments of Kalakot area contains a total of 30 genera and 42 species and includes variety of dinocysts, spores, pollen, fungal and algal remains. Various

productive horizons have been located from Metka, Mehgola and Tattapani areas.

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*

Processing of Kargil Molasse samples from Yogma area of Ladakh has been completed. All the samples proved to be barren.

R.K. Saxena & 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 Himalaya*

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

Morphotaxonomic study of leaf-impressions collected from the Siwalik sediments of Arjun Khola, Surai Khola and Rehar, western Nepal has been carried out. The work on leaf-impressions and few fruits and seeds from Surai Khola sequence has been finalized. Photodocumentation of all the identified leaf-impressions and fruits from Arjun Khola Siwaliks belonging to about 60 species has been completed.

Six species of leaf-impressions from Siwalik sediments of Rehar, Mahendra Raj Marg have been identified and assigned to the genera *Lagerstroemia, Diospyros, Albizia, Millettia, Terminalia* and *Randia* of the family Lythraceae, Ebenaceae, Fabaceae, Combretaceae and Rubiaceae, respectively.

N. Awasthi & Mahesh Prasad

About 30 fossil woods collected from Siwalik sediments of Kalagarh, Uttar Pradesh were sectioned and studied. Investigation on the leaf-impressions collected from Siwalik sediments of Hardwar, Kathgodam and Koilabas was carried out.

A leaf-impression, resembling modern *Caningia odorata*, from Siwaliks of Koilabas, Nepal.

Identification of some more leaf-impressions from Kathgodam area has been done and assigned to the new taxa *Hopea macrantha, Geijera parviflora, Chukrassia tabularis, Dysoxylum klanderi, Millettia ovalifolia, Pongamia pinnata, Machilus odoratissima, Diospyros ebenum* and *Phyllanthus gracilis* of dicotyledonous families. An analysis of physiognomic characters of the leaf-impressions has also been carried out.

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

A rich palynoflora mainly consisting of algal zygospores, fungal spores and microthyriaceous ascostromata, pteridophytic spores, gymnospermous and

angiospermous pollen has been recovered from the Siwalik sediments exposed in the Arjun Khola area of western Nepal. Significant elements of the palynoflora have been compared to those of the extant members of Zygnemataceae, Microthyriaceae, Cyatheaceae, Schizaeaceae, Polypodiaceae, Parkeriaceae, Lycopodiaceae, Pinaceae, Poaceae, Asteraceae, Malvaceae, Typhaceae, Nymphaeaceae and Leguminosae. Recorded palynotaxa indicate the prevalence of a warm humid climate during the deposition of Siwalik sediments in this area. The palynofloral assemblage resembles those known from the Surai Khola area of Nepal both in terms of stratigraphic position and palynological composition.

A well-preserved Eocene palynoflora has been recorded from Bhaisakati Formation near Kelabari area of western Nepal. This is the first record of Eocene palynoflora from Nepal Himalaya. A palynofloral assemblage, rich in angiospermous pollen and pteridophytic spores, has been recovered from the peat samples of Sitalpur.

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, Meghalaya and Arunachal Pradesh*

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

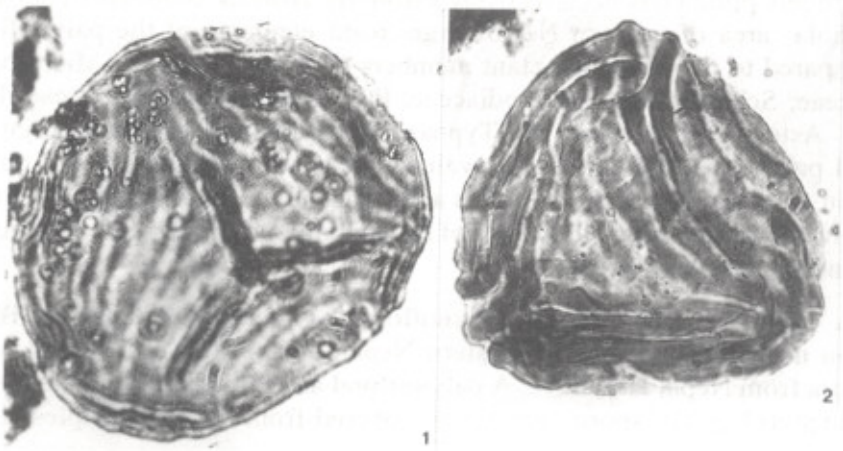
A large number of impressions of leaves, fruits and seeds, collected from Makum Coalfield, were studied. A preliminary examination revealed the presence of about 25 new taxa. Their identification is in progress.

A fossil male cone found in association with monocotyledonous leaflets, collected from Ledo-Tirap Colliery, was studied in detail. It shows close resemblance with that of *Nypa* of Arecaceae, which provides further evidence that the Makum coals were deposited in the coastal environment.

Besides, a fossil wood collected from the Tertiary of Tripura was studied in detail and identified as *Cynometra* of Fabaceae. Besides, a manuscript entitled, "Status of gymnosperms in the Tertiary flora of India" was finalized.

N. Awasthi & R.C. Mehrotra

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



Fossil *Ceratopteris* spores from the Miocene sediments of Tripura.

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

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

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

Samples collected from Pecharthal area, Tripura were palynologically investigated. The assemblage comprises 40 dispersed genera and 58 species. The common taxa are *Dictyophyllidites dulcis, Lygodiumsporites lakiensis, Dandotiaspora plicata, Striatriletes susannae, S. multicostatus, Azolla aglochidia, Polypodiaceaesporites tertiarus, Pilamonoletes excellensus, Pinuspollenites crestus, Podocarpidites cognatus*, etc. The assemblage is dominated by pteridophytic spores, followed by angiospermic and gymnospermous pollen. Some fungal spores are also occasionally met with. The assemblage is placed under *Striatriletes susannae* Cenozone for the subsurface sediments around Gojalia, Rokhia and Baramura.

Pteridophytic spores recovered from various Tertiary sediments of India were assessed. It was observed that the reticulate type of *Lycopodium* spores were most prevalent in Palaeocene than pitted foveolate types. *Lycopodiumsporites* and *Dandotiaspora* were the two most dominant genera during Palaeocene in India. *Osmunda* spores represented by *Osmundacidites* were never very prominent but exhibit their maximum development during Middle-Late Eocene. *Ceratopteris* spores

have the oldest record and thus it seems that this genus originated in India. Polypodiaceous and other monolete spores (commonly *Polypodiaceaesporites* and *Seniasporites*) are encountered throughout the Tertiary but were prominent in Oligocene and Early Miocene.

R.K. Kar

Twenty samples from Bapung, Mukshay, Thangskai and Wailyncott of Meghalaya were macerated and slides prepared from these regions were studied. The genera that could be identified are : *Dandotiaspora, Lycopodiumsporites, Lygodium-sporites, Cyathidites, Polypodiaceaesporites, Kielmeyerapollenites, Lakiapollis, Retitribrevicolporites, Tricolpites, Spinizonocolpites,* etc.

M. Nanda [BSRS] & R.K. Kar

Thirty samples collected from Bhalu Kurung, Meghalaya were chemically processed. Out of these, 21 samples yielded spores and pollen grains. The slides were scanned and important palynotaxa photographed. The following species could be identified : *Lycopodiumsporites speciosus, Dandotiaspora telonata, D. plicata, Matanomadhiasulcites maximus, Tripilaorites triangulus, Kielmeyerapollenites syncolporatus* and *Spinizonocolpites echinatus*. The assemblage indicates a Late Palaeocene age for the sediments.

R.K. Kar & M. Chakraborty [J.T.O.]

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*

Samples from 3 coal seams in Selsella, Rekmangeri District, Garo Hills were macerated and important taxa were recovered. Among the pteridophytic genera *Dandotiaspora* and *Lycopodiumsporites* in association with *Dictyophyllidites* were dominant. In angiospermous genera, the dicotyledonous pollen, viz., *Kielmeyerapollenites, Margocolporites, Retitricolporites, Droseridites, Psilastephano-colporites, Retitribrev icolporites, Palaeocaesalpinaceaepites, Tricolpites* and *Matanomadhiasulcites* are followed by the monocotyledonous group of pollen such as *Palmidites, Proxapertites*

as well as *Spinizonocolpites*. Occurrence of *Laricoidites* and *Apectodinium* along with other dicotyledonous taxa such as *Kielmeyerapollenites* and *Psilastephanocolpites* is noteworthy in the top seam of Selsella coal mine. The assemblage recovered from three seams (Lower, Middle and Upper) are compared with other known Palaeocene-Lower Eocene formations of India.

K. Ambwani

Programme 6.4 : Palynological investigation of the Tertiary sedimentsof 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*

Palynological investigation of different sections exposed along Haflong-Silchar Road was carried out. The palynotaxa mostly comprise *Striatriletes susannae, S. microverrucosus, Tricolporopilites robustus* and *Pellicieroipollis langenheimii*. The assemblage was not diversified and different degrees of thermal alteration of the spores and pollen grains were observed.

J.P. Mandal

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

Objective : *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*

Detailed documentation of palynoflora recovered from the Baghmara Formation, exposed along Baghmara-Siju Road Section, Garo Hills was done. The assemblage is dominated by pteridophytic spores, amongst which *Striatriletes* and *Polypodiaceaesporites* contribute the bulk of the assemblage. Gymnospermic pollen

are sporadically represented by species of *Podocarpidites, Pinuspollenites, Piceapollenites, Abiespollenites* and *Araucariacites*. Angiospermic pollen come next to pteridophytes in order of dominance and are represented by species of *Tricolpites, Bombacacidites, Retistephanocolpites, Pellicieroipollis, Compositoipollenites, Meliapollis*, etc. Fungal spores are recorded by *Parmathyrites, Phragmothyrites, Monoporites*, etc. Reworked forms of Palaeozoic are frequent in occurrence. The assemblage recorded here compares with the Barail assemblages of Assam and Meghalaya.

Based on the palynofloral evidence it is inferred that the area had mainly tropical-subtropical climate during its deposition. The occurrence of gymnospermous pollen, particularly of pinaceous affinity, indicates presence of upland in nearby area. Records of palm pollen alongwith dinoflagellate cysts reflects coastal marine environment of deposition. Reworked palynofossils in the sediments may be due to the emerging of Gondwana sediments during the evolution of Himalaya and then erosion and subsequent deposition along with the sediments of Baghmara Formation.

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*

Palynological analysis of Maibong road section and Lumding-Haflong road section was completed. The spore-pollen assemblage contains species of *Phragmothyrites, Dictyophyllidites, Polypodiisporites, Podocarpidites, Pinuspollenites, Tricolporopollis, Striatriletes, Polyadopollenites*, etc., with some recycled Palaeozoic saccate pollen grains. Amongst the pteridophytic spores *Striatriletes* complex is dominant and resembles spores of aquatic fern, *Ceratopteris* Borgn. Amongst angiospermic pollen *Tricolporopollis rubra* is dominant. The palynofossil assemblage and its relationship with other similar known assemblages indicate subtropical humid conditions 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*

Palynofossils recovered from Dilli area, Tikak Parbat Formation (Oligocene) were studied. The assemblage consists of 41 genera and 60 species. Pteridophytic spores and angiospermic pollen are well represented. The common genera are : *Lygodiumsporites, Osmundacidites, Polypodiisporites, Crassoretitriletes, Polypodiaceaesporites, Schizaeoisporites, Striatriletes, Polyadopollenites, Meyeripollis, Bombacacidites, Lakiapollis* and *Compositoipollenites*. The assemblage indicates that the sediments were deposited in fresh water swamp in a tropical-subtropical climate.

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*

Slides already prepared from Kopili Formation were studied. Pteridophytic genera like *Striatriletes, Polypodiaceaesporites* and *Polypodiisporites* are in dominance. The angiospermic and other pteridophytic genera present are *Cyathidites, Lygodiumsporites, Biretisporites, Dictyophyllidites, Tricolpites, Densiverrupollenites, Retitribrevicolporites*, etc. *Notothyrites, Phragmothyrites* and *Frasnacritetrus* are well represented fungal components. Algae are represented by dinoflagellate cysts. Reworked Gondwana palynofossils such as *Callialasporites trilobatus* and *Indotriradites* sp. were also found to be present.

G.K. Trivedi

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*

Qualitative study of 30 particulate coal pellets from 4 coal seams of Changki Valley coal belt, Mokokchung District of Nagaland under normal incident light revealed that they are rich in vitrinite macerals with low to moderate proportions of inertinite macerals. Resinite is the most common maceral of liptinite group followed by cutinite, suberinite, exsudatinite and sporinite in order of abundance. Pyrite and calcite minerals predominate over clastic minerals.

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 analysis of 5 surface samples from near Berijam Lake in Kodaikanal has revealed a rich pollen/spores assemblage wherein preponderance of pollen of alien plant taxa such as *Acacia, Pinus, Alnus, Betula* and *Eucalyptus* have been recorded. However, the pollen grains of shola elements are relatively poor and are represented by *Elaeocarpus, Ternstroemia, Euonymus, Ilex, Osbeckia*, etc.

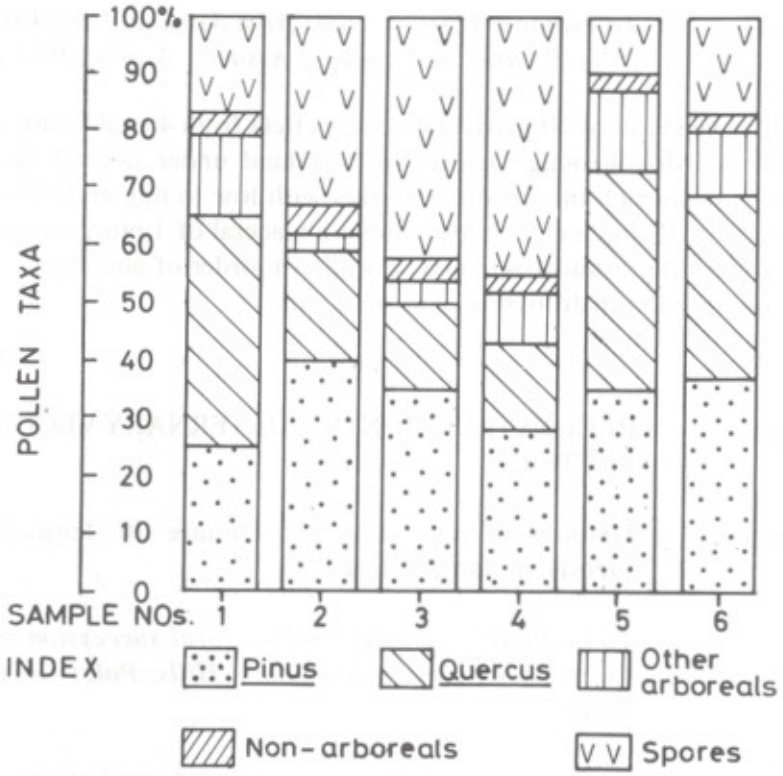
Pollen analysis of 10 soil samples from Berijam Lake, dating back to 16,000 years B.P., has revealed the poor occurrence of shola trees in the assemblage. The tree taxa recorded are *Elaeocarpus, Symplocos, Osbeckia, Ilex*, etc. *Senecio* and *Impatiens*, close associate herbs of shola forest, are recorded in good frequencies. A number of fungal spores are also enumerated in the assemblage.

H.P. Gupta & S.K. Bera

Study of pollen morphology under light microscope of 19 tree taxa belonging to families Meliaceae, Moraceae, Myristicaceae, Myrsinaceae and Myrtaceae has been completed.

H.A. Khan

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



Pollen spectra from Nachiketa Tal, Garhwal Himalaya showing the existence of temperate dense forest in the region.

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

Pollen analysis of 8 surface samples from oak forests of Deoria Tal, Garhwal Himalaya has revealed the dominance of arboreals, viz., *Quercus* followed by *Rhododendron, Alnus, Betula, Viburnum*, Rosaceae and Oleaceae. *Corylus, Carpinus, Myrica, Juglans* are sporadic. *Pinus* pollen in most of the samples deem to be drifted. Grasses, sedges, Asteraceae, Apiaceae, *Artemisia*, etc. constitute the non-arboreal vegetation.

Pollen analysis of a 3.0 m deep soil profile from Deoria Tal, Garhwal Himalaya has shown that the vegetation sequence begins with mixed oak-pine forests. *Alnus, Betula, Rhododendron, Ulmus,* Rosaceae, *Virburnum* and *Berberis* were sporadic. Subsequently the forests became more sparse as indicated by the reduced values of arboreal constituents. Thereafter, there was improvement in the frequencies of *Quercus, Betula, Alnus, Rhododendron*, etc. indicating the establishment of open mixed oak-pine forest once again.

Chhaya Sharma & M.S. Chauhan

Pollen analysis of 4 surface samples from near Nachiketa Tal, Garhwal Himalaya has shown the dominance of *Quercus* followed by *Pinus, Alnus, Betula, Juglans, Carpinus,* etc. Poaceae, Cheno/Ams, *Artemisia*, Rosaceae, etc. constitute the ground vegetation which corresponds more or less with modern vegetation.

Pollen analysis of 26 samples from Nachiketa Tal profile (NT-1) has revealed the presence of mixed oak-pine forest. The other arboreals, viz., *Rhododendron, Betula, Ulmus, Celtis*, etc. are sporadically represented. The overall vegetation composition suggests the prevalence of warm and moist climate in the region. Later on, the decline in *Quercus* together with some other broad-leaved elements and a simultaneous increase in *Pinus* and grasses signify that the climate became less humid than before. The upper part of the sequence portrays more or less the present day vegetational scenario as indicated by the improved frequencies of *Quercus, Juglans*, etc. and also increase of the anthropogenic activities in the region as evidenced by first appearance of *Plantago* together with increase in cerealia type and other culture pollen.

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*

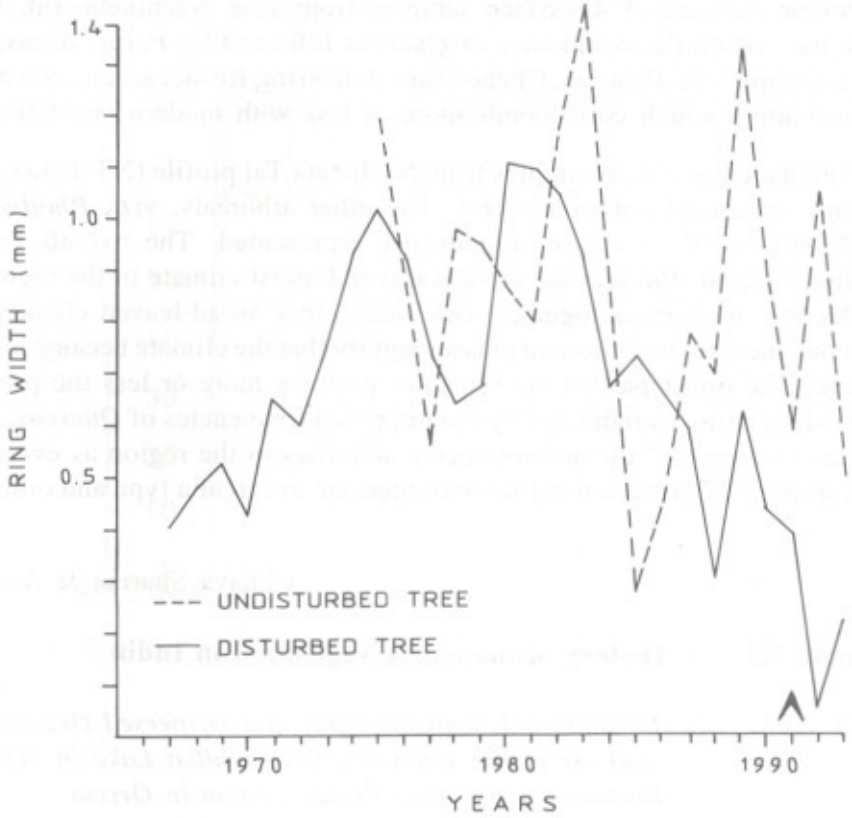
Identification of fungal spores recovered from 3 sites–Rambha, Balugaon and Nala Bana Island, Chilka Lake was completed. The taxa recorded are : *Amblyosporium, Clasterosporium, Vizella, Plochmopeltidella, Botryodiploidia, Sclerococcum, Glomus, Sporidesmium, Bipolaris, Drechslera, Memnoniella, Cirrenalia, Trichocladium, Spegazzinia, Gelasinospora, Papularia*, etc.

H.P. Gupta & Asha Khandelwal

Pollen analysis of a profile (3.0 m deep) collected from Solari Village, Chilka Lake indicates poor occurrence of mangrove taxa since 1870 ± 300 years B.P. Mangrove elements, although meagre, belong to the family Rhizophoraceae; *Avicennia, Exoecaria agallocha* and *Acanthus ilicifolia, Sonneratia* are sporadic. The assemblage since 1870 ± 300 yrs B.P. to recent is overall dominated by herbaceous elements, viz., grasses, sedges, Cheno/Ams and pteridophytes.

H.P. Gupta & R.R. Yadav

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



Raw ring width data from undisturbed and disturbed trees of Kail pine. The arrow indicates the year of earthquake.

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

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

Tree ring samples from 47 trees of *Pinus roxburghii, P. gerardiana* and *Cedrus deodara* from Chamba and Dharmsala in Himachal Pradesh and 95 samples of *Picea smithiana, Abies pindrow, Cedrus deodara* and *Juniperus* sp. from Dodital and Agora in Uttarkashi, Uttar Pradesh were collected, mounted on wooden frames and their cross sections polished. Tree core samples collected from Furkia and Dwali near Pindari Glacier were dated. The chronology of *Abies pindrow* has been found to extend from 1625-1992 AD.

Tree ring samples of *Pinus wallichiana* collected from Agora were dated and studied. The chronology has shown the signature of 1991 Uttarkashi earthquake. Tree ring chronology of *Pinus wallichiana* extending from 1621-1989 AD from Kinnaur,

Himachal Pradesh has been prepared. Statistical properties of the chronology show autocorrelation 0.567 and mean sensitivity 0.185. A good correlation has been found between this chronology and the temperature data from Mukteshwar indicating its suitability for climate analysis.

R.R. Yadav & Amalava 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*

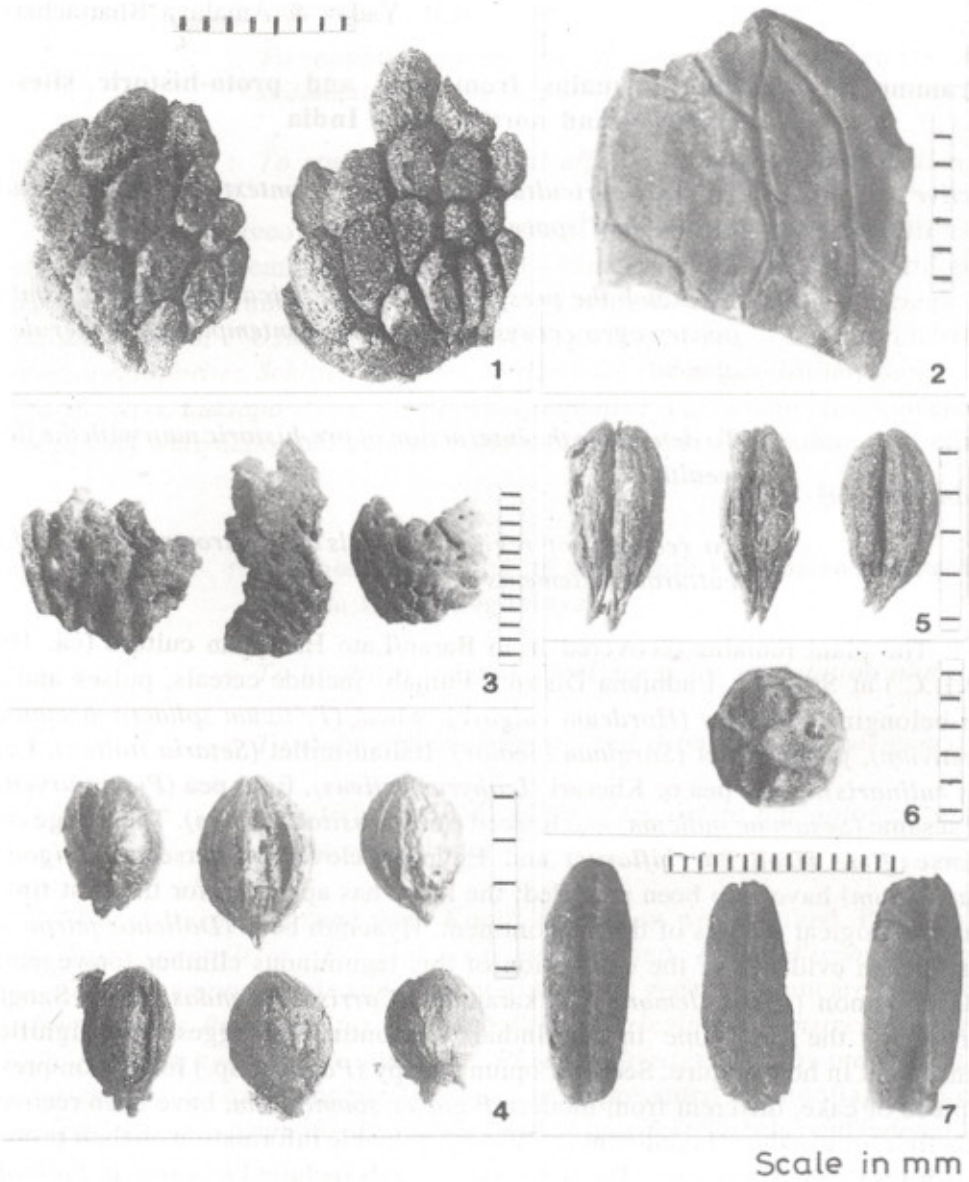
: *To determine the interaction of pre-historic man with the floral wealth*

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

The plant remains recovered from Baran/Late Harappan culture (ca. 1900-1400 B.C.) at Sanghol, Ludhiana District, Punjab include cereals, pulses and oil-seeds belonging to barley *(Hordeum vulgare)*, wheat *(Triticum sphaerococcum* and *T. aestivum)*, jowar-millet *(Sorghum bicolor)*, Italian-millet *(Setaria italica)*, Lentil (*Lens culinaris*), grass-pea or Khesari *(Lathyrus sativus)*, field-pea *(Pisum arvense)*, til or sesame *(Sesamum indicum)* and linseed *(Linum usitatissimum)*. The forage crops of horse gram *(Dolichos biflorus)* and Egyptian-clover or barseem *(Trigonella alexandrinum)* have also been recorded; the latter has appeared for the first time in the archaeological records of the subcontinent. Hyacinth bean *(Dolichos purpureus)* seeds furnish evidence of the cultivation of this leguminous climber for vegetable. Seeds of lemon *(Citrus lemon)* and karaunda *(Carrisa carandas)* from Sanghol, reported for the first time in the Indian subcontinent, suggest the significant advancement in horticulture. Seeds of opium-poppy (*Papaver* sp.) found compressed in a piece of cake, different from modern *Papaver somniferum*, have been recovered for the first time in the subcontinent and furnish valuable information on their probable use in drugs by the Harappans. The remains of weeds include *Vicia sativa, Indigofera* sp., *Indigofera astragalina, Fumaria* sp., *Phalaris minor, Cenchrus* sp., *Chenopodium album, Desmodium* sp. and *Capparis aphylla*. Mixed in the wood charcoal pieces of *Acacia* sp., *Ziziphus* sp., *Tamarix articulata, Albizia lebbek, Ficus glomerata* and *Ephedra foliata*, a charcoal piece of *Jasminum* sp. has been recorded for the first

time, which signifies the gardening activities of Harappans.

K.S. Saraswat



Fruit and seed remains from Kushana Period (100 - 300 AD) at Sanghol, Punjab. **1.** Fruit-coat pieces of sharifa *(Annona squamosa)* ; **2.** Fruit-shell piece of walnut *(Juglans regia)* ; **3.** Almond *(Prunus amygdalus)* fruit-shell pieces; **4.** Coriander *(Coriandrum sativum)* fruits; **5.** Cumin *(Cuminum cyminum)* fruits; **6.** Seed of black-pepper *(Piper nigrum)*; **7.** Stones of date *(Phoenix* sp.).

From the Kushana Period (1st-3rd century A.D.) at the same site at Sanghol, district Ludhiana, Punjab, the seeds and fruits of rice *(Oryza sativa)*, bread-wheat *(Triticum aestivum)*, dwarf-wheat *(T. sphaerococcum)*, hulled-barley (*Hordeum vulgare*), jowar-millet *(Sorghum bicolor)*, lentil *(Lens culinaris)*, green-gram or mung *(Vigna radiata)*, black-gram or urd *(Vigna mungo)*, cow-pea *(Vigna unguiculata)*, gram *(Cicer arietinum)*, field-pea *(Pisum arvense)*, horse-gram *(Dolichos biflorus)*, grass-pea *(Lathyrus sativus)*, til *(Sesamum indicum)*, field-brassica *(Brassica juncea)* and cotton *(Gossypium arboreum/herbaceum)* have been encountered. In the remains of spices and condiments, the fenugreek seeds (*Trigonella foenum-graecum*), a native of eastern Europe, have been found in large quantity. Coriander *(Coriandrum sativum)* and cumin *(Cuminum cyminum)* of Mediterranean region and black-pepper *(Piper nigrum)* of Indo-Malaysian region are the new records and deem to be introduced during Kushana Period.

Fruit remains include grape *(Vitis vinifera)*, almond *(Prunus amygdalus)*, walnut *(Juglans regia)*, date *(Phoenix* sp. cf. *P. dactylifera)*, phalsa (*Grewia* sp.), jujube *(Ziziphus nummularia)*, jambolana *(Syzygium cumini)*, chebulic-myrabolan *(Terminalia chebula)*, anwala *(Emblica officinalis)* and custard-apple or sharifa *(Annona squamosa)*. Remains of Sharifa fruit, which is native of West Indies and regarded to have been introduced by the Portugese, suggest its earlier introduction in India.

A.K.S. Pokharia [BSRS] & K.S. Saraswat

The archaeobotanical findings from Manjhi, Saran District, Bihar (transitional phase of Red Ware and Northern Black Polished Ware during ca. 250 B.C. to 250 A.D.) include : pulses, viz., *Cajanus cajan* and *Vigna aconitifolia*; leguminous species, viz., *Desmodium, Indigofera, Melilotus, Medicago sativa, Trigonella*; millets, viz., *Eleusine indica, Panicum* sp., *Paspalum scrobiculatum, Pennisetum typhoides, Setaria glauca;* oil-seeds of *Sesamum indicum*; sedges, viz., *Cyperus, Carex, Elaeochoris, Fimbristylis* and *Scirpus*; weeds– *Argemone mexicana, Amaranthus* sp., *Chenopodium album, Cleome spinosa, Commelina* sp., *Crotalaria* sp., *Dactyloctenium aegyptium, Jacquemontia* sp., *Lathyrus aphaca, Ocimum* sp., *Rumex dentatus, Salmalia malabarica, Solanum* sp. *Trianthema monogyna, Vicia hirsuta, Ziziphus monogyna* and *Z. oenoploea.*

Chanchala Srivastava

Programme 7.6 : Aerospora of Lucknow : its biochemical and clinical implications

Objective : *To monitor the aerospora of Lucknow and surrounding areas daily 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*

The damp aerospora of Lucknow has been studied thoroughly for the precise identification of each bioparticles present in the monsoon period. The number and types of pollen grains were poor, while fungal spores showed rich assemblage in varying frequencies, viz., *Curvularia* (52.3%), *Alternaria* (4.6%), *Chaetomium* (9.5%), *Fusarium* (7.1%), *Torula* (4.6%), *Nigrospora* (7.1%), etc. Algae belonging to Bacillariophyceae *(Fragilaria, Nitzschia, Navicula, Hantzschia, Synedra)*, Cyanophyceae *(Plectonema, Lyngbya, Oscillatoria, Nostoc* and *Gloeocapsa)* , Chlorophyceae *(Chlorella, Coccomyxa* and *Chlorococcum)* were also encountered.

Asha Khandelwal

PROJECT 8 : GEOCHRONOMETRY OF INDIAN ROCKS

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

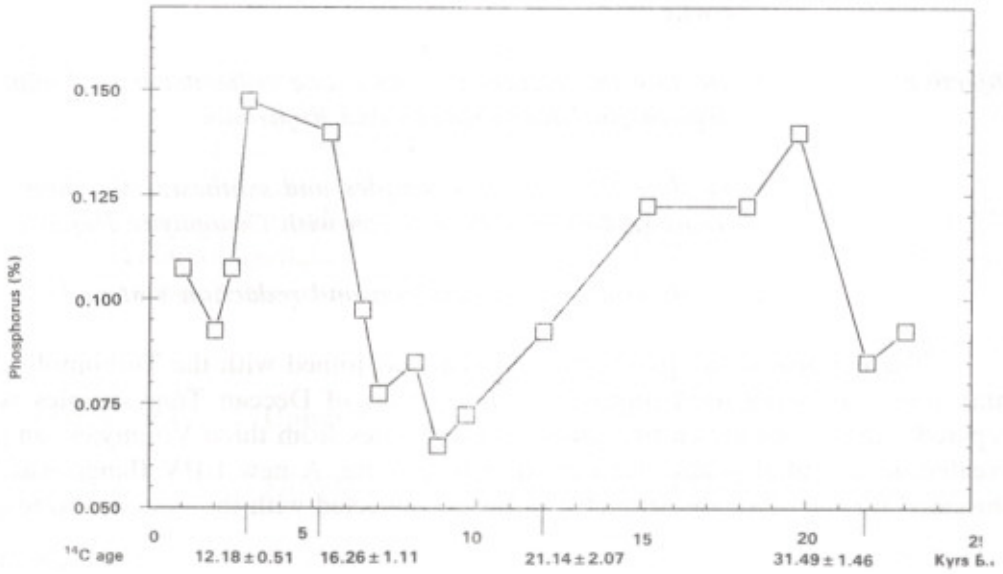
Objective : *To date Quaternary sediment profiles, ocean sediment cores, coastal and shell deposits and Kankar horizons in the Ganga plain*

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

A total of 88 samples were processed. Of these, 69 samples were dated. Some of the results are as follows :

Four profiles of peat deposits (28 samples) collected from Sandy Nallah in Nilgiris were dated. The interpretation of the age data together with ^{13}C analyses of samples indicated an arid phase from 6 to 3.5 kyrs ago and a short wet phase about 600 yrs ago. The latter appears to correspond to the Medieval warm period which was recorded earlier only in Europe and America, may have extended over the entire Northern Hemisphere. This work was done in collaboration with Physical Research Laboratory, Ahmedabad and Indian Institute of Science, Bangalore.

Sediment profiles (13 samples) collected at Kinnaur, Baspa Basin, Takche bog, Hanse and Spiti Valley were dated for geomorphological evolution of Baspa Basin and palaeoclimatic studies in the Himachal Himalaya.



Profile of authigenic phosphorous content in the 23m long sediment core from Tsokar Lake, Ladakh.

Calcrete (Miliolite) deposits in Porbander area were dated for inferring the periods of regressional phases of sea and subaerial exposure of these sequences. The ages range from 5,700 to 33,400 yrs which need to be compared with the results from samples of forams from these horizons.

The samples of fresh water shells and organic deposits collected from a profile of clay deposit at Luni River (7 samples), Gosaiganj, Lucknow have been dated for understanding the past climatic events in Gangetic plain. In this profile, comparison of ages of shells and of organic matter indicates that organic matter ages do not correlate well with depth.

G. Rajagopalan

For the reconstruction of past trophic conditions around Tsokar Lake, Ladakh on the basis of elemental analysis, phosphorus concentrations (authigenic phosphorus in the sediment is primarily through biotic cycling) at different depths of the sediment core TP-6, covering a time span of 32,000 yrs BP to the beginning of Holocene, were measured. Sixteen samples were analysed for measuring authigenic phosphorus concentrations using Spectrophotometer. The concentrations range from 650-1475 ppm. Conclusions derived for the reconstruction of past trophic conditions are in agreement with those derived on the basis of other elemental, organic and mineral content data.

G. Rajagopalan & B. Sekar [T.O.]

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

: *To develop data acquisition and reduction system*

The extraction and purification system was joined with the Turbomolecular pump and it is being used routinely. Thin section of Deccan Trap samples were prepared. XRD analyses on two glauconite separates from three Vindhyan samples revealed all essential peaks characterising glauconite. A new UHV flange was got fabricated for the mass spectrometer and was connected with the system and tested.

C.M. Nautiyal

PROJECT 9 : ANNOTATED ATLASES, CATALOGUES, MONOGRAPHS AND BOOKS AND RESEARCH PROGRAMMES *AD FINUM*

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 & Gondwana Palynostratigraphy)

Programme 9.2 : A catalogue of fossil dinoflagellates from India

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

Detailed morphologic and taxonomic studies revealed that *Fibrocysta variabilis* Mehrotra & Sarjeant 1987 is a junior synonym of *Apectodinium paniculatum* (Costa & Downie) Lentin & Williams 1977 while cysts described as *Fibrocysta* sp. by Mehrotra and Sarjeant (1987) belong to *Apectodinium quinquelatum* (Williams & Downie) Lentin & Williams 1981. A manuscript dealing with the significant finding of the marker dinoflagellate cyst *Apectodinium* in bore-cores of Narsapur Well - 1, Krishna-Godavari Basin is finalized.

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

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 carryout ultrastructural studies*

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

Palynological investigations on the carbonaceous Intertrappean sediments of Laxmipur area, Kutch indicate a pteridophyte dominant assemblage. The palynofossils recorded include species of *Cyathidites, Todisporites, Lygodiumsporites, Lycopodiumsporites, Osmundacidites, Klukisporites, Polypodiisporites, Triletes, ?Azolla, Ariadnaesporites, Cicatricosisporites, Triporoletes, Classopollis, Podocarpidites, Ephedripites, Araucariacites, Inaperturopollenites, Tricolporoidites* and *Monocolpites*.

A. Rajanikanth

Programme 9.6 : 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 *Anogeisus latifolia* Wall., *A. pendula* Edgew. and *A. sericea* Brand 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.

D.C. Saini

Programme 9.7 : Inventory of type and figured palaeobotanical specimens/ slides (megafossils) available with repository of BSIP Museum

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

Inventory Part II was published. Compilation of data for Inventory Part III is under progress.

G.P. Srivastava (Co-ordinator)
[Group effort]

Programme 9.8 : Annotated synopses of palaeobotanical contributions related to Gondwana of India

Objective : *To index and update the published literatures*

: *Publication of abstracts of papers and articles on palynology, plant megafossils and biodiagenesis related with Gondwana sequence of India*

The palynological references published from 1937 to 1993 on the Gondwana sediments of India have been compiled and published as Annotated Synopses. This whole compilation of data included the search for each reference along with its abstract, entry of data in computer and editing to make ready for publication.

Vijaya & Ram-Awatar

Indexed and updated the published literature. Compiled and edited abstracts of relevant research papers and articles. Finalized Annotated Synopses on the Indian Mesozoic megaplants.

A. Rajanikanth & Neeru Prakash

An Annotated Bibliography of the literature on and related to plant megafossils from the Permian of India was prepared and published. For this more than 500 research papers and articles published between 1830 and 1993 were abstracted. The compiled data was put on a computer using the approved format on dB3PLUS. For printing,

a text-file was made and transferred to the WS6 word-processor. An index giving several parameters, such as -- author names, taxa names, locality names, formation names, etc. was also prepared.

Usha Bajpai & K.J. Singh

An Annotated Synopses of the biopetrological investigations carried out up to November, 1993 on the Gondwana (Permian) coals of India was compiled and published. The work involved card indexing, procurement of literature from several sources, consultation of more than 450 published papers, short notes and letters to the editors, besides abridging of abstracts, maintenance of uniformity in language, editing of drafts and preparation of index for the bibliography.

B.K. Misra & O.S. Sarate

Programme 9.9 : Cenozoic plant remains of Palamu, Bihar

Objective : *To study morphotaxonomy of megafossils from the Neogene sediments of Mahuadanr Valley*

: *To reconstruct vegetational history, palaeoecology, phytogeography and depositional environment*

Old collection of leaf-impressions from Mahuadanr Valley was sorted out and some new forms belonging to *Sterculia, Artocarpus, Croton* and family Lauraceae have been identified.

G.P. Srivastava

Programme 9.10 : Siwalik flora of West Bengal

Objective : *To study plant megafossils from the Siwalik sediments exposed in various localities of Darjeeling District*

: *To build up the floristics for interpreting palaeoecology, phytogeography and evolutionary patterns of the Himalayan flora*

A number of leaf-impressions from the Himalayan foot-hills of Darjeeling District were collected. Some of them have been tentatively identified belonging to the families Apocynaceae, Lythraceae, Anacardiaceae, Leguminosae and Urticaceae. Photo-documentation of specimens has also partly been done.

J.S. Antal

Programme 9.11 : Collection of extant plant materials from foot-hills of Himalaya

Objective : *To enhance the collection of extant plant materials and their preparations for development of Herbarium of the Institute as repository of the authentic plant specimens and samples*

: *To provide authentically identified extant plant materials to the scientists as per their requirements*

: *Preparation of Inventory and Altases of Herbarium holdings*

Collected about 700 plant specimens, 110 samples of polleniferous material, wood samples of about 4 species and seeds of about 10 species from Bahraich forest, Uttar Pradesh. All plants have been identified.

About 800 plant specimens, 150 samples of polleniferous material and seeds and fruits of about 15 species have been collected from Oodlabari of Darjeeling District and Jaldhaka range of Jalpaiguri District in West Bengal. About 1000 plant specimens, seeds and fruits of about 20 species from Nichlaul Forest, Maharajganj, Uttar Pradesh were collected.

Preparation of Inventory of Herbarium holdings (seeds and fruits) is under progress. Prepared about 2290 Cards for Computer feeding. For this purpose, all seeds and fruits lodged in Herbarium, have been physically verified. A computer printout of the Inventory has been prepared.

D.C. Saini (Co-ordinator) [Group Effort]

PROJECT 10 : APPLICATION OF GEOBOTANICAL ANALYSIS IN

I. MINERAL PROSPECTING

II. RECONSTRUCTING THE HISTORY OF MODERN VEGETATION THROUGH CENOZOIC ERA
(Director – Co-ordinator)

Objective : *To assess the extant plant communities for indication of minerals in the underlying strata*

: *To reconstruct the patterns of migration, extinctions and diversification of Cenozoic floras in conjunction with the lineages of modern floras*

Collected and scanned the relevant literature and prepared notes on Geobotany. About 120 reference cards were prepared and bibliography on the subject collected from NBRI, GSI and BSIP libraries.

J.S. Guleria, S.K. Bera, Madhav Kumar,
D.C. Saini & B. Sekar

Under the guidance of Director, B.S.I.P. visited Geobotany Laboratory of the Mohanlal Sukhadia University, Udaipur to discuss with Professor Y.D. Tiagi and Dr N.C. Aery, Department of Botany about the infrastructure of research project "Geobotany". Detailed discussions were held about the equipments required for carrying out analytical work on geobotanical samples. It was recommended that a laboratory and the latest technology like ICP machines should be established.

J.S. Guleria, Madhav Kumar & B. Sekar

Sponsored Project

S.P. : **Holocene palynostratigraphy and palynoenvironment 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*

Pollen analysis of a 3.0 m deep profile from Solari Village, north of Balugaon, Chilka Lake, Orissa has revealed a rich pollen assemblage both quantitatively and qualitatively and the dates for the base of profile has been extrapolated to about 2,000 Yrs B.P. Both core and peripheral mangrove pollen taxa are encountered between 3.0 to 2.0 m depth in good frequencies and they belong to Rhizophoraceae, *Avicennia, Excoecaria, Acanthus, Heritiera, Sonneratia, Acrostichum, Lumnitzera, Phoenix, Arecaceae, Barringtonia, Terminalia, Emblica, Tamarix, Urticaceae,* etc. After 2.0 m depth the degradation of mangrove taxa started and succeeded by Poaceae, Cyperaceae, Cheno/Ams, *Justicia, Artemisia, Acacia, Typha, Nymphoides, Potamogeton*, etc. The other palynodebris include fern spores, dinoflagellates, microforaminifera, *Concentricystis*, fungal spores, etc. in varying frequencies. Their photodocumentation has been done.

Eight soil profile samples of Chandrapur Village, north of Barkul, have been chemically processed and pollen analysed. Bottom sample at the depth of 3.0 m has shown varying frequencies of *Rhizophora, Excoecaria, Lumnitzera*, Fabaceae, Urticaceae, Cheno/Ams, Asteraceae, Lamiaceae, Poaceae, Cyperaceae, *Typha,*

Nymphoides, etc.

Displayed posters about the annual progress of the project work in 5th DST Group Monitoring Workshop in Earth Sciences at Cochin University of Science and Technology, Cochin, during 18 to 20 January, 1994.

H.P. Gupta & Deepak Kohli

Collaborative Projects

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

Study of macrofossils from Halkal Formation, Badami Group at Kolkur, previously opined to be of Precambrian - Cambrian transition in peninsular India was done. The assemblage shows predominance of *Chuaria* Walcott and *Tawuia* Hofmann in association of *Protoarenicola* Wang and *Beltina* Walcott commonly known from the beds of ± 1000 to 900 Ma. This fact is also supported by the study of organic-walled microfossils.

Study on a new form of Hyellaceae, *Blainiella* gen. nov. from the Blaini Siltstone (Neoproterozoic) exposed along Song River near Maldeota was completed. Organic-walled microfossils have been recorded from the brachiopod-bearing beds of Tal Formation exposed near Gopi-Chand Ka Mahal and Surket.

P.K. Maithy & R. Babu

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

For the preparation of a pollen atlas, revision of following genera, viz., *Ammandra, Elaeis, Daemonorops, Pseudophoenix, Cocos, Oncosperma, Phoenix, Sclerosperma, Licuala, Rhapis, Irialella*, etc. was done. A detailed morphological study of *Nypa fruticans, Ammandra decasperma, Elaeis guineensis, Licuala* (diff. spp.), *Daemonorops ruber, Pseudophoenix* (diff. spp.) was carried out and manuscripts on the study were finalized.

K. Ambwani
R.N. Kapil [Delhi] & B.D. Sharma [Calcutta]

PROJECT : VEGETATIONAL HISTORY, PALAEOENVIRONMENT AND CLIMATIC CHANGES DURING SIWALIK IN WEST CENTRAL NEPAL

Out of a fairly rich collection of plant megafossils from the Arjun Khola and Binai Khola formations of the Churia Group, exposed along Tinau Khola near Butwal and Mahendra High Way between Baryhat and Dumkibas, Nepal respectively, some dicotyledonous leaf-impressions have been studied and compared with those of extant taxa. They show close resemblance with the leaves of *Fissistigma minuticalyxe, F. bicolour, F. rubiginosum* and *F. polyandra, Miliusa roxburghiana* (Annonaceae); *Gynocardia* (Flacourtiaceae); *Garcinia paniculata* (Clusiaceae); *Dysoxylum binectariferum, D. reticulatum* (Meliaceae); *Berchemia floribunda* and *Ventilago calcyculata* (Rhamnaceae); *Stephegyne pyrifolia* (Rubiaceae) and *Artocarpus heterophyllus* and *Conocephalus* spp. (Moraceae).

N. Awasthi & M. Konomatsu [Japan]

Work other than Programmes

Organic-walled microfossil analysis of 30 samples belonging to Chattisgarh Group, Raigarh was done. Preservation and yield of microfossils is poor. Identifiable forms are few acritarchs and tubular sheaths.

P.K. Maithy & R. Babu

To study calcareous algal fossils the samples from Cretaceous-Eocene sediments exposed near Varagur, Trichinopoly District were found barren. The slides prepared from limestone samples of Bagh Bed, Madhya Pradesh have been studied. The study reveals the presence of several algal forms possibly of the families Dasycladaceae, Codiaceae etc. A first draft of the paper entitled "Occurrence of *Actinoporella cretacica* Raineri from Bagh beds, Jhabua area, central India" was prepared.

P.K. Maithy & B.N. Jana

Initiated collaboration with National Botanical Research Institute, Central Drug Research Institute, Lucknow University, etc. to extract and study organic molecules from DOM and fossils. Preliminary studies conducted on shale and limestone of Bhima Group have indicated the presence of sterols. Confirmatory studies are under progress. A *Dipterocarpus* wood from Siwalik sediments has also been subjected to solvent extraction and apparently contained sufficient organic molecules. Efforts are underway to identify and study these molecules.

Manoj Shukla
[Dr S.K. Nigam & Dr Gopal Misra -- NBRI]

Palynostratigraphical investigation on the 6 bore-hole cores in the Upper Assam Basin was finalized in collaboration with Oil India Limited, Duliajan. The assemblage comprises 87 genera and 120 species constituting pteridophytic spores, gymnospermous and angiospermous pollen, fungal spores and bodies and dinoflagellate cysts. The distributional pattern of the palynomorphs confirms the reliability of the palynoflora in distinguishing the different litho-units and also for long distance correlation. Quantitative and qualitative analyses of the palynoflora indicate the presence of lowland subtropical rain forest during Palaeogene. In Neogene, it changes into montane vegetation. Palaeoecological condition of deposition of these sediments is also inferred.

R.K. Kar, [G.K. Handique, C.K. Kalita],
J. Mandal, S. Sarkar, M. Kumar and A. Gupta

Out of 10 coal and shale samples from newly explored Gondwana sequence in Tamil Nadu, supplied by M.E.C. Ltd., Nagpur, only 5 were found to be suitable for the study of maturation and estimation of microconstituents. The coals have reached

sub-bituminous C stage (Ro max. 0.40-0.46%) in rank. The vitrinite fraction (8-78%) in these coals is dominantly composed of structured variety (telinite). Samples TC-1/2 and TC-1/4 (of bore-hole TC-1) represent a relatively better quality coal than rest of the samples. Syngenetic pyrite occurs frequently in all the samples, indicating reducing environment during the deposition of vegetal matter. In general, the coals are not comparable to the Lower Gondwana coals, however, in some properties they can be compared with the Cretaceous coals of Kutch, Gujarat.

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

Biopetrological preparations and microscopic investigations of 12 coal samples (4 Tertiary- Assam, 8 Gondwana- Pasang/Samla), supplied by the Indian Institute of Technology, Delhi have been carried out. The original samples of each area accompanied with three extracted residues (`N.M.P.'- 1 methyl 2-Pyrolidone, `Ce'- Cetene (1-Hexadecene) and `A.O.'- Anthracene oil respectively). Rank of the Assam coal (Ro max. 0.66-0.74%) gradually decreases from the sample no.1 (original) to sample no.4 (`A.O.'extracted). However, the rank of the Gondwana coals (Ro max. 0.47-0.62% Pasang, 0.46-0.55% Samla) increases progressively from the original to extracted ones. Whereas, last two samples (`Ce' and `A.O.' extracted) of both Gondwana areas have not much difference.

In all the coal samples hydrogen-rich microconstituents (perhydrous or fluorescing vitrinite and liptinites) progressively decrease from original to extracted ones. Oxidation rim, especially in Tertiary extracted coals, appears at margins of vitrinite particles as well as around cracks and fissures developed within the vitrinite itself. Inertinite macerals appear to be unchanged/unaffected. Extracted Gondwana coal samples show relatively more clarity in microstructures. Tertiary extracted samples exhibit dullness in structures, especially of inertinite macerals.

B.K. Misra & B.D. Singh

Twenty samples of coal and associated resinous matter from various areas have been chemically (IR and GCMS) analysed in collaboration with the scientists of Industrial Toxicological Research Centre and differential oxidative tendencies were observed. The loss of aliphatic C-H functions, development of carboxyl moieties and induced aromatization are being studied to understand the principal chemical changes taking place during the oxidation of coal.

R. Saxena

Morphographic study of a new spore genus, *Dharmsalasporis*, from the Dharmsala Group of Kangra District, Himachal Pradesh was carried out and finalized. *Dharmsalasporis* is characterized by its very large size and exceptionally short laesurae never exceeding one-sixth of the spore radius.

A manuscript dealing with the lithostratigraphic study of the Ratnagiri beds,

now formally designated as Sindhudurg Formation, has been finalized.

R.K. Saxena

A palynofloral assemblage consisting of 33 genera and 40 species has been studied from the Kasauli sediments and three palynological zones have been recognised in the sequence. A comparison of the present assemblage with those recorded earlier from the Kasauli sediments shows that the assemblage zones can be extended laterally. The overall palynofloral assemblage suggests that the sediments were deposited under fresh water environment, though restricted brackish water influence is discernible. A warm and humid subtropical climate seems to have prevailed during the deposition of these sediments.

H.P. Singh & Samir Sarkar

Palynofossil assemblages recovered from six profiles of the Lower Tertiary formations exposed on the Bilaspur - Simla Highway lying on the western side of the Surajpur Thrust, Himachal Pradesh have been analysed.

Samir Sarkar

Morphotaxonomic work on palynotaxa recorded from Chainpuri Section (Late Cretaceous) and Lipak Black Shale (Oligocene) sediments, Andaman Islands was completed. The palynoflora is represented by dinoflagellate cysts, fungal remains, pteridophytic spores and angiospermic pollen. In all, 32 genera and 41 species have been identified.

A manuscript dealing with morphological variation and taxonomic implications in some Indian Tertiary angiosperm pollen belonging to *Assamialetes, Spinizonocolpites, Kapurdipollenites, Densiverrupollenites* and *Tricolporopilites* was prepared. This paper also deals with botanical relationship and evolutionary aspects of these genera.

S.K.M. Tripathi

The comparative account of yellow rain samples obtained from Vikas Nagar area of Lucknow in three subsequent years, i.e. 1992, 1993 and 1994 was studied and found no qualitative variation. However, the quantitative differences have been noticed in each year's samples.

Photomicrography of palynodebris obtained from pollen profile of Andaman and Nicobar Islands has been accomplished. The preparation of pollen diagram is in progress.

H.P. Gupta & Asha Khandelwal

Pollen analysis of 8 surface samples collected from subalpine and alpine region in Kupup, Sikkim has revealed the overall dominance of non-arboreals over arboreals. The non-arboreals are dominated by exceedingly high values of grasses and

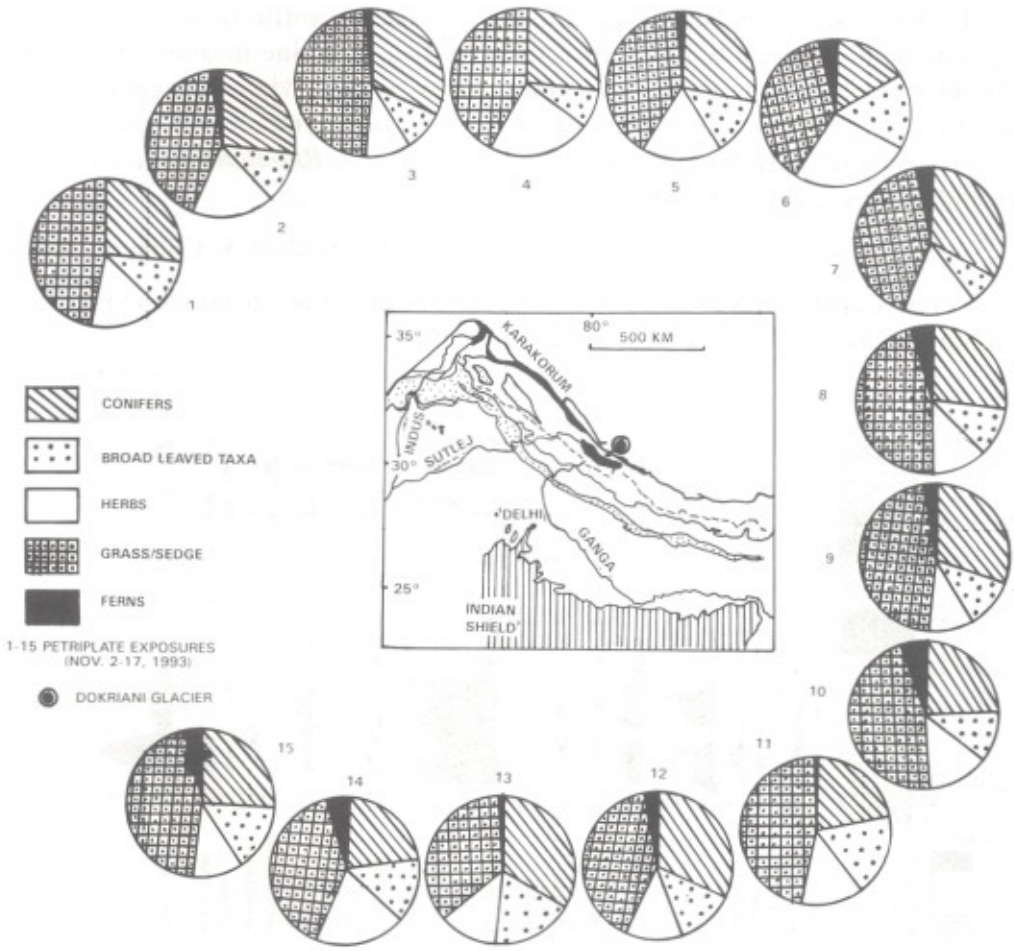
Asteraceae, whereas the arboreals are represented by moderate values of *Alnus* and low frequencies of *Betula* and *Rhododendron*.

Chhaya Sharma & M.S. Chauhan

Growth ring features of *Sahnioxylon*, a Mesozoic conifer, were studied. Well developed late wood, narrow early wood, complacent ring width pattern and low mean sensitivity indicate that this plant used to grow under favourable climatic conditions. Growth ring characteristics are indicative of warm temperate to subtropical climate with very long growing season.

R.R. Yadav & A. Bhattacharyya

Ten surface samples (moss cushions, surface soils) collected from Dokriani Glacier, Uttarkashi were chemically processed. Fifteen petriplate exposures from



Aerospora catches at Dokriani Glacier in Uttarkashi showing the occurrence of thermophilous pollen.

Glacier base camp (3,650 m) were pollen analysed. The study reveals that the atmosphere was highly charged with pollen/spores showing predominance of non-arboreals. *Pinus, Abies, Quercus, Betula*, etc. are represented in low to moderate values. Number of fungal spores are recorded in the assemblage. Other varia include fungal hyphae, insect wings, epidermal peelings and trichomes.

S.K. Bera

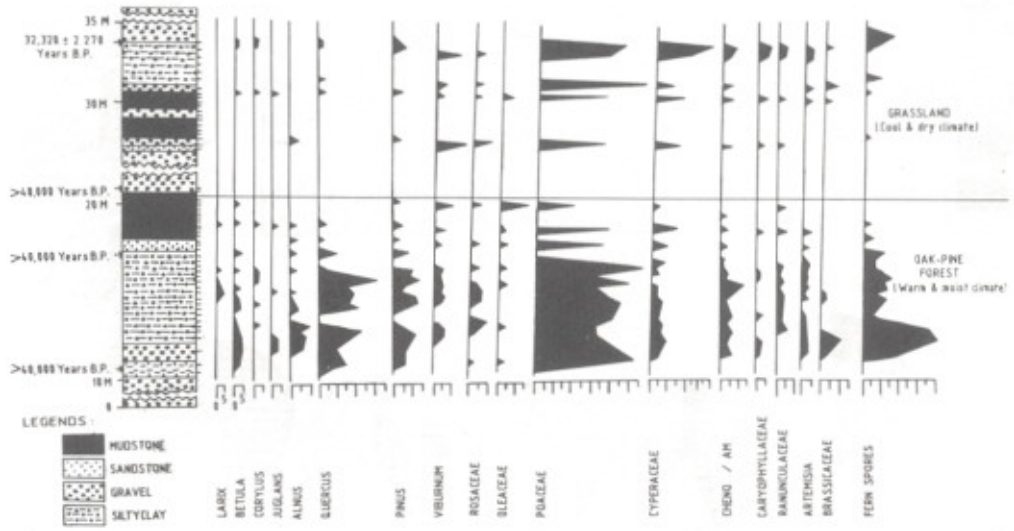
Pollen analysis of 52.0 m thick composite Quaternary section (BMT/GJR-II) exposed at Bilaspur, Kumaon Himalaya was carried out and the pollen diagram was prepared. The synthesis of data reveals that prior to 40,000 years B.P. the vegetation was dominated by mixed oak-pine forests, depicting the prevalence of warm and humid climate. Between 40,000 to 32,000 years B.P. these forests were replaced by open grassland vegetation under the regime of cold and dry climate.

Pollen analyses of 16 samples from a 1.5 m deep profile from Takche, Spiti Valley was done. The study has shown the presence of alpine meadow dominated chiefly by sedges and grasses. The other non-arboreals, viz., *Polygonum* spp., *Thalictrum, Arnebia*, Cheno/Ams, *Artemisia*, Ranunculaceae, etc. are also encountered in good frequencies, whereas the arboreals, such as *Salix, Rhododendron, Ephedra, Alnus* and *Juniperus* are sporadically represented.

M.S. Chauhan & Chhaya Sharma

A few samples of Subathu Formation, collected during Chandigarh visit, have been found to be barren of any siliceous microfossils.

Anil Chandra



Vegetation scenario since > 40,000 years B.P. in Kumaon Himalaya.

The dodecahedral cysts of *Braarudosphaera bigelowii* consisting of biomineralized calcite were analysed employing light and Scanning Electron Microscopy. The radial pentalith suture-intercepts closely match golden mean ratio (5+1)/2, and the cysts display quasiperiodic tiling of three-dimensional space, also known different organisational level of a variety of microbiogenic entities using a vast array of building material, viz., radiolaria (hydrous-silica), coccoliths (biogenic calcite), pollen and spores (organic polymers), viruses (nucleoprotein), including more recent find of quasicrystalloid 5-fold symmetry discovered in Mn-Al alloys, optically condensed matter and all-carbon Buckminsterfullerene molecules. Thermodynamics of quasiperiodic symmetry in living and non-living systems has yet to be understood, but the architecture of quasicrystalline microbiogenic particles invisible to naked eye, appears to be governed by golden mean ratio.

S.A. Jafar

Phylogenetic and constructional constraints in shaping Glossopterid floristic are examined in the light of fresh anatomical details known from petrified fossil remains. Considering other significant factors, such as (i) removal of soil-cover by glaciation, (ii) Post-Carboniferous floristic vacuum without threat of serious competition, (iii) onset of warm-humid climate, (iv) widespread Early Permian intracratonic sea incursions producing vast favourable wetland habitat, probably contributed to sudden dominance and continued sustenance of Glossopterid floristic under varied wetland scenario, viz., coastal/estuarine mangrove and lacustrine/fluvial swamps throughout Permian. Remarkable analogy of leaf morphology/ultrastructure of extant pantropical fern *Acrostichum aureum* Linn. with that of Glossopterid leaf, and adapted to varied wetland habitats, suggests large shrub-thicket model for Glossopterid plant; taphonomic evidences suggest relatively high biomass productivity of foliage ensuring genesis of coal.

Computer simulation of Glossopterid leaf-outline transformations inscribed within Cartesian-coordinate, generated leaf-outlines with a "node" or "point of arrest", signifying their affinity with dicotyledonous leaf.

S.A. Jafar & R.K. Kar

Critical evaluation of published fossil records and field observations coupled with recovery of rich assemblage of calcareous nannofossils from Harudi and Fulra Limestone formations suggested a Late Middle Eocene (Bartonian) transgressive event flooding Deccan Basalts in Kutch Basin. This model questions the existence of marine Palaeocene, Lower Eocene and Lutetian rocks in onland areas.

S.A. Jafar & J. Rai

A manuscript on Late Jurassic ammonoids and their associated dinoflagellate cyst assemblages from Tethys Himalaya highlighting integrated biostratigraphic

approach was prepared for presentation at the 9th Himalayan-Karakorum-Tibet Workshop, Kathmandu, Nepal.

Rahul Garg, K.P. Jain & Khowaja-Ateequzzaman
[Jai Krishna] (BHU)

A manuscript dealing with the restudy and redescription of holotypes and other specimens of selected Indian Tertiary angiosperm pollen taxa available at the Birbal Sahni Institute of Palaeobotany, Lucknow has been finalized and submitted.

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 and K. Ambwani

International Geological Correlation Programmes

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

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

IGCP Project No. 320 : **"Neo Proterozoic events and resources."**
Manoj Shukla
Corresponding Member, International Working Group

IGCP Project No. 329 : **"Palaeogeographic and palaeoecologic evolution of Paratethyan basins during Neogene and their correlation to global scales."**
R.K. Saxena
Member, National Working Group

IGCP Project No. 237 : **"Floras of Gondwanic Continents."**
Hari K. Maheshwari
Co-convener, National Working Group
R.S. Tiwari
Member, National Working Group

IGCP Project No. 359 : **"Nonmarine Triassic."**
R.S. Tiwari
Member, International Working Group
Vijaya
Member, International Working Group

Papers Submitted

Ambwani, K. – Pollen morphology and aperture development in African oil palm – *Elaeis quinensis* Jacq. *Phytomorphology.*

Ambwani, K. & Kar, R.K. – Volcanic effect on the plant tissues with particular reference to middle lamela. *Phytomorphology.*

Ambwani, K. & Kumar, M.– Pollen morphology of *Ammandra decasperma* Cook Phytalephantoideae. *Phytomorphology.*

Anand-Prakash, Misra, B.K. & Singh, B.D.– Fluorescence microscopy in the evaluation of Indian Gondwana coals. *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

Antal, J.S. & Awasthi, N. – Fossil flora from the Himalayan foot-hills of Darjeeling District, West Bengal and its palaeoecological and phytogeographical significance. *Palaeobotanist.*

Awasthi, N. & Mehrotra, R.C. – Critical comments on a liliaceous inflorescence. *Curr. Sci.*

Awasthi, N., Mehrotra, R.C. & Bhattacharyya, A. – Fossil wood of *Cynometra* from the Tertiary of Tripura. *Geophytology.*

Bajpai, U., Kapoor, H.M. & Maheshwari, H.K. – Late Palaeozoic floral succession in the Perigondwana. *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

Bajpai, U. & Maheshwari, H.K. – Late Palaeozoic plant-geography of the Perigondwana and evolution of Kashmir Basin. *J. geol. Soc. India.*

Bajpai, U. & Singh, K.J. – Indian Gondwana : Annotated Synopses-Permian megaplants. *B.S.I.P.,* Lucknow.

Banerjee, J. – Upper Gondwana megafloral succession of Rajmahal Basin, India. *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

Bera, S.K. & Gupta, H.P. – Pollen rain at Dokriani Glacier (Bamak), Uttarkashi, U.P. *Palaeobotanist.*

Bera, S.K. & Kohli, D. – Himalaya Ka Nirman. *Avishkar* (in Hindi).

Chandra, A. & Kumar, M. – The palynology of the Late Tertiary sediments at Site 218 in the Bengal Fan, northeastern Indian Ocean. *Palaeobotanist.*

Chandra, S. & Singh, K.J. – Plant fossils from the type locality of Talchir Formation and evidence of earliest plant / animal activity in Gondwana of India. *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

Chauhan, M.S. – Origin and history of tropical deciduous Sal *(Shorea robusta)* forests in Madhya Pradesh. *Palaeobotanist.*

Garg, R. & Jain, K.P. – Significance of the terminal Cretaceous calcareous nannoplankton marker *Micula prinsii* at the Cretaceous-Tertiary boundary in the Umshoryngkew Section, Meghalaya, India. *Curr. Sci.*

Garg, R., Khowaja-Ateequzzaman & Jain, K.P. – Occurrence of the marker dinoflagellate cyst *Apectodinium* in the Narsapur Well-1, Krishna-Godavari Basin, India. *Palaeobotanist.*

\Gupta, A. – Fungal fruiting bodies from Early Tertiary sediments of Sirmaur District, Himachal Pradesh. *Bot. J. Linn. Soc.*

Gupta, H.P. – Palynology, man and environment in Ganga Basin. *Micropalaeontology.*

Gupta, H.P. – Chilka Lake : Changing scenario. *Science Reporter*, New Delhi.

Gupta, H.P. & Kohli, D. – Chilka jheel ka bigarata paryavarniya swarup evam astitwa per prashna chinha. *Kendriya Sachiwalaya Hindi Parishad,* New Delhi (in Hindi).

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Jafar, S.A. & Kar, R.K. – Glossopteris flora : A case for wetland mangrove vegetation? *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

Jafar, S.A. & Rai, J. – Late Middle Eocene (Bartonian) calcareous nannofossils and its bearing on coeval post-trappean transgressive event, Kutch Basin, western India. *Geophytology.*

Jha, N. & Srivastava, Suresh C. – Kamthi Formation : Palynofloral diversity. *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

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. *Proc. Int. Himalayan Geol. Seminar, Shimane,* Japan.

Kar, R.K., Handique, G.K., Kalita, C.K., Mandal, J., Sarkar, S., Kumar, M. & Gupta, A. – Palynostratigraphical studies on subsurface Tertiary sediments in Upper Assam Basin, India. *Palaeobotanist.*

Kar, R.K., Mandal, J., Sarkar, S. & Kumar, M. – *Pilatrisyncolpites triangulatus* gen. et. sp. nov. from the Oligocene of Upper Assam, India. *Geophytology.*

Khan, H.A. – Pollen morphology of some plants of Silent Valley, Kerala, India (Part II) - Acanthaceae. *Palaeobotanist.*

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

Khandelwal, A. & Gupta, H.P. – Uttar Pradesh : Floral diversity during Holocene period (10,000 years B.P.) and changing environmental scenario. *Proc. Biodiversity Consultations,* Ministry of Environment & Forest, U.P.

Khandelwal, A. & Gupta, H.P. – Organodebris analysis of Chilka Lake, Orissa, India : An assessment of the depositional environment. *Palaeobotanist.*

Kohli, D., Pandey, P.S. & Gupta, H.P. – Floristic composition and phytosociological analyses of Samaspur Wetland, Rae Bareli. *Geophytology.*

Kohli, D., Pandey, P.S., Gupta, H.P. & Khandelwal, A. – Phytoplankton diversity of Samaspur Lake, Rae Bareli, U.P. *Geophytology.*

Kohli, D., Yadav, R.R. & Bhattacharyya, A. – Bhukamp evam vriksha valaya. *Vigyan Garima Sindhu*, New Delhi (in Hindi).

Konomatsu, M. & Awasthi, N. – Some plant fossils of the Churia Group (Siwalik) from Tinau Khola and Binai Khola, west- central Nepal. *Proc. Int. Himalayan Geol. Seminar,* Shimane, Japan.

Kotlia, B.S., Bhalla, M.S., Ramesh, R., Rajagopalan, G., Chauhan, M.S. & Sharma, C. – Climatic records in the Pleistocene fluvio-lacustrine deposits of Bhim Tal, Naukuchia Tal Basin, Kumaon Himalaya, India. *Quaternary Research.*

Kumar, M. – Morphology and phylogeny of some angiosperm pollen from the Tertiary sediments of India. *Palaeobotanist.*

Kumar, M. – Pollen tetrads from Palaeocene sediments of Meghalaya, India : Its morphological and phylogenetic implications. *Palaeobotanist.*

Kumar, P. – The present and the past pterophytes of the Satpura Basin : A sporological approach. *Palaeobotanist.*

Kumar, P. – The Jabalpur Formation of the Satpura Basin : Palynology and palaeoclimate. *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

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Maheshwari, H.K., Kapoor, H.M. & Bajpai, U. – *Kashmiria* gen. nov., a probable marattialean fern from the Mamal Formation in the Kashmir Basin. *J. palaeontol. Soc. India.*

Maithy, P.K. & Babu, R. – Occurrence of endosporulating cyanobacteria in the Lower Bhander Limestone Formation, Bhander Group exposed around Narsingarh, Madhya Pradesh. *Palaeobotanist.*

Mandal, J., Chandra, A. & Kar, R.K. – Palynofossils from the Kadamtala coal, Middle Andaman, India. *Geophytology.*

Mandaokar, B.D. – Palynology of coal-bearing sediments of Tikak Parbat Formation from Dilli Colliery (Dilli-Jeypore Coalfield), Assam, India. *Palaeobotanist.*

Mandaokar, B.D. – Morphotaxonomic advances of Polypodiaceous spores under light and Scanning Electron Microscope from Ledo Colliery (Oligocene), Tinsukia District, Assam, India. *Palaeobotanist.*

Mehrotra, R.C. & Awasthi, N. – Status of gymnosperms in the Indian Tertiary flora. *Palaeobotanist.*

Misra, B.K. & Sarate, O.S. – Indian Gondwana : Annotated Synopses - Biopetrology. *B.S.I.P.,* Lucknow.

Misra, B.K. & Singh, B.D. – Liptinite macerals in Singrauli coals, India : Their characterization and assessment. *Palaeobotanist.*

Misra, B.K. & Singh, B.D. – Fluorescing inertinite macerals in Indian Gondwana coals. *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

Misra, B.K., Singh, B.D. & Anand-Prakash – Biopetrographic approach to the spontaneous combustion susceptibility of Indian Gondwana coals with reference to some coals of Raniganj and Singrauli coalfields. *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

Prasad, M. – Plant megafossils from Siwalik sediments of Koilabas, central Himalaya, Nepal and their impact on palaeoenvironment. *Palaeobotanist.*

Prasad, M. – Morphotaxonomical studies on angiospermous plant remains from the foot-hills of Kathgodam, north India. *Phytomorphology.*

Rajanikanth, A. – Palaeobotany and stratigraphic implication of Mesozoic "Gondwana" sediments of Pranhita-Godavari Graben. *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

Rajanikanth, A. & Prakash, N. – Indian Gondwana : Annotated Synopses - Mesozoic megaplants. *B.S.I.P.,* Lucknow.

Ram-Awatar – Palynostratigraphy of Supra-Barakar sediments (Pali, Tiki and Parsora formations) and their stratigraphic positions in South Rewa Basin, Madhya Pradesh, India. *Proc. 9th Int. Gondw. Symp.,* Hyderabad.

Rao, M.R. – Fungal remains from Tertiary sediments of Kerala Basin, India. *Geophytology.*

Saini, D.C. – Rhynchosia pyramidalis (Lam.) Urb. (Fabaceae) : A new record for India. *Proc. natn. Acad. Sci. India.*

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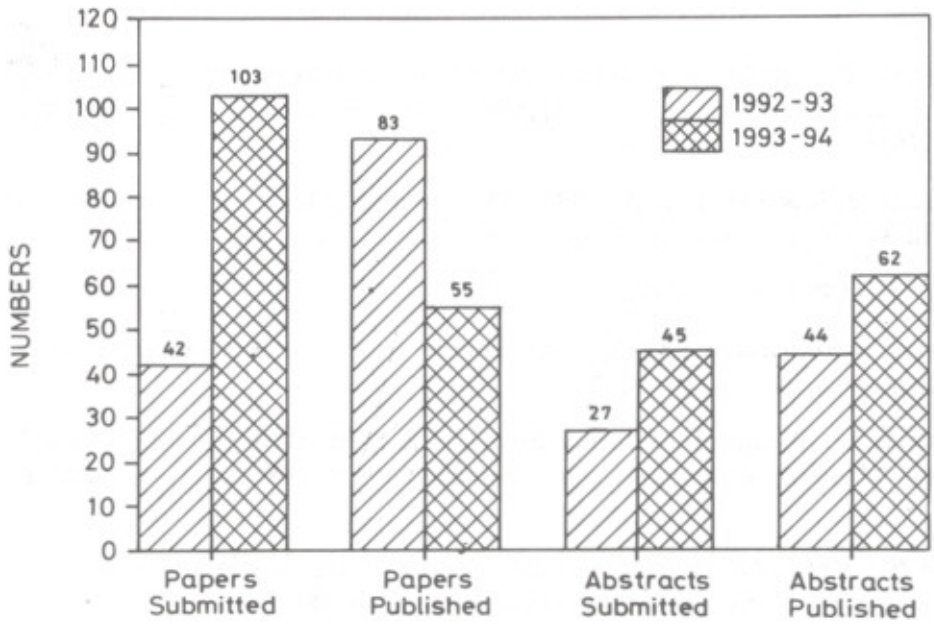

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Field Excursions

K. Ambwani

Collection of the polleniferous material of modern palms was carried out from south India.

K. Ambwani & R.S. Singh

A field excursion to Rajasthan was undertaken to collect the Tertiary sediments for palynological investigation from different localities.

J.S. Antal

An excursion was undertaken for collection of plant megafossils from the Siwalik sediments of Darjeeling District, West Bengal.

N. Awasthi

An excursion was undertaken to Kasauli, Dharampur, Kumar Hatti and Barog in Solan District, Himachal Pradesh and collected leaf-impressions from Kasauli beds.

N. Awasthi & J.S. Guleria

Visited Forest Research Institute, Dehradun for consultation of their Xylarium and Herbarium.

A.P. Bhattacharyya

An excursion to collect Permian sediments from Oodlabari and adjacent areas in Darjeeling District, West Bengal was undertaken.

S.K. Bera

Undertook an excursion to Dokriani Glacier, Uttarkashi in collaboration with WIHG, Dehradun and collected 55 samples (moss cushion, surface soil, snow and ice) alongwith 3 soil profiles (1.0 m each). Besides, petriplates were also exposed to study the aerospora in the region.

A. Chandra

Visited Chandigarh for EDX of Andaman and Nicobar samples at the Geology Department of Punjab University. Besides, an excursion on Chandigarh-Simla Road was undertaken and rock samples from Dagshai, Subathu and Kasauli formations were collected from Chakki Ka Moore-Koti Bridge section along Koshali Nala for examining the presence of siliceous microfossils.

M.S. Chauhan

Undertook a field excursion to Spiti Valley, Himachal Pradesh in collaboration with Wadia Institute of Himalayan Geology, Dehradun and collected 24 surface samples (moss cushions, soil samples) and 9 soil profiles from different potential sites for pollen analytical investigation in the region.

R. Garg & Khowaja-Ateequzzaman

Participated in the post-conference Field Excursion to Type Maastrichtian, ENCL Quarry, and Cretaceous-Tertiary boundary sequence, Curfs Quarry, near Maastricht, south of Holland.

Areas visited by scientists to collect research material during 1993-94.

A sampling site at Dangmal in Mahanadi Delta, Orissa.

J.S. Guleria

Undertook a field excursion for Rajasthan, Gujarat and Peram Island and collected a large number of plant fossils from various Tertiary localities.

J.S. Guleria, M. Kumar & B. Sekar

Undertook a field excursion for geobotanical work in zinc rich Zawar mines near Udaipur and visited Geobotany Laboratory of the Mohanlal Sukhadia University, Udaipur.

H.P. Gupta, A. Khandelwal, R.R. Yadav & D. Kohli

Undertook field excursion to Mahanadi-Baitarni delta, Orissa and visited northern flank of Chilka Lake and Bhitarkanika Reserve mangrove forest. Collected surface samples, polleniferous material from mangrove plants and 2 soil profiles one each from Dangmal from near Baitarni Delta and Bhuwania, north-western flank of Chilka Lake.

Collected three profiles of approximately 300 m each from Sadanandpur, Bhagwanpur and Erbang in Mahanadi Delta — courtesy Professer N.K. Mahalik, Department of Geology, Utkal University, Bhubaneshwar, Orissa.

R.K. Kar

A field excursion was undertaken in Tripura and Assam and collected palynological samples.

Visited Rajasthan and collected a number of palynological samples.

Tamir cliff contact of Bijori and Pachmarhi Formation, Madhya Pradesh.

Permian - Triassic contact exposed along road cutting section about 4 km south-east of Lingti Guest House in Spiti Himalaya.

P. Kumar

Collected rock samples from Delakheri to Sangakhera, Tamia and Tura Nagar in Satpura Basin, Madhya Pradesh.

P.K. Maithy

Visited Bhima Basin to collect samples from Halkal Formation (? Precambrian-Cambrian transition) — IGCP 303.

A field excursion was undertaken to study the Terminal Proterozoic - Cambrian succession exposed in Garhwal syncline (IGCP 303).

P.K. Maithy & R. Babu

Collected samples from the Vindhyan Supergroup exposed around Satna, Rewa and Maihar (including palynological and trace fossils).

Ram-Awatar

Collected outcrop samples from Mandaksa Nala, Ganmachidum Hill, Kunzum-

Stratigraphic section of Ruksho Formation (Yogma Member), Kargil District, Laddakh.

Takcha and Lalung Road sections and other areas of Spiti Valley, Tethyan Himalaya, Himachal Pradesh.

D.C. Saini

Collected about 800 plant specimens, 150 samples of polleniferous material and seeds-fruits of about 15 species from Oodlabari, Darjeeling District and Jaldhaka Range of Jalpaiguri District in West Bengal.

Collected about 1,000 plant specimens, seeds and fruits of about 20 species from Nichlaul Forest, Maharajgunj District in Uttar Pradesh.

K.S. Saraswat

Collected plant remains from the archaeological excavations at ancient Imlidih-Khurd, Gorakhpur District, Uttar Pradesh.

Collected plant remains from the archaeological excavations at ancient Kunal, Hisar District, Haryana.

S. Sarkar

A field trip was undertaken in Bhalubong and Rehar areas of Nepal and stratigraphically located Siwalik samples were collected.

R.K. Saxena & S. Sarkar

A field trip was undertaken in the Kargil and its adjoining areas of Ladakh for collecting Kargil Molasse deposits. Samples were collected from Yogma, Pashkyum, Titismik and Kargil stratigraphic sections.

M. Shukla & M. Sharma

Systematic sampling of chert and stromatolites from Kaladgi and Bhima basins was carried out.

A.K. Srivastava, R. Tewari & S.M. Singh

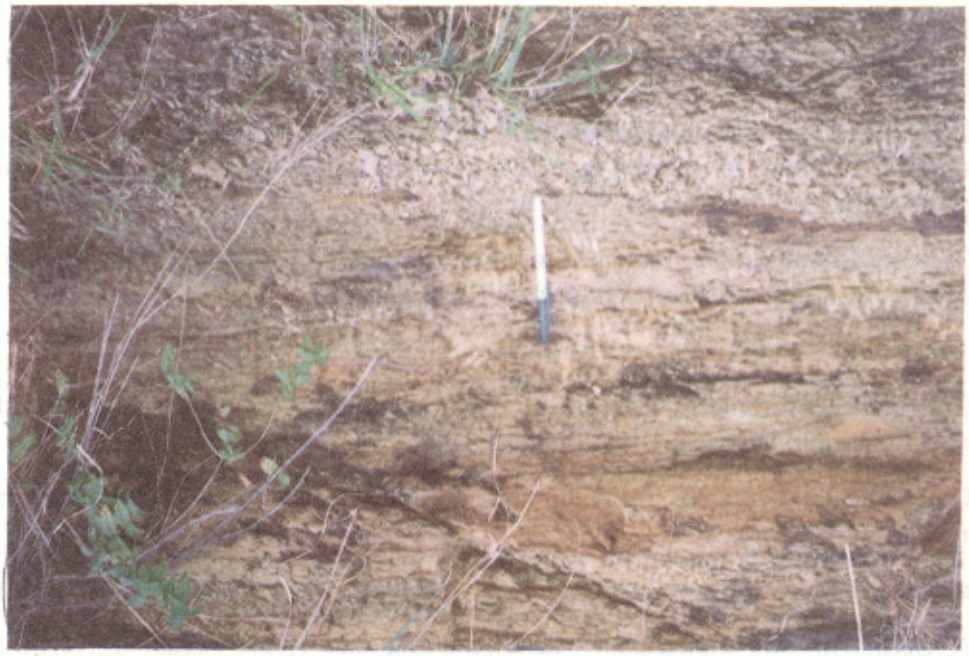
A field excursion was undertaken to collect plant fossils from different localities of Daltonganj, Hutar, Auranga, North Karanpura, South Karanpura and Jharia coalfields.

Suresh C. Srivastava & R. Kar

An excursion was undertaken to Tatapani-Ramkola Coalfield, Surguja District, Madhya Pradesh for collection of Gondwana sediments for palynological studies.

R.S. Tiwari

After the "Non-marine Triassic Stratigraphy Symposium" held at Albuquerque



Estheriid-bearing horizon in Lower Panchet sediments exposed in Machkandajhor, Raniganj Coalfield, Damodar Basin.

in November, 1993 a field trip was undertaken to various Palaeozoic-Mesozoic localities in New Mexico, USA, including the Petrified Forest of Arizona. Carboniferous and Permian localities near Freiberg, Germany were also visited.

R.S. Tiwari, A. Tripathi & Vijaya

Visited areas in south of Damodar River and Ajay River section in Damodar Basin (AT & V) for the collection of material from outcrop sections and the bore-cores.

A. Tripathi & Vijaya

During the field excursion in Pachwara Coalfield, Rajmahal Basin a petrified branched stem (about 12 ft long) has been found lying along the bedding plane *in situ*, in ferruginous pebbly sandstone exposed on the left bank of Bansloi River near Kharikasol Village.

A. Tripathi & Vijaya

Visited Pachwara Coalfield, Rajmahal Basin for the collection of palynological samples from subsurface and outcrop sections.

R.R. Yadav & A. Bhattacharyya

Ninety five tree cores of *Picea smithiana, Abies pindrow, Cedrus deodara* and *Juniperus* sp. were collected from Dodital and Agora in Uttarkashi, Uttar Pradesh Himalaya.

Deputation/Training/Study/Visit Abroad/in Country

Rahul Garg

After attending the *International Conference DINO5,* Zeist, visited the Laboratory of Palaeobotany and Palynology (LPP Foundation), University of Utrecht, The Netherlands in April, 1993.

Khowaja-Ateequzzaman

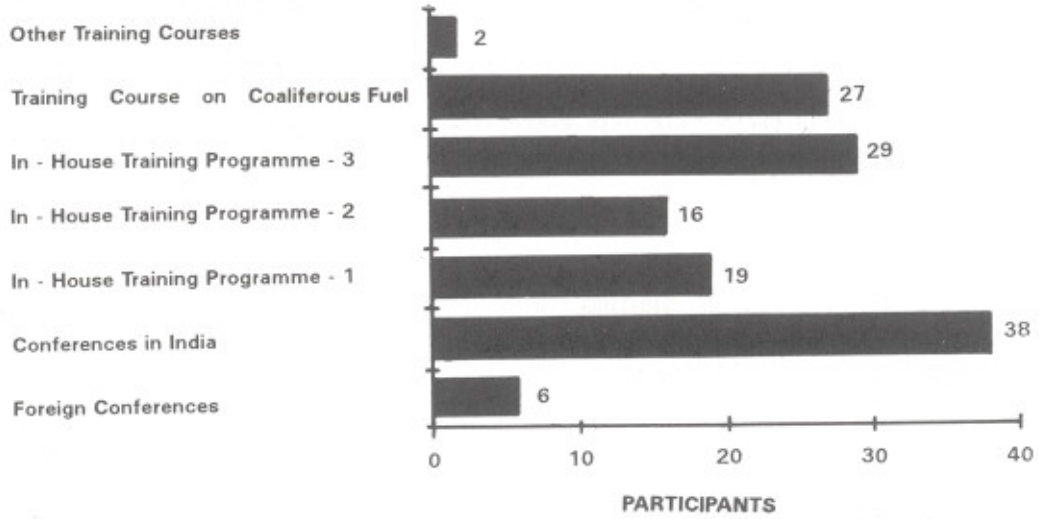
After attending the *International Conference DINO5,* Zeist, visited the Laboratory of Palaeobotany and Palynology (LPP Foundation), University of Utrecht, The Netherlands. Also visited the Micropalaeontology Laboratory, British Museum (Natural History), London, England in April-May, 1993 .

Archana Tripathi

Before and after the *XV International Botanical Congress,* Yokohama, visited Museum and Botanical Garden at Yokohama, Japan during August 26-27 and September 4, 1993.

Kavita Kumar

Deputed for short term course *"Computer Application to Library and Information Activities"* conducted by INSDOC, New Delhi from September 13 - October 15, 1993.



Deputation in conferences/training courses during 1993-94.

R.S. Tiwari

After attending the *Non-marine Triassic Symposium,* Albuquerque, visited Tuscon University, U.S.A. from October 24-31, 1993, thereafter the Palaeobotanical Department of Senkenberg Museum, Frankfurt, and the Geology Department, University of Freiberg, Germany from November 1-8, 1993.

S.K. Bera

Deputed for *"Dokriani Bamak Glacier Expedition"*, Uttarkashi (sponsored by DST and organised by WIHG, Dehradun) from October 22 - November 21, 1993.

P.K. Maithy & R.K. Kar

Attended DST sponsored *"Project Monitoring Committee"* meeting held at Chandigarh from December 8-10, 1993.

P.K. Maithy & M. Sharma

Attended a field Workshop *"Terminal Proterozoic and Lower Cambrian in India"*, organised by Palaeontological Society of India at Dehradun, January 2-8, 1994.

H.P. Gupta & D. Kohli

Attended *"5th DST Group monitoring Workshop on Earth Sciences"* held at Cochin from January 18-20, 1994.

Kamal Narang

"Professional Series Programme on UNIX and UNIFY" held at Prosix Softron (P) Ltd., Lucknow from February 7-12, 1994.

Deputation to Conferences/Symposia/ Seminars/Workshops

Rahul Garg **Khowaja-Ateequzzaman**	• *"5th International Conference on Modern and fossil dinoflagellates (DINO5)"* held at Zeist, The Netherlands from April 18-24, 1993.
C.M. Nautiyal	• *"National Symposium on International Geosphere Bio sphere Programme"* held at Madras from April 21-24,1993.
	• *"6th National Symposium on Mass Spectrometry"* held at Dehradun from October 11-13, 1993.
Shaila Chandra **Shyam C. Srivastava** **Archana Tripathi**	• *"15th International Botanical Congress"* held at Yokohama, Japan from August 28 - September 3, 1993.
G. Rajagopalan	• *"Workshop on Kodungallur - A geoscientific approach"* held at Thiruvananthapuram on September 14, 1993 (Financial support was provided by organizers).
R.S. Tiwari	• *"Nonmarine Triassic Symposium"* held at Albuquerque, New Mexico from October 17- 24, 1993.
Pramod Kumar **S.K.M. Tripathi** **R.C. Mehrotra** **Madhav Kumar** **M.S. Chauhan**	• *"16th Indian Botanical Conference"* held at Jabalpur from December 3-5, 1993.
Chanchala Srivastava	*"Annual Archaeological Conference"* held at Bareilly from December 4-6, 1993.
Shaila Chandra **Shyam C. Srivastava** **A.K. Srivastava** **H.A. Khan** **S.K. Bera** **O.S. Sarate** **Rashmi Srivastava** **B.D. Mandaokar**	• *"Conference on Recent trends in Botany"* held at Amravati from December 6-8, 1993 (scientists received total financial support from organizers).

R.S. Tiwari **Anand Prakash** **Manoj Shukla**	• *DST Sponsored Brain Storming Session on "Palaeobiochemistry"* held at Chandigarh from December 9-10, 1993 (scientists received total financial support from organizers).
K. Ambwani **D. Pradhan**	• *"81st Session, Indian Science Congress Association"* held at Jaipur from January 3-8, 1994.
All the Scientific Staff of B.S.I.P.	• Group Discussion *"Contribution of Palaeobotany to Gondwana Geology"* held at B.S.I.P., Lucknow from January 6-7, 1994.
R.S. Tiwari **H.K. Maheshwari** **Suresh C. Srivastava** **Anand-Prakash** **S.A. Jafar** **Jayasri Banerji** **A.K. Srivastava** **G.P. Srivastava** **Pramod Kumar** **Archana Tripathi** **Vijaya** **B.K. Misra** **Neerja Jha** **Ram-Awatar** **A. Rajanikanth** **Rajni Tewari** **B.D. Singh** **K.J. Singh** **A.P. Bhattacharyya** **Neeru Prakash** **P.K. Bajpai**	• *"9th International Symposium on Gondwana Geology, Geophysics and Mineral Resources"* held at Hyderabad from January 10-14, 1994.
G. Rajagopalan **Chhaya Sharma** **Asha Khandelwal** **R.R. Yadav** **A. Bhattacharyya**	• *"Regional Consultations on Biodiversity"* held at State Forest Department, Lucknow from January 19-20, 1994.
P.K. Maithy	• *"14th Indian Colloquium on Micropalaeontology and Stratigraphy"* held at Madras from March 16-18, 1994.
B. Sekar	• *"National Symposium on Applied Geochemistry"* held at Madras from March 23-25, 1994.

Papers pr esented at Conferences/ Symposia/Meetings

Ambwani, K. & Kar, R.K. – Volcanic effect on the plant tissues with particular reference to middle lamella. *81st Session, Indian Sci. Congr. Assoc.,* Jaipur, January 1994.

Anand-Prakash – Degradation, preservation and rank of organic matter in the sediments. *Brain Storming Session on Palaeobiochemistry,* Chandigarh, December 1993.

Anand-Prakash – Genesis of Gondwana coals of India : A petrological approach. Group Discussion - Contribution of Palaeobotany to Gondwana Geology, B.S.I.P., Lucknow, January 1994.

Anand-Prakash, Misra, B.K. & Singh, B.D. – Fluorescence microscopy in the evaluation of Indian Gondwana coals. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Bajpai, U., Kapoor, H.M. & Maheshwari, H.K. – Late Palaeozoic floral succession in the Perigondwana. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Banerji, J. – Upper Gondwana megafloral succession of Rajmahal Basin. *9th Int. Gondw.*

Symp., Hyderabad, January 1994.

Banerji, J. – Megafloristic evidences for the age of Rajmahal Formation. *Group Discussion - Contributions of Palaeobotany to Gondwana Geology,* B.S.I.P., January 1994.

Bera, S.K. & Gupta, H.P. – Pollen rain at Dokriani Glacier (Bamak), Uttarkashi, U.P. *"Conf. Recent trends in Botany",* Amravati, December 1993.

Bhattacharyya, A. & Yadav, R.R. – Tree ring data : A clue to study biodiversity in time and space in the Himalayas. *Reg. Consult. on Biodiversity,* Lucknow, January 1994.

Chandra, S. – Discovery of bryophytic remains from the Early Permian beds of India. *XV Int. bot. Congr.,* Yokohama, August-September 1993.

Chandra, S. – Four decades of Lower Gondwana palaeobotany. *Conf. Recent trends in Botany,* Amravati, December 1993.

Chandra, S.– Early development of the Glossopteris flora and the age of Talchir

Formation. *Group Discussion - Contributions of palaeobotany to Gondwana Geology,* B.S.I.P., January 1994.

Chauhan, M.S. – Origin and history of tropical deciduous Sal (*Shorea robusta*) forests in Madhya Pradesh. *16th Indian bot. Conf.,* Jabalpur, December 1993.

Garg, R. & Jain, K.P. – Dinoflagellate cysts and calcareous nannoplankton across K/T boundary event at Umshoryngkew River, Meghalaya, India. *V Int. Conf. Modern & fossil dinoflagellates* (*DINO5*), Zeist, The Netherlands, April 1993.

Jafar, S.A. & Kar, R.K. – Glossopteris flora : A case for wetland mangrove vegetation?

9th Int. Gondw. Symp., Hyderabad, January 1994.

Jha, N. & Srivastava, Suresh C. – Kamthi Formation : Palynofloral diversity. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Khan, H.A. – Pollen morphology of some plants of Silent Valley, Kerala, India (part-II) - Acanthaceae. *Conf. Recent trends in Botany,* Amravati, December 1993.

Khandelwal, A. & Gupta, H.P. – Uttar Pradesh : Floral diversity during Holocene Period (10,000 yrs B.P.) and changing environmental scenario. *Reg. Consult. Biodiversity,* Lucknow, January 1994.

Khowaja-Ateequzzaman – Dinoflagellate cyst biostratigraphy and palaeoenvironment of Trichinopoly Formation with remarks on Albian-Turonian bioevents, Cauvery Basin, India. *V Int. Conf. Modern & fossil dinoflagellates (DINO 5),* Zeist, The Netherlands, April 1993.

Kumar, M. – Morphology and phylogeny of some angiosperm pollen from the Tertiary sediments of India. *16th Indian bot. Conf.,* Jabalpur, December 1993.

Kumar, P. – The present and the past pterophytes of Satpura Basin : A sporological approach. *16th Indian bot. Conf.,* Jabalpur, December 1993.

Kumar, P. – The Jabalpur Formation of the Satpura Basin : Palynology and palaeoclimate. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Maithy, P.K. & Babu, R. – *Blainella* gen. nov. : a new record of cyanophycean remain from the Late Neoproterozoic sequence, Mussorie Syncline. *XIV Indian Colloq. Micropaleontol. Stratigr.,* Madras, March 1994.

Mandaokar, B.D. – Palynology of coal-bearing sediments of Tikak Parbat Formation from Dilli Colliery (Dilli Jeypore Coalfield), Assam, India. *Conf. Recent trends in Botany,* Amravati, December 1993.

Mehrotra, R.C. – Status of gymnosperms in the Tertiary flora of India. *16th Indian bot. Conf.,* Jabalpur, December 1993.

Misra, B.K., Singh, B.D. & Anand-Prakash – Biopetrographic approach to spontaneous combustion susceptibility of Indian Gondwana coals : A case study from Raniganj and Singrauli coalfields. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Rajagopalan, G. – C-14 dating of Kodungallur samples. *Workshop on Kodungallur – A geoscientific approach,* Thiruvananthapuram, September 1993.

Rajanikanth, A. – Palaeobotany and stratigraphic implications of Mesozoic "Gondwana" sediments of Pranhita-Godavari Graben. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Ram-Awatar – Palynostratigraphic studies of Supra-Barakar sediments in South Rewa Gondwana Basin, Madhya Pradesh, India. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Sarate, O.S. –Petrological study of coals from Mulug coal belt, Godavari Graben, Andhra Pradesh. *Conf. Recent trends in Botany,* Amravati, December 1993.

Sarate, O.S. – Quality and rank assessment of Ramagundam coals, Godavari Graben, Andhra Pradesh. *Conf. Recent trends in Botany,* Amravati, December 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 climate during Late-Pleistocene. *Nat. Symp. Applied Geochem.,* Madras, March 1994.

Sharma, C. & Chauhan, M.S. – Vegetation and related climate in Kumaon Himalaya during Late Quaternary Period. *Reg. Consult. Biodiversity,* Lucknow, January 1994.

Shukla, M. – Scope of palaeobiochemistry in Precambrian. *Brain Storming Session on Palaeobiochemistry,* Chandigarh, December 1993.

Singh, K.J. & Chandra, S. - Further observations on the genus *Senotheca* Banerjee. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Srivastava, A.K. – Morphological and evolutionary significance of the Glossopteris flora. *Conf. Recent trends in Botany,* Amravati, December 1993.

Srivastava, A.K. – Morphological and stratigraphical significance of the Glossopteris flora. *Group Discussion - Contribution of Palaeobotany to Gondwana Geology,* B.S.I.P., January 1994.

Srivastava, A.K. – Plant / animal relationship in the Gondwana Supergroup of India. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Srivastava, C. – Ancient plant economy at Manjhi, Saran District, Bihar (Ca. 250 B.C. to 250 A.D.). *Annual Archaeol. Conf.,* Bareilly, December 1993.

Srivastava, R. & Awasthi, N. – Carbonised woods of Sterculiaceae and Sapindaceae from the Miocene sediments of Kerala Coast. *Conf. Recent trends in Botany,* Amravati, December 1993.

Srivastava, Shyam C. – Reconstruction and affiliation of two hundred million years old seeds from India. *XV Int. bot. Congr.,* Yokohama, Japan, August-September 1993.

Srivastava, Shyam C. – Palaeofloral study of Indian Triassic : Impact on Gondwana geology. *Group Discussion : Contribution of Palaeobotany to Gondwana Geology,* B.S.I.P., January 1994.

Srivastava, Shyam C. & Prakash, N. – A sporophyllous structure from the Triassic (Nidpur beds) of Gondwana. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Srivastava, Suresh C. – Palynoevents in Permian sequence of Arunachal Pradesh. *Group Discussion : Contribution of Palaeobotany to Gondwana Geology,* B.S.I.P., January 1994.

Srivastava, Suresh C. & Bhattacharyya, A.P. – Palynofloral succession from Permian sediments in West Siang District, Arunachal Pradesh, India. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Tewari, R. – Palaeobotanical investigations of Raniganj Formation of Jharia Coalfield. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Tiwari, R.S. – Evolutionary shifts in Triassic palynofloras and palynoevents stratigraphy. *Nonmarine Triassic Symp.,* Albuquerque, October 1993.

Tiwari, R.S. – Scope, application and current status of palaeobiochemistry. *Brain Storming Session on Palaeobiochemistry,* Chandigarh, December 1993.

Tiwari, R.S. -– Palynoevent stratigraphy in Gondwana sequence of India. *9th Int. Gondw. Symp.*, Hyderabad, January 1994.

Tripathi, A. – Major palynological events vis a vis development of Glossopteris flora through Lower Gondwana of India. *XV Int. bot. Congr.,* Yokohama, Japan, August-September 1993.

Tripathi, A. – Early angiosperm pollen, palynological assemblages and absolute age relationship of Intertrappean beds in Rajmahal Basin, India. *Group Discussion : Contribution of Palaeobotany to Gondwana Geology,* B.S.I.P., January 1994.

Tripathi, A. – Palynostratigraphic zonation of Upper Permian Coal Measures on Peninsular India. *9th Int. Gondw. Symp.,* Hyderabad, January 1994.

Tripathi, S.K.M. – On geological distribution and botanical relationship of some Tertiary angiosperm pollen. *16th Indian bot. Conf.,* Jabalpur, December 1993.

Vijaya – Permian-Triassic boundary in peninsular India. *Group Discussion - Contribution of Palaeobotany to Gondwana Geology,* B.S.I.P., January 1994.

Vijaya – Advent of Gondwana deposits on Indian peninsula : A palynological reflection and relationship. *9th Int. Gondw. Symp.*, Hyderabad, January 1994.

Yadav, R.R. & Gupta, H.P. – Phytodiversity in Rajasthan since 10,000 yrs B.P. and possible remedial measure of heathland management. *Reg. Consult. Biodiversity,* Lucknow, January 1994.

Lectures Delivered

By Institute's scientists

N. Awasthi

- *"Early history and origin of angiosperms"*. U.G.C. sponsored Refresher Course in Botany for college and university teachers, Department of Botany, Lucknow University, Lucknow.

S.A. Jafar

- *"Calcareous nannofossil/palynofossil data and its bearing on the evolution of Andaman-Nicobar Basin, India"* at B.S.I.P., Lucknow.

C.M. Nautiyal

- *"Past global changes - Rapporteurs's presentation on the session by the same name"*, National Symposium on IGBP at Anna University, Madras.
- Radio talks on *"Weather change"* and Group discussion on *"Environmental change : concern for the future"* for AIR, Lucknow.

G. Rajagopalan

- *"Radiocarbon dating method and its applications to the study of vegetational changes and climatic inferences"*, IX U.G.C. sponsored Refresher Course in Botany for university and college teachers at Botany Department, Lucknow University, Lucknow.
- *"Dating methods for geological samples"*, A series of 4 lectures at Geology Department, Lucknow University, Lucknow.
- *"Radioisotope dating methods useful for palaeoclimatic studies"* and *"Isotopic and geochemical approaches to the study of palaeoclimate"*, SERC School on Geomagnetism & Earth's interior at University of Bombay, Bombay.

A. Rajanikanth

- *"Plant evolution"* Science Day Lecture Series at Dabbler's Public School, Indira Nagar, Lucknow.

M. Sharma

- *"Origin of life and early biosphere"*, National Science Day Lecture Series at B.S.I.P., Lucknow.

Alpana Singh

- *"Women scientists of India"*, National Science Day Lecture Series at B.S.I.P., Lucknow.

R.S. Tiwari

- *"Permian/Triassic boundary in India"*, Department of Geology, Freiberg University, Freiberg, Germany.
- *"Inaugural Lecture"*, Children Science Congress Work shop, Regional Science Centre, Lucknow
- *"Palynoevent stratigraphy in Gondwana Sequence of India"*, Key Note Lecture, 9th International Gondwana Symposium, Hyderabad.
- *"Vigyan : Nai Kshitiz Nai Dishayen"*, Group Discussion telecast by Doordarshan Kendra, Lucknow.
- *"Story of plant fossils"*, Valedictory Lecture, National Science Day function, Regional Science Centre, Lucknow.

By outside scientists in the Institute

Sri Ravi Shanker
- Deputy-Director General, Geological Survey of India (Northern Region), Lucknow, *"Event Stratigraphy of Himalaya"* on May 14, 1993.

Sri K. Krishnanunni
- Deputy-Director General, Geological Survey of India (Northern Region), Lucknow. *"Geological Information Systems - A case study of Project Vasundhara"* on May 28, 1993.

Dr T.R. Venkatesan
- Physical Research Laboratory, Ahmedabad, *"The Chronology of Deccan Traps"* on October 18, 1993.

Dr John F. Rigby
- Brisbane, Australia, *"Implications of the Permian flora of the Prince Charles Mountains, East Antarctica"* on January 21, 1994.

Professor Y.D. Tiagi
- Ex-Professor of Botany, Udaipur, *"Geobotany and biogeochemistry and their utility in mineral exploration"* on January 25, 1994.

Honours and Awards

H.P. Gupta
D. Kohli

- Recipient of Third Prize from Kendriya Sachiwalaya Hindi Parishad, New Delhi for scientific article in Hindi entitled *"Chilka Jheel - bigarta paryavarniya swarup evam astitva per prashna chinha"* in 15th Akhil Bhartiya Hindi Vaigyanik Evam Takniki Lekh Pratiyogita.

H.A. Khan

- Presided the Plenary Session of the *Conference on Recent trends in Botany,* Amravati.

H.K. Maheshwari

- Sessional Chairman, *9th International Symposium on Gondwana Geology, Geophysics and Mineral Resources,* Hyderabad.

P.K. Maithy

- Sessional Chairman, IV Session-Palynology, *14th Indian Colloquium Micropalaeontology and Stratigraphy, Madras.*

C.M. Nautiyal

- Chaired two scientific presentation sessions at *National Children's Science Congress,* New Delhi.

Rashmi Srivastava

- Awarded Prashasti Patra from Kendriya Sachiwalaya Hindi Parishad, New Delhi for scientific article in Hindi entitled*"Bhartiya vano ka udbhava evam vikas Puravanaspatik vishleshan"* in 15th Akhil Bhartiya Hindi Vaigyanik evam Takniki Lekh Pratiyogita.

Shyam C. Srivastava

- Co-chaired the Symposium *Evolution of pteridophytes and gymnosperms : Integrating fossil evidence.* XV International Botanical Congress, Yokohama.
- Conferred upon a "Momento" by Amravati University during *Conference on Recent Trends in Botany*, Amravati and invited to release a volume Souvenir-AMUNI during inauguration of Conference.
- Chaired Valedictory Session, Conference *on Recent trends in Botany,* Amravati.

R.S. Tiwari

- Chief Guest, *Children Science Congress Workshop* at Regional Science Centre, Lucknow
- Sessional Chairman, Technical Session I, *Brain Storming Session on "Palaeobiochemistry"*, organised by DST at Chandigarh.

- Sessional Chairman, *9th International Symposium on Gondwana Geology, Geophysics and Mineral Resources,* Hyderabad.
- Presided the Valedictory and Prize Distribution functions on National Science Day, Regional ScienceCentre,Lucknow

Vijaya

- Elected Fellow, Geological Association & Research Centre, India.

Representation in Committees/Boards

Anand-Prakash	• Treasurer, Indian Association of Palynostratigraphers
	• Treasurer, The Palaeobotanical Society, Lucknow
N. Awasthi	• Chief Editor, *'Geophytology'*
Usha Bajpai	• Member, Managing Council, Indian Association of Palynostratigraphers
	• Member, Executive Council, The Palaeobotanical Society, Lucknow
Anil Chandra	• Member, Executive Council, The Palaeontological Society, Lucknow
	• Editor, *'Geophytology'*
Shaila Chandra	• Vice-President, Indian Society of Geoscientists
H.P. Gupta	• Business Manager, Indian Association of Palynostratigraphers
S.A. Jafar	• Organizing Secretary, Lucknow Chapter, Zaheer Science Foundation, New Delhi
K.P. Jain	• Secretary, Indian Association of Palynostratigraphers
	• Member, Executive Committee, The Palaeobotanical Society, Lucknow.
	• Editor, *'The Palaeobotanist'*
R.K. Kar	• Founder Member, Indian National Earth Science Academy
H.A. Khan	• Editor, *'Indian Journal of Bio-Research'*
Asha Khandelwal	• Member, Executive Council, Indian Aerobiological Society
Hari K. Maheshwari	• Member, Committee for Fossil Plants, International Association of Plant Taxonomy
	• Member, Editorial Board, *'The Palaeobotanist'*
	• Editor, Indian Association of Palynostratigraphers
P.K. Maithy	• Editor, Editorial Board, *'The Palaeobotanist'*
	• Member, Editorial Board, *'Geoviews'*

B.K. Misra	• Joint Secretary, Indian Society of Geoscientists
C.M. Nautiyal	• Member, Steering Committee, Science Festival, Regional Science Centre, Lucknow
	• General Secretary, Co-ordination Committee - 1993 (UP) for National Children's Science Congress.
G. Rajagopalan	• Member, National Organising Committee, Nuclear Track Society of India, Calcutta
	• Member, Academic Committee of School of Archaeological Dating, Jadavpur University
A. Rajanikanth	• Joint Secretary, The Palaeobotanical Society, Lucknow
Rakesh Saxena	• Associate Member, International Committee for Coal Petrology
R.K. Saxena	• Secretary, Indian Society of Geoscientists
	• Member, Editorial Board, *'Indian Society of Geoscientists Bulletin'*
Chhaya Sharma	• Member, Felicitation Committee for UNESCO ICCROM Award
Manoj Shukla	• Member, Executive Committee, The Palaeobotanical Society, Lucknow
A.K. Srivastava	• Member, Advisory Board, *'Journal Neo Botanica'*
	• Member, Editorial Board, *'Indian Society of Geoscientists Bulletin'*
	• Treasurer, Indian Society of Geoscientists
	• Corresponding Member, Botanical Society of China
	• Member, Latin American Association of Palaeobotany and Palynology
Shyam C. Srivastava	• Member, International Organization of Palaeobotany Medal Selection Committee
	• Honorary (Affiliate) Member, Palaeobotany Section, Botanica Society of America
R.S. Tiwari	• Chief Editor, *'The Palaeobotanist'*
	• Secretary, The Palaeobotanical Society, Lucknow

- Co-Editor, *'Asian Journal of Plant Sciences'*
- Member, Working Group, Non-marine Triassic Stratigraphy
- Member, National Organising Committee, 9th International Gondwana Symposium, Hyderabad
- Founder Member, International Society of Applied Biology
- Member, Editorial Board, *'Journal of Biological Memoirs'*
- Member, National Organising Committee, IV International Congress of Ethnobiology

Vijaya

- Editor, *'Geophytology'*
- Corresponding Member, Subcommission on Triassic Stratigraphy
- Voting Member, International Working Group on the Carboniferous/Permian Boundary

Doctoral Degree Awarded

Name	*University*	*Title of Thesis*
Mukund Sharma	Lucknow	Contribution to the Palaeobiology of Mesoproterozoic Vindhyan sediments of India

Training Courses/Programmes

A special training course on *"Coaliferous fuel resources of India : Parameters of studies in palynology and biodiagenesis"* was conducted at the Institute from December 13 - 20, 1993. This training course was inaugurated by Sri Ravi Shanker, Deputy-Director General, Geological Survey of India (Northern Region), Lucknow. The purpose of this effort was to take this rapidly expanding science from laboratory to the users; addressing the high potential utility of palynology and biodiagenesis in the exploration of coaliferous fuels and their utilization. This course was designed to cover all fundamental and applied aspects of studies in the light of latest researches and concepts. The following scientists of the Institute delivered lectures in this course:

R.S. Tiwari	*Introduction to the theme*
R.K. Kar	*Concepts, potential and prospects of palynology*
Anand-Prakash	*Coals and lignites of India*
	Organic petrology
S.K.M. Tripathi	*Techniques of palynological studies*
K. Ambwani	*Techniques of SEM studies*
Archana Tripathi	*Morphology of Palaeozoic and Mesozoic palynofossils*
R.K. Saxena	*Morphology of Tertiary palynotaxa*
	Biozonation, correlation and application in exploration
Vijaya	*Palynostratigraphy of Permian Period in India*
B.D. Singh	*Coal micro-constituents and their classification*
B.K. Misra	*Application of biopetrological studies in utilization and exploration of coal and lignite*
R.S. Tiwari	*Futuristic approach to the theme*

Each lecture was followed by the practical demonstrations, performed by respective speakers, with scientists (B.N. Jana, M.R. Rao, Neerja Jha, Ram-Awatar, Alpana Singh & Madhav Kumar) and technical personnel (H.N. Boral, Indra Goel, Chandra Pal & V.P. Singh) of the Institute.

A lecture on *Computer and its role in scientific studies* by Kamal Narang was also delivered in this course. Besides, data processing, preparation of charts, diagrams,

etc., using computer was (K. Narang & R. Nandhagopal) also demonstrated to the participants.

The course ended with a "Scientific Discussion" session under the supervision of the Director, Dr R.S. Tiwari. The scientists participated in the discussion were R.K. Kar, Suresh C. Srivastava, Anand-Prakash and R.K. Saxena.

Participants from the following universities/organizations attended the course:

Birla Sugar Girls College, Porbander (Gujarat)

Geology Department, Bangalore University, Bangalore

Botany Department, Bangalore University, Bangalore

Department of Applied Geology, Dibrugarh University, Dibrugarh

Botany Department, P.G. College of Science, Saifabad, Hyderabad

Geology Department, University of Jammu, Jammu

Geology Department, Lucknow University, Lucknow

Geology Department, A.C. College Campus, University of Madras, Madras

Department of Applied Geology, University of Madras, Madras

Geology Department, Ranchi University, Ranchi

Central Fuel Research Institute, Dhanbad

Central Mine Planning & Design Institute, Ranchi

North-Eastern Hill University, Shillong, Meghalaya

Geology Department, Vikram University, Ujjain

Botany Department, Narain P.G. College, Shikohabad

J.R.F. (Sponsored Project), Birbal Sahni Institute of Palaeobotany

Birbal Sahni Research Scholars, Birbal Sahni Institute of Palaeobotany

In-House Training Programme

An In-House Training Programme-1 for *"Computer Training Course"* was organised under the supervision of Dr G. Rajagopalan from April 12 to May 31, 1993 to prepare a computer literate generation at the Institute. This training had two modules — the Basic Module and the Advanced Module, covering (i) Computer Fundamentals,

(ii) Disk Operating System, (iii) Word Processor, (iv) Data Base Management System, and (v) Electronic Spreadsheet. These courses were specifically prepared (with a series of lectures and practical demonstrations) for easy understanding of the computer concepts and its efficient use. Lectures were given by Kamal Narang and he was assisted by R. Nandhagopal during hands-on practical training.

Following members of staff deputed from Scientific, Technical and Administrative cadres underwent the training course :

S.K.M. Tripathi
R. Babu
Alpana Singh
Jyotsana Rai
Asha Gupta
Rashmi Srivastava
A.P. Bhattacharyya
Neeru Prakash
G.K. Trivedi
Indra Goel
V.K. Singh
Chandra Pal
Reeta Banerji
A.K. Srivastava
Kavita Kumar
R.K. Kapoor
Ruchita Chatterji
P. Thomas
Koshy Thomas

An In-House Training Programme - 2 ***"Angiosperm/non-angiosperm pollen morphology and allied aspects"*** was organised under the guidance of Dr H.P. Gupta from July 19-27, 1993 with a view to generate scientific discussion and to resolve several issues concerning this important aspect of palynology. The programme was covered by a series of following lectures (as well as practical demonstrations) by scientists of the Department of Quaternary Biogeography and Archaeobotany :

H.P. Gupta	*Introduction : Terminology, definition and classification*
Chhaya Sharma	*Pollen morphology of primitive angiosperms : An emphasis on discrimination of angiospermic and non-angiospermic pollen/spores*
R.R. Yadav	*Ecological adaptations and pollen characters*
Asha Khandelwal	*Pollen morphology of monocots : An evaluation of pollen characters*
S.K. Bera & M.S. Chauhan	*Apertural distribution in dicots : An evaluation of pollen apertures*
A. Bhattacharyya	*Pollen types in gymnosperms and their allies in angiosperms*
Asha Gupta	*Spore types in Bryophytes and Pteridophytes*

The following members attended this In-House Training Course-2 :

Jayasri Banerji	Neerja Jha
Archana Tripathi	Alpana Singh
Vijaya	Ram-Awatar
J.P. Mandal	A. Rajanikanth
M.R. Rao	Madhav Kumar
S.K.M. Tripathi	B.D. Mandaokar
S. Sarkar	G.K. Trivedi
R.S. Singh	Madhavi Chakraborty

Another In-House Training Programme - 3 *"Basics of field work for palaeobotanical studies"* was organized under the supervision of Drs Anand-Prakash and Anil Chandra from October 4 - 15, 1993 with a view to generate awareness amongst scientists about the basic principles and concepts of field geology, which is an important aspect of our research activities. The programme was covered by following lectures (including tutorials and practical, wherever necessary) :

Anil Chandra	*Introduction to Geology*
	Plate/global tectonics
Anand-Prakash	*Basics of field work*
	Recognition of land forms and structural features
	Geological mapping
Rahul Garg	*Geological sections*
Manoj Shukla	*Section measurement*
R.K. Saxena	*Principles of stratigraphy*
S.A. Jafar	*Facies and sedimentary environments*
B.K. Misra	*Economic geology (fossil fuels)*

The following members attended this In-House Training Course-3 :

Jayasri Banerji	Madhav Kumar
G.P. Srivastava	B.D. Mandaokar
Usha Bajpai	R.C. Mehrotra
B.N. Jana	Neeru Prakash
Neerja Jha	Mahesh Prasad
Asha Khandelwal	A. Rajanikanth

J.P. Mandal	Ram-Awatar
M.R. Rao	O.S. Sarate
Archana Tripathi	Alpana Singh
S.K.M. Tripathi	Chanchala Srivastava
Vijaya	Rajni Tewari
S.K. Bera	G.K. Trivedi
M.S. Chauhan	Madhavi Chakraborty
Asha Gupta	E.G. Khare
Deepak Kohli	

All the courses proved to be a successfull endeavour.

Technical Assistance rendered to other Agencies

Assistance to agencies/universities/institutes

Coal Wing, Geological Survey of India, Calcutta

Mineral Exploration Corporation Limited, Nagpur

Indian Institute of Technology, Delhi

Oil and Natural Gas Commission, Western Region, Vadodara

Geology Department, Kumaon University, Nainital

Department of Botany, Allahabad University, Allahabad

Department of Botany, H.N.B. Garhwal University, Srinagar, Garhwal

Participants of Special Training Course, "Coaliferous fuel resources of India

Radiocarbon dating of samples :

Geological Survey of India, Lucknow

Physical Research Laboratory, Ahmedabad

Wadia Institute of Himalayan Geology, Dehradun

Kumaon University, Nainital

Indian Institute of Science, Bangalore

Dr T. Satyamurthy, Director, State Department of Archaeology, Thiruvananthapuram, Kerala

Prof. P.K. Banerji, Emeritus Scientist, CSIR, Jadavpur University, Calcutta
Mr. S.P. Jalote, Jai Prakash Industries, New Delhi

Publications of the Institute

The Palaeobotanist

Number 1 of Volume 42 of the Institute's journal was published during the year.

The manuscripts of remaining numbers 2 and 3 of Volume 42 were also edited and sent to Press for publication.

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 published.

Thirtyninth Sir Albert Charles Seward Memorial Lecture entitled *'Climatic changes over space and time and their repercussions on the vegetation'* delivered by Dr V.M. Meher-Homji, French Institute, Pondicherry was edited and sent for publication.

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

Part II of the Inventory of Type and figured specimens at the BSIP Repository was published, which comprises about 95 printed pages. Each entry in the Inventory furnishes the information on locality, stratigraphy, age, etc. of the specimens preserved at the Museum's Repository.

Indian Gondwana : Annotated Synopses

Two volumes, consisting of parts I to IV, of *Annotated Synopses of Abstracts* of papers published so far on Palynology, Biopetrology and Palaeobotany concerning the Indian Gondwana (Early Permian to late Lower Cretaceous) sequence were published and released at the occasion of 9th International Gondwana Symposium held at Hyderabad in January, 1994. Of the two volumes, Volume I comprises the Abstracts of papers on Palynology and Biopetrology, while Volume II contains the Abstracts on Permian and Mesozoic megaplants.

Annual Report

Annual Report of the Institute, both in Hindi and English, were published and sent to DST, various colleges, universities and institutions.

This year the publications of the Institute netted an income of Rs. 3,12,552.00, out of which about Rs. 1,36,878.00 were earned in foreign exchange which is approximately equivalent to US $ 4,591.00.

Library

The services of the library were also made available to scientists/teachers/ students of other organisations and universities. The total number of registered borrowers is 134. Sixty seven current periodicals are being procured on exchange basis and 79 current periodicals are subscribed by the library.

The holdings of the Library are as follows :

Particulars	Additions during 1993-1994	Total
Books	119	4,643
Journals	118	9,982
Reprints	458	34,696
Reference Books	1	189
Theses	–	83
Reports	–	46
Maps & Atlases	1	59
Microfilms/Fisches	–	294

Reprint Section

Reprints of research papers purchased	77
Reprints sent out in exchange	2,987
Institutions on exchange list	51
Individuals on exchange list	389
Professor Sahni's papers sent out	24
Institute publication sent out	17

Hindi is also being used in day-to-day working in the Library.

Library facility provided to

Department of Geology, University of Lucknow, Lucknow
Department of Botany, University of Lucknow, Lucknow
University College of Swansea, Wales, U.K.
Department of Botany, Garhwal University, Srinagar
Department of Botany, University of Allahabad, Allahabad
Department of Physics, Lucknow University, Lucknow

Participants of the Special Training Course – *Coaliferous fuel resources of India: Parameters of studies in palynology and biodiagenesis*

Computerisation of Library

The addresses of individual scientists as well as institutions in the exchange mailing list have been updated. About 300 records have been put on a Data Base created on UNIFY for testing the Dbase.

Herbarium

Inventory of Herbarium-holdings (seeds, fruits and wood- blocks) is being prepared. Rearrangement of pollen slides is in progress. During the year about 300 herbarium sheets were checked for their correct identity and about 400 plant specimens were mounted on herbarium sheets. This year about 300 plant specimens were identified and 200 sheets were registered.

The holdings of the herbarium material are as under :

Particulars	Additions during 1993-1994	Total
Herbarium		
Herbarium sheets of plant specimens	200	13,575
Herbarium sheets of leaf specimens	15	215
Xylarium		
Wood blocks	6	3,958
Wood discs	3	32
Wood core samples	91	331
Wood slides	–	4,728
Sporothek		
Polleniferous material	60	1,430
Pollen slides	–	11,419
Carpothek		
Fruits/seeds	75	2,276
Photo negatives	–	5

Museum

Museum of the Institute is being developed as a nodal centre for the dissemination of palaeobotanical knowledge. Keeping this objective in view the activities of the museum were planned in such a way so as to create general awareness towards the science of Palaeobotany amongst the students and general public. For this purpose, exhibitions were arranged at Lucknow and at other places in the country.

On the occasion of 81st Indian Science Congress at Jaipur an exhibition was arranged on the theme *"Science in India : Excellence and accountability"* from 3 - 11 January, 1994. General visitors, students, teachers and scientists were provided information about the Institute and its activities by means of photographs, charts and fossil specimens. Thousands of persons visited our stall. During 9th International Gondwana Symposium held at Hyderabad from 10-14th January, 1994 an exhibition was also arranged on the theme *"Panorama of Indian Gondwana Flora"*. Delegates from India and abroad took keen interest in our exhibits.

A week long activity was arranged to celebrate National Science Day from 21-28th February, 1994. Students of local schools / colleges and general public were invited to visit Museum and Laboratories of the Institute. A wide publicity was also made through the local press. Popular Lectures on *Plant Evolution, Earliest Biosphere* and *Women Scientists of India* were delivered by the young scientists of the Institute (Drs A. Rajanikanth, M. Sharma and Alpana Singh, respectively). About 1500 students of 55 educational institutions visited the Museum besides people from different walks of life. Short science films were also screened for the visitors. On 27th February, 1994 a painting competetion was organised for children below 12 years in two groups (i) between 5-8, (ii) between 9-12. About 250 students of 40 educational institutions participated in this competetion. In all, 46 prizes were distributed by the Director of the Institute. 28th February was observed as an Open House for the visitors. The Institute also participated in the Science Fair at Regional Science Centre, Lucknow.

Work on Inventory Part III of the Type and Figured specimens / slides (megafossils) is under progress.

Fossil specimens were sent to 15 educational institutions in order to make them conversant about the fossil plants. Fossil specimens were also sent to Nepal as gift and to Argentina on exchange.

Teachers of different refresher courses being conducted by the Academic Staff College of Lucknow University and scientists of Germany, Australia, Japan, Indonesia, Argentina and United States of America visited the Institute's Museum, besides citizen of our own country.

Type and Figured specimens / slides / negatives

The scientists of Institute deposited specimens / slides / negatives of 26 research papers to the repository of the Institute Museum.

Particulars	*Additions during 1993-94*	*Total*
Type and Figured specimens	169	5,204
Type and Figured slides	152	10,749
Negatives of the above	300	13,815

New collections

Specimens/samples collected from 151 localities of the country as a result of their field excursions were submitted to the museum by the Institute staff.

Department	*Specimens*	*Samples*
Non Vascular Plants	90	113
Palaeophytic Evolutionary Botany	600	25
Cenophytic Evolutionary Botany	1,043	
Quaternary Biogeography and Archaeobotany		226
Pre-Gondwana and Gondwana Palynostratigraphy of India		1,158
Post-Gondwana Palynostratigraphy of Peninsular India		85
Post-Gondwana Palynostratigraphy of Extra-Peninsular India		165
Planktonology		144

Samples received for investigation

Dy. Chief Geologist, MECL, Nagpur	3 samples
G. Kumar, GSI (NR), Lucknow	45 samples
Director, Bhutan Unit, G.S.I., Samchi, Bhutan	31 samples

Presentation of fossil specimens within the country

Secretary, Government of India, DST, New Delhi

Department of Botany, Kohima Science College, Kohima, Nagaland

Department of Geology, Punjab University, Chandigarh

Geological Association and Research Centre, Balaghat, Madhya Pradesh

Womens College, Agartala, Tripura

Department of Geology, Government Arts College, Tamil Nadu

Gurukul Kangri University, Haridwar, Uttar Pradesh

Al-Ameen P.U. College, Bidar, Karnataka

Department of Botany, Pachaippa's College, Salem, Madras

P.G. Department of Botany, Dungar College, Bikaner, Rajasthan

La Martiniere College, Lucknow, Uttar Pradesh

Kendriya Vidyalaya, Aliganj, Lucknow, Uttar Pradesh

Kendriya Vidyalaya, Bakshi Ka Talab, Lucknow, Uttar Pradesh

Ethiraj College for Women, Madras

National Council of Science Museums, Sector-V, Bidhan Nagar, Calcutta, West Bengal

Abroad

Department of Geology, Tribhuwan University, Kirtipur, Kathmandu, Nepal

Professor S. Archangelsky, Palaeobotany Division, Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina

Distinguished Visitors

Professor P. Rama Rao, Secretary, Department of Science & Technology, Technology Bhavan, New Mehrauli Road, New Delhi

Dr T. Viswanathan, Director, Indian National Scientific Documentation Centre, New Delhi

Dr V.M. Meher-Homji, French Institute, Pondicherry

Sri Ravi Shanker, Deputy-Director General, Northern Region, Geological Survey of India, Lucknow

Dr G. Vellinayagam, Department of Geology, Kurukshetra University, Kurukshetra, Haryana

Sri V.K. Srivastava, Deputy Secretary, Department of Science & Technology, New Delhi

Sri K. Krishnanunni, Deputy-Director General, Northern Region, GSI, Lucknow

Dr H.P. Joshi, Director-General (Retd.), Archaeological Survey of India, New Delhi

Dr P.K. Bhowmick, Director, National Science Centre, New Delhi

Sri J.R. Venkatesan, Physical Research Laboratory, Ahemdabad

Sri Om Sehgal, University of Mussourie, Columbia, U.S.A.

Sri K. Kumar Robinson, Singapore

Sri Widodo Sunarno, National Library of Indonesia, Jakarta, Indonesia

Professor S. Archangelsky, Division Palaeobotanika, Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina

Sri Bhagwan Singh, Former High Commissioner of India in Fiji, New Delhi

Dr Keiji Nakazawa, Faculty of Science, Kyoto University, Kyoto, Japan

Dr Thomas Kreuser, Geology Department, University of Koln, 5000 Koln, Germany

Dr John F. Rigby, School of Geology, OVT, Queensland 4001, Australia

Dr Anshu K. Sinha, Wadia Institute of Himalayan Geology, Dehradun

Dr B.D. Acharya, Director, Department of Science & Technology, New Delhi

Professor Y.D. Tiagi, Ex-Professor of Botany, Udaipur, Rajasthan

Institutional Visitors

Punjab University, Chandigarh

J.N.V. University, Jodhpur, Rajasthan

M.L.K. P.G. College, Balrampur, Gonda District, Uttar Pradesh

Sibsagar College, Joysagar, Assam

Cotton College, Guwahati, Assam

Colvin Taluqukadar's College, Lucknow, Uttar Pradesh

Dungar College, Bikaner, Rajasthan

I.T. College, Lucknow, Uttar Pradesh

Nari Shiksha Niketan Degree College, Lucknow, Uttar Pradesh

Mahila Mahavidyalaya, Lucknow, Uttar Pradesh

Lucknow Christian College, Lucknow, Uttar Pradesh

K.S. Saket P.G. College, Faizabad, Uttar Pradesh

St. Andrew's College, Gorakhpur, Uttar Pradesh

Jaipuria School, Lucknow, Uttar Pradesh

Lucknow University, Lucknow, Uttar Pradesh

Acharya Narendradev Girls Degree College, Kanpur, Uttar Pradesh

B.S.N.V. College, Lucknow, Uttar Pradesh

J.N. Degree College, Lucknow, Uttar Pradesh

Delegates of special Training Course on "Coaliferous fuel resources of India – Parameters of studies on palynology and biodiagenesis"

Teachers of Refresher Course, Academic Staff College, Lucknow University, Lucknow

Electronic Data Processing Unit

The Institute's Electronic Data Processing (EDP) Unit carried out the training programmes for staff, Software Development and assisted scientific, technical and administrative staff in jobs like chart preparation, table and graphical presentation, text layout for slides (transparencies) and OHP sheets, manuscript layout and database applications, printing jobs, etc. Some of the assignments completed by the Unit are given below.

A six week Training Programme for Institute's staff was conducted in April-May 1993. A group of 20 persons from scientific, technical and administration undertook the training. The Programme had two sessions daily, viz., Theory and Practical. The subjects covered in theory were Computer Fundamentals, Operating System, Word Processor, Data Base Management System and Spread sheets. The courseware was written in lucid language and was specifically designed for the purpose. The practicals discussed real-life problems. A self-evaluated test was conducted at the end of the programme and a progress report was submitted to Director. The trained staff are using the system effectively.

A Laser Printer was acquired this year for high resolution printing of textual and graphical matters. The major job carried out successfully was the preparation of *"Indian Gondwana : Annotated Synopses"* for release at 9th International Gondwana Symposium held at Hyderabad. The Annotated Synopses had two volumes. Volume 1 covered *"Palynology and Biopetrology"* and Volume 2 contained information on *"Permian megaplants"* and *"Mesozoic megaplants"*. The whole data was fed in a Dbase format. The 2,000 odd record comprising the Author, Year of publication, Title, Reference and Abstract were imported in WORDSTAR 6.0 for page layout. More than 300 pages were printed on Utoplex sheets using Laser Printer in a photo-ready format for offset printing. The database has been backed up on Magnum for future use by scientists.

The new custom softwares for accounts section were implemented,viz., Employee's monthly Paybill system which is developed in Softbase DBMS software, GPF accounts in Lotus-123 macro-Progamming and Pension accounts for pensioners in Dbase III-plus. These packages have been developed in-house after studying the exact requirements of accounts. These packages have been successfully running for a year now.

New software packages, viz., Windows 3.1 with mouse—a graphical user interface, Akshar–a bilingual wordprocessor and DevBase–a bilingual database management system were procured to facilitate interactive and friendly usage of

computer and utilities. The bilingual softwares were procured to give the user an option to work in Hindi also. Museum labels for exhibits were done in Akshar bilingual wordprocessor. Hindi keyboard stickers were also procured for users convenience.

Two more computers were hooked up with the LAN Network as nodes. Under the Network maintenance schedule, it was tried to minimize the connectors/cable length usage in LAN Network. The LAN Network has two host lines connected to the server MAGNUM, with six PCs in each. The LAN has three modes namely PC to Unix platform, PC to DOS platform and PC to PC file server having an access to data/resources of Magnum mini computer and other PCs in the LAN. Library Management System has been developed after consultations with the Library staff in UNIFY RDBMS Software under Unix Operating System. The data entry of books/ journals is in progress. Once the data entry is completed the scientists will have the facility to access the Library Information data at their end by connecting their PCs to Unix platform mode with Mini Computer. The BLIMS system also has facility of issue, return and reservation of Literature.

A lecture and demonstration on computer and its role in scientific studies were given during the special Training Course on *"Coaliferous fuel resources of India : Parameters of studies in palynology and biodiagenesis"* organised at the Institute in December 1993. Databases, spreadsheets, charts preparation was also demonstrated to the participants.

Departments at the Institute

1. Department of Non-Vascular Plants
   (Dr P.K. Maithy)
2. Department of Palaeophytic Evolutionary Botany
   (Dr Hari K. Maheshwari)
3. Department of Mesophytic Evolutionary Botany
   (Dr Shyam C. Srivastava)
4. Department of Cenophytic Evolutionary Botany
   (Dr N. Awasthi)
5. Department of Quaternary Biogeography and Archaeobotany
   (Dr H.P. Gupta)
6. Department of Pre-Gondwana and Gondwana Palynostratigraphy
   (Dr Suresh C. Srivastava)
7. Department of Post-Gondwana Palynostratigraphy of Peninsular India
   (Dr R.K. Kar)
8. Department of Post-Gondwana Palynostratigraphy of Extra-Peninsular India
   (Dr R.K. Saxena; Scientist-in-charge)
9. Department of Planktonology
   (Dr K.P. Jain)
10. Department of Biodiagenesis
    (Dr Anand Prakash)
11. Department of Radiometric Dating
    (Dr G. Rajagopalan)

Scientific Personnel

Director

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

Deputy Directors

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

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

Assistant Directors (Special Grade)

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

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., F.Pb.S.

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

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

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

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

Suresh C. Srivastava, Ph.D., F.I.A.P., F.Pb.S.

Assistant Directors

Jayasri Banerji, Ph.D.

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

C.M. Nautiyal, Ph.D.

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

Chhaya Sharma, Ph.D., F.I.A.P.

Jaswant Singh, Ph.D.

A.K. Srivastava, Ph.D., F.S.G., F.I.C.S.

G.P. Srivastava, Ph.D.

Shyam C. Srivastava, Ph.D.

Senior Scientific Officers

Anil Agarwal, Ph.D.

Krishna Ambwani, Ph.D.

Usha Bajpai, Ph.D.

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

J.S. Guleria, Ph.D.
B.N. Jana, Ph.D.
Neerja Jha, Ph.D.
H.A. Khan, Ph.D.
Asha Khandelwal, Ph.D.
Pramod Kumar, Ph.D.
J.P. Mandal, Ph.D.
B.K. Misra, Ph.D., F.S.G.
M.R. Rao, Ph.D.
Samir Sarkar, Ph.D.
Rakesh Saxena, Ph.D.
R.K. Saxena, Ph.D., F.S.G., F.P.S.
Manoj Shukla, Ph.D., F.G.S.
R.S. Singh, Ph.D.
Archana Tripathi, Ph.D., F.P.S., F.G.A.R.C.
S.K.M. Tripathi, Ph.D.
Vijaya, Ph.D., F.L.S., F.P.S.
R.R. Yadav, Ph.D.

Junior Scientific Officers

Rupendra Babu, Ph.D.
S.K. Bera, Ph.D.
Amalava Bhattacharyya, Ph.D.
A.P. Bhattacharyya, Ph.D.
M.S. Chauhan, Ph.D.
Asha Gupta, Ph.D., F.L.S., F.P.S.
Khowaja-Ateequzzaman, Ph.D.
Madhav Kumar, Ph.D.
B.D. Mandaokar, Ph.D.
K.L. Meena, Ph.D.
R.C. Mehrotra, Ph.D.
Neeru Prakash, Ph.D.
Mahesh Prasad, Ph.D.
A. Rajanikanth, Ph.D., F.G.S.
Jyotsana Rai, Ph.D.

Ram-Awatar, D.Phil.
D.C. Saini, Ph.D., F.E.S.
O.S. Sarate, Ph.D., LL.B.
Mukund Sharma, Ph.D., F.G.S.
Alpana Singh, Ph.D.
B.D. Singh, Ph.D., F.S.G.
K.J. Singh, Ph.D.
A.P. Srivastava, Ph.D. (Expired on 15-08-93)
Chanchala Srivastava, Ph.D.
Rashmi Srivastava, Ph.D.
Rajni Tewari, Ph.D.
G.K. Trivedi, Ph.D., F.P.S.

Emeritus Scientists

H.P. Singh, Ph.D., F.Pb.S.
B.S. Venkatachala, Ph.D., F.N.A.Sc., F.G.S., F.B.S., F.Pb.S., F.Pn.S. (up to November 13, 1993)

Sponsored Project (DST)

Deepak Kohli, M.Sc. (JRF)
Poonam Sharma, M.Sc. (JRF)
K.V. Sreekanth, M.Sc. (JRF)

Technical and Administrative Personnel

Publication

R.L. Mehra, D.P.T., P.G.D.C.A. (Proof Reader)

Library

J.N. Nigam, B.A., B.Lib.Sc. (J.T.O.)
Kavita Kumar, B.Sc., B.Lib.Sc. (J.T.A.)
V.K. Nigam, M.Com., B.Lib.Sc. (J.T.A.)
A.K. Srivastava, B.Com., B.Lib.Sc. (Console Operator)
S.R. Yadav, B.A. (Temp. J.T.A. on ad-hoc basis)

Museum

P.K. Bajpai, B.F.A. (J.T.O.-Artist)
Kamla M. Chhabra, B.Sc. (J.T.O.)
Prem Prakash, B.Sc. (S.T.A.)
Diwakar Pradhan, B.Sc. (S.T.A.)

Herbarium

J.C. Srivastava, M.Sc. (J.T.O.)
Sunita Khanna, B.Sc. (S.T.A.)

Photography

P.C. Roy (S.T.A.)
Pradeep Mohan, B.F.A. (J.T.A.)

Laboratory Services

H.N. Boral, B.Sc. (T.O.)
B. Sekar, B.Sc., A.I.C. (T.O.)
Madhavi Chakraborty, M.Sc. (J.T.O.)
Indra Goel, B.Sc. (J.T.O.)
Asha Guleria, B.Sc. (J.T.O.)
T.K. Mandal, B.Sc. (J.T.O.)
V.K. Singh, M.Sc. (J.T.O.)
E.G. Khare, M.Sc. (S.T.A.)
Reeta Banerji, B.Sc. (J.T.A.)

R.C. Misra, B.Sc. (J.T.A.)
Chandra Pal, B.Sc. (J.T.A.)
Keshav Ram, B.A. (J.T.A.)
V.P. Singh, B.Sc. (J.T.A.)
A.K. Srivastava, B.Sc. (J.T.A.)

Technical Services

Kamal Narang, B.Tech. (Programmer–Computer)
Madhukar Arvind, B.Sc. (J.T.A.–Computer)
R. Nandhagopal, B.Sc., P.B.D.C.A., C.S.A. (J.T.A.–Computer)
Avanish Kumar, B.Sc., LL.B., P.G.D.C. (Console Operator)
V.S. Panwar (Glass Blower)
A.K. Ghosh, G.I.T.I., N.C.T.V.T., E.S.C (Electrician)
M.S. Rana, B.A. (Generator Operator)
Chandra Bali (Mechanic)
Chhotey Lal (Mechanic)
P.S. Saluja, S.T.S.C.T.I., (Mechanic)
S.C. Singh, B.A. (Mechanic-cum-Section Cutter)

Sponsored Project

Jagdish Prasad (T.A.)

Administration

Registrar

S.C. Bajpai, M.Sc., LL.B., F.I.E.T.E.

Accounts Officer

J.C. Singh, M.A.

P.S. to Director

S.P. Chadha, B.A.

Section Officers

B.K. Jain, B.A.
I.J. Mehra, B.A.

Bhagwan Singh
H.S. Srivastava, B.Com.

Maintenance Officer

R.B. Kukreti, B.A.

Assistants

I.J.S. Bedi
Ramesh Chandra
N.N. Joshi
R.K. Takru, B.A.

Upper Division Clerks

Usha Chandra
R.K. Kapoor, B.A.
Hari Lal
V. Nirmala
P. Thomas

Cashier

Dhoom Singh, B.A.

Store-Keeper

Ruchita Chatterji, M.A.

Lower Division Clerks

Swapna Mazumdar, B.A.
S. Murukan Pillai, B.A.
Shail S. Rathore, B.A.
Gopal Singh, B.A.
K.P. Singh
Koshy Thomas
N. Unnikannan

Drivers

Nafees Ahmed
Lallan (Expired on 13.01.94)

D.K. Misra
Balbir Singh

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)
Haradhan Mahanti (Attendant)
Shri 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)
K.K. Bajpai, B.A. (Peon)
Dhan Bahadur Kunwar (Peon)
Mahadev Prasad (Peon)
Hari Kishan (Peon)
S.C. Misra (Peon)
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 (Mrs) Anita Dwivedi, Junior Scientific Officer with effect from 28.03.1994.

Dr (Mrs) Vandana Prasad, Junior Scientific Officer with effect from 28.03.1994.

Dr Jitendra Pandey, Junior Scientific Officer with effect from 31.03.1994.

Sri Ratan Kar, Birbal Sahni Research Scholar with effect from 18.10.1993.

Sri Anil Kumar Singh Pokharia, Birbal Sahni Research Scholar with effect from 18.10.1993.

Sri Krishna Kumar Pandey, Birbal Sahni Research Scholar with effect from 27.10.1993.

Sri Shiv Mohan Singh, Birbal Sahni Research Scholar with effect from 01.11.1993.

Km. Ruchi Srivastava, Birbal Sahni Research Scholar with effect from 03.11.1993.

Km. Manisha Nanda, Birbal Sahni Research Scholar with effect from 09.11.1993.

Sri R.K. Takru, Assistant, appointed as Section Officer (F & A) with effect from 11.02.1994.

Sri Yogendra Pratap Singh appointed as Junior Technical Assistant (Computer) with effect from 31.03.1994.

Mrs Renu Srivastava appointed as Lower Division Clerk with effect from 01.10.1993.

Mrs M. Jagath Janani appointed as Junior Stenographer with effect from 03.02.1994 (on temporary basis).

Sri Vijay Pratap Singh appointed as Driver with effect from 25.01.1994.

Sri Madan Mohan Misra appointed as Driver with effect from 02.02.1994.

Promotions

Dr K.P. Jain, A.D.(SG), promoted as Deputy Director with effect from 01.04.1993.

Dr G.P. Srivastava, S.S.O., promoted as Assistant Director with effect from 01.04.1993.

Sri V.K. Singh, S.T.A., promoted as Junior Technical Officer with effect from 01.04.1993.

Sri H.S. Srivastava, Officiating S.O., promoted as Section Officer with effect from 22.11.1993.

Sri Bhagwan Singh, Officiating S.O., promoted as Section Officer with effect from

22.11.1993.

Sri I.J. Mehra, Officiating S.O., promoted as Section Officer with effect from 22.11.1993.

Sri B.K. Jain, Officiating S.O., promoted as Section Officer with effect from 22.11.1993.

Sri Ramesh Chandra, Officiating Assistant, promoted as Assistant with effect from 20.01.1994.

Sri N.N. Joshi, Officiating Assistant, promoted as Assistant with effect from 20.01.1994.

Sri I.J.S. Bedi, Officiating Assistant, promoted as Assistant with effect from 20.01.1994.

Sri R.K. Takru, Officiating Assistant, promoted as Assistant with effect from 20.01.1994.

Sri R. Kukreti, Junior Assistant, promoted as Maintenance Officer with effect from 22.11.1993.

Sri R.K. Kapoor, Officiating U.D.C., promoted as Upper Division Clerk with effect from 16.03.1994.

Mrs V. Nirmala, Officiating U.D.C., promoted as Upper Division Clerk with effect from 16.03.1994.

Sri A.K. Ghosh, Electrician promoted to next higher grade (3) with effect from 01.04.1993.

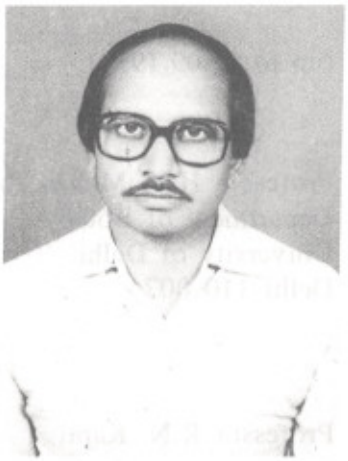
Retirements

Sri T.N. Shukla, Section Officer (F & A), retired on 31.12.1993.

Sri Hanuman Prasad, Driver, retired on 31.01.1994.

Obituary

Dr A.P. Srivastava, Junior Scientific Officer
(28.08.1959 - 15.08.1993)



Dr A.P. Srivastava

Sri Lallan, Driver
(01.01.1947 - 13.01.1994)

Sri Lallan

Organisational Structure

Governing Body

(up to 16.09.1993)	(w.e.f. 17.09.1993)
Chairman	
Professor H.Y. Mohan Ram Department of Botany University of Delhi Delhi 110 007	Professor C.V. Subramanian "Anjaneya", Plot 885 62 Ramaswami Salai K.K. Nagar Madras 600 078
Members	
Professor R.N. Kapil Department of Botany University of Delhi Delhi 110 007	Professor M.S. Srinivasan Department of Geology Banaras Hindu University Varanasi 221 005
Secretary or His Nominee Department of Science and Technology, Technology Bhavan New Mehrauli Road New Delhi 110 016	Secretary or His Nominee Department of Science and Technology, Technology Bhavan New Mehrauli Road New Delhi 110 016
Sri S.B. Krishnan Joint Secretary & Financial Adviser, DST Technology Bhavan New Mehrauli Road New Delhi 110 016	Sri S.B. Krishnan Joint Secretary & Financial Adviser, DST 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	Dr P.K. Hajra Director Botanical Survey of India P-8, Brabourne Road Calcutta 700 001

Sri S.N. Chaturvedi
Director-General
Geological Survey of India
27, Jawaharlal Nehru Road
Calcutta 700 016

Sri D.B. Dimri
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. FRI
Dehradun 248 001

Dr S.C.D. Sah
Vikaspuram Enclave
General Mahadeo Singh Road
Ballupur, P.O. FRI
Dehradun 248 001

Professor D.D. Pant
106, Tagore Town
Allahabad 211 002

Dr V.C. Thakur
Director
Wadia Institute of Himalayan
Geology
Dehradun 248 001

Professor C.P. Sharma
Head, Department of Botany
Lucknow University
Lucknow 226 007

Professor S.K. Singh
Head, Department of Geology
Lucknow University
Lucknow 226 007

Member-Secretary

Director
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Director
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Assistant Secretary (Non-member)

Registrar
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Registrar
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Finance and Building Committee

(up to 16.09.1993)

(w.e.f. 17.09.1993)

Chairman

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

Professor C.V. Subramanian
"Anjaneya", Plot 885
62 Ramaswami Salai
K.K. Nagar
Madras 600 078

Members

Sri S.B. Krishnan
Joint Secretary & Financial
Adviser, DST
Technology Bhavan
New Mehrauli Road
New Delhi 110 016

Sri S.B. Krishnan
Joint Secretary & Financial
Adviser, DST
Technology Bhavan
New Mehrauli Road
New Delhi 110 016

Sri S.C. Jain (up to 25.02.1994)
Former Divisional Engineer
Northern Railway, A-431, Indira Nagar
Lucknow 226 016

Sri S.P. Elhence (w.e.f. 26.02.1994)
Chief Engineer (Retd.) P.W.D.,U.P.
B-87, Indira Nagar
Lucknow 226 016

Nominee of Secretary to the
Government of India, DST
Technology Bhavan
New Mehrauli Road
New Delhi 110 016

Nominee of Secretary to the
Government of India, DST
Technology Bhavan
New Mehrauli Road
New Delhi 110 016

Prof. C.P. Sharma (up to 25.02.1994)
Head, Department of Botany
Lucknow University
Lucknow 226 007

Prof. S.K. Singh (w.e.f. 26.02.1994)
Head, Department of Geology
Lucknow University
Lucknow 226 007

Chief Engineer U.P.P.W.D.
or his nominee
95th Circle, P.W.D.
Lucknow 226 001

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

Director
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Assistant Secretary (Non-member)

Registrar
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Registrar
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Research Advisory Council

(up to 25.02.1994)

(w.e.f. 26.02.1994)

Chairman

Director
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Director
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Members

Dr S.C.D. Sah
Vikaspuram Enclave
General Mahadeo Singh Road
Ballupur, P.O. FRI
Dehradun 248 006

Dr S.C.D. Sah
Vikaspuram Enclave
General Mahadeo Singh Road
Ballupur, P.O. FRI
Dehradun 248 006

Professor R.N. Kapil
Department of Botany
University of Delhi
Delhi 110 007

Dr K.S. Manilal
Department of Botany
University of Calicut
Calicut 673 635

Dr B.D. Sharma
Director
Botanical Survey of India

Professor C.K. Varshney
School of Environmental
Sciences, Jawaharlal Nehru

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

University
New Delhi 110 067

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

Dr N.D. Mitra
Sr. Deputy-Director General
Geological Survey of India
Calcutta 700 016

Professor V.N. Raja Rao
Centre of Advanced Study in Botany
University of Madras
Madras 600 025

Professor D.D. Nautiyal
Department of Botany
Allahabad University
Allahabad 211 002

Dr Jagdish Pandey
KDM Institute of Petroleum
Exploration,
Oil & Natural Gas Commission
Dehradun 248 195

Convener

Deputy-Director
Birbal Sahni Institute of

Deputy-Director
Birbal Sahni Institute of

Palaeobotany
Lucknow 226 007

Palaeobotany
Lucknow 226 007

Secretary (Non-member)

Registrar
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Registrar
Birbal Sahni Institute of
Palaeobotany
Lucknow 226 007

Internal Committees

(w.e.f. 08.04.1993)

Programming and Evaluation Committee

R.S. Tiwari	Chairman
G. Rajagopalan	
K.P. Jain	
H.K. Maheshwari	
P.K. Maithy	
R.K. Kar	

Co-ordination Unit for Scientific Activities (w.e.f. 29.03.1993)

Suresh C. Srivastava	In-Charge
Archana Tripathi	
B.D. Singh	

Advisory Committee for Scientific Innovation

K.P. Jain	Convener
Hari K. Maheshwari	
P.K. Maithy	
H.P. Gupta	
Shaila Chandra	
Anand-Prakash	
S.A. Jafar	
C.M. Nautiyal	

Library and Information Committee

Hari K. Maheshwari	Convener
Chhaya Sharma	
Jayasri Banerji	
J.S. Guleria	
B.K. Misra	

Museum and Display Committee

R.K. Kar	Convener
Shaila Chandra	
Shyam C. Srivastava	
G.P. Srivastava	
Vijaya	

Herbarium Committee

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

Purchase Committee

R.S. Tiwari - Convener
P.K. Maithy
S.C. Bajpai
J.C. Singh
H.S. Srivastava

Quality Control Committee

P.K. Maithy - Convener
A.K. Srivastava
R.R. Yadav
B.K. Jain

Excursion Equipment Committee

H.P. Gupta - Convener
Neerja Jha
R.S. Singh
M.R. Rao
H.S. Srivastava

Photography Committee

Shaila Chandra - Convener
Manoj Shukla
Usha Bajpai

Maceration Facility Committee

R.K. Saxena - Convener
J.P. Mandal
H.N. Boral

SEM, Computer and Telephone Committee

G. Rajagopalan - Convener
H.K. Maheshwari

S.A. Jafar
K. Ambwani
Usha Chandra

Building Construction and Maintenance Committee

Anand-Prakash - Convener
S.C. Bajpai
J.C. Singh
I.J. Mehra

Electrical Maintenance and Audio-Visual Committee

C.M. Nautiyal - Convener
B.N. Jana
I.J. Mehra
R.B. Kukreti
A.K. Ghosh

Vehicle Maintenance Committee

Anil Chandra - Convener
S.C. Bajpai
K.P. Singh

Garden Committee

Pramod Kumar - Convener
Samir Sarkar
Asha Khandelwal
S.K.M. Tripathi
D.C. Saini
Swapna Mazumdar

Canteen Committee

A.K. Srivastava - Convener
Rahul Garg
R.K. Takru
Bhagwan Singh
P.K. Bajpai
D. Pradhan
P. Thomas

Staff Welfare Committee (w.e.f. 15.08.1993)

Anand-Prakash	- Chairman
Rahul Garg	- Secretary
K.S. Saraswat	
G.P. Srivastava	
Asha Khandelwal	
P.K. Bajpai	
Chandra Pal	
V. Nirmala	
K.P. Singh	
K.C. Chandola	

Rajbhasha Karyanvayan Samiti (w.e.f. March, 1993)

H.K. Maheshwari	- Convener
J.S. Antal	
J.C. Srivastava	
H.S. Srivastava	
Kavita Kumar	

Steering Committee for Golden Jubilee Year Celebrations of BSIP

R.S. Tiwari	- Chairman
S.C. Bajpai	- Secretary
G. Rajagopalan	
K.P. Jain	
H.K. Maheshwari	
P.K. Maithy	
R.K. Kar	
N. Awasthi	
H.P. Gupta	
Shaila Chandra	
Suresh C. Srivastava	
Anil Chandra	
Anand-Prakash	

Report to
the Governing Body,
Birbal Sahni Institute of Palaeobotany, Lucknow

We have audited the attached Balance Sheet of the Birbal Sahni Institute of Palaeobotany, Lucknow, as at 31st March, 1994, and the Income and Expenditure Account and Receipts & Payment Account for the year then ended and report that subject to our comments as given in Annexure A to this Report :

In our opinion and to the best of our information and according to the explanations given to us the said accounts give a true and fair view –

(i) In the case of Balanace Sheet of the State of affairs of the Institute as at 31st March, 1994,

(ii) In the case of Income and Expenditure Account, of the excess of income over expenditure for the year then ended, and

(iii) In the case of Receipts and Payment Account, of the receipts and payments of the Institute for the year then ended.

Place : Lucknow
Date : 4 July, 1994

For **SINGH AGARWAL & ASSOCIATES**
Chartered Accountants

Sd/-

(Mukesh Kumar Agarwal)
Partner

Annexure - 'A'

(Annexure to and forming part of the Audit Report for the year ended 31st March, 1994)

Comments on Accounts of Birbal Sahni Institute of Palaeobotany, Lucknow for the year ended 31st March, 1994.

Accounts

1. Accounts of various projects tenable at the Institute have been maintained separately and do not form part of the Balance Sheet and Income and Expenditure Account and Receipts and Payment Account.

2. Accounts have been maintained on cash basis.

3. Verification of bank account reveals that various entries have been incorporated in the Bank Reconciliation Statement under the head "Credit without advice (C.W.A.)" and "Debit without advice (D.W.A.)" amounting to Rs. 5,585/- and Rs. 34,206/-, respectively.

   As explained to us, the above entries are not at present traceable. But according to our opinion, the same are verifiable provided proper communication is there between the various departments of the Institute. For example – one entry of Rs. 3,966/- which has been shown under the head "Debit without advice" in Bank Reconciliation statement, has been reflected by the stores department in their list of unsettled advances of Radio Carbon Dating as advance payment to some party of U.K.

4. Various advances were found pending recovery for an unduly long period. Efforts are to be made for speedy settlement of the same.

General Provident Fund

5. In the administration of withdrawals from GPF accounts, rules regarding withdrawal from the fund have not been complied with and innumerable employees have been allowed to withdraw more than what is permissible under the GPF rules. As explained to us, excess withdrawals have been allowed in the cases where necessity of the same had been preassessed by the Institute.

Publication

6. On scrutiny of record of the priced publications of Palaeobotany, it has been observed that during the last several years, the Institute had brought out publications on different subjects to sell put in the market. Stock position of these priced publications as on 31.03.94 is about Rs. 16.76 lacs apart from

which Rs. 2.48 lacs is reserve stock, totalling stock of Rs. 19.24 lacs. Further, we observed that because requirements of these priced publications had not been properly assessed by the Institute, the same are lying in stock which causes blockade of valuable fund, deterioration in quality and blockade of storage space, etc.

Library

7. No physical verification was made during the year under audit. As explained to us, library stocks are being physically verified after 5 years, as per Central Government Rules.

Stores

8. Fixed Assets Register has been maintained w.e.f. 1988 onwards and no record has been maintained regarding fixed assets acquired out of grants or otherwise before 1988. According to information and explanations furnished before us, no physical verification of fixed assets has been made. No identification marks on the fixed assets have been made for efficient and proper verification thereof.

9. No depreciation on fixed assets has been charged, as per accounting policy of the Institute.

Suggestions

10. Looking at the volume of transactions, it is being suggested, for better, efficient and correct presentation of accounts, that the account books must be prepared on the basis of "Double Entry System" of accounting which is a commonly accepted accounting system.

11. Backlog in the maintenance of Fixed Assets Register must be updated, at earliest, with the help of some technical personnel.

Replies to the audit points raised by the Chartered Accountants in the Institute's Accounts for the year ended at 31.3.1994

1. Accounts of various sponsored Projects tenable at the Institute are being maintained separately as per observations raised by Government Auditor to project the correct state of Accounts of the Institute funds.
2. No comments.
3. All entries under the Head "Credit without advice" & "Debit without advice" have since been cleared.
4. Efforts are being made to settle the advances.
5. GPF Advances/withdrawals have been sanctioned as per rules. However, the comments of the Chartered Accountants have been noted.
6. Vigorous efforts are being made to increase the sale proceeds of the priced publications.
7. No comments.
8. Audit comments noted.
9. Our Accounts are being maintained as per Government of India Rules where provision for depreciation has not been contemplated.

Sd/-
J.C. Singh
(Accounts Officer)

Sd/-
S.C. Bajpai
(Registrar)

Birbal Sahni Institute of

Balance Sheet as at

Liabilities	Amount Rs.	Amount Rs.
Capital Fund		
Balance as per last year's Balance Sheet	4,69,56,888.52	
Add Govt. of India Grant 1992-93	1,92,000.00	
On Capital Fund 1993-94	51,70,000.00	5,23,18,888.52
Excess of Income over Expenditure	32,04,830.13	
Add for the year	7,93,889.40	39,98,719.53
Cost of Land donated by U.P. Government		32,292.00
Founder's Donation		1,52,500.00
MGT Scheme (CSIR)		8,100.79
Coal Scheme (CSIR)		7,784.66
Palynological Scheme (CSIR)		5,207.87
UNESCO Aid Fund		19,629.75
Burmah Oil Co. Donation		1,900.00
Rajasthan Scheme (Sponsored by Univ. of Wisconsin)		23,009.15
C.D. Pant Memorial Fund		4,203.10
C.L. Katiyal Memorial Fund		7,273.74
Other Misc. Donations		25,918.06
P.C. Bhandari Memorial Fund		7,446.90
A.C. Seward Memorial Fund		23,041.98
P.K. Srivastava Memorial Fund		6,295.22
Birbal Sahni Research Award Endownment		46,829.00
Professor T.M. Harris Endownment		15,294.83
Gift in Kind		
Humboldt Foundation (West Germany)		75,000.00
General Provident Fund		
Liabilities & Provisions		1,11,89,330.00
Security (Capital)	28,483.90	
Security Revenue Plan	15,000.00	
Security Revenue Non-Plan	2,000.00	45,483.90
Group Linked Insurance Scheme		250.00

Palaeobotany, Lucknow

31st March, 1994

Assets	Amount Rs.	Amount Rs.
Land		
Donated by U.P. Government		32,292.00
Works & Buildings		
As per last year's Balance Sheet	68,94,217.88	
Out of Founder's Donation	50,000.00	
Additions during the year	27,16,148.00	96,60,365.88
Research Apparatus & Equipments		
As per last year's Balance Sheet	2,01,20,948.96	
Additions during the year	5,22,182.50	2,06,43,131.46
Workshop Equipments		
As per last year's Balance Sheet		2,06,890.69
Office & Misc. Equipments		
As per last year's Balance Sheet	14,05,669.75	
Additions during the year	7,43,179.25	21,48,849.00
C-14 Radiometric Dating Equipments		
As per last year's Balance Sheet	54,27,669.41	
Additions during the year	22,023.25	54,49,692.66
Plant & Machinery		
As per last year's Balance Sheet		22,69,937.21
Apparatus & Equipments Donated		
M.G.T. Scheme (CSIR)	7,155.79	
Burmah Oil Co.	700.00	
Founder's Donation	2,500.00	
Coal Scheme (CSIR)	6,645.29	
Palynological Scheme (CSIR)	5,207.87	
Rajasthan Scheme (Sponsored by Univ. of Wisconsin)	22,029.45	
UNESCO Aid Equipment	19,629.75	
Humboldt Foundation	75,000.00	1,38,868.15
Vehicles		
As per last year's Balance Sheet	6,51,398.57	
Additions during the year	2,93,227.09	9,44,625.66
Furniture & Fixture		
As per last Year's Balance Sheet	23,33,843.28	
Additions during the year	5,563.80	23,39,407.08

Liabilities	Amount Rs.	Amount Rs.

Total	**6,80,14,399.00**

For **Singh Agarwal & Associates**
Chartered Accountants
(Mukesh Kumar Agarwal)

Sd/-
J.C. Singh
(Accounts Officer)

Assets	Amount Rs.	Amount Rs.
Furniture & Fixture (Fixed)		
Burmah Oil Co.	1,200.00	
M.G.T. Scheme (CSIR)	945.00	
Coal Scheme (CSIR)	1,139.37	
Rajasthan Scheme	979.70	4,264.07
Books & Journals		
As per last year's Balance Sheet	24,38,674.34	
Additions during the year	4,75,715.54	29,14,389.88
Founders Library Donated		50,000.00
Founders Fossil Collection		50,000.00
Maps & Toposheets		13,142.00
UNESCO Book Coupons		543.12
Investment (Donation)		
As per last year's Balance Sheet	155,20,100.00	
Additions during the year	15,500.00	1,35,600.00
Cash in Hand	127.97	
Balance with State Bank of India	43,19,733.38	43,19,861.35
Unsettled advances (Plan)	5,21,156.24	
Unsettled advances (Capital)	24,03,132.40	
Unsettled advances (Non-Plan)	1,66,729.85	30,91,018.49
Security Money		
M/s Krishna & Co., Lucknow	3,000.00	
M/s Sardarji, Lucknow	5,000.00	
G.P.O., Lucknow	100.00	8,100.00
Loans & Advances		
House Building Advance	19,73,712.30	
Conveyance Advance	4,05,658.00	
Festival Advance	24,720.00	24,04,090.30
General Provident Fund		
Investment in 5 year's Time Deposit	23,00,000.00	
Special Deposit Scheme in S.B.I., Lucknow	74,05,000.00	
Advances	12,67,934.00	
With State Bank of India in Savings Bank A/c	2,16,396.00	1,11,89,330.00
Total		**6,80,14,399.00**

Sd/
S.C. Bajpai
(Registrar)

Sd/-
Dr. R.S. Tiwari
(Director)

Birbal Sahni Institute

Income & Expenditure Account

Expenditure	Plan Rs.	Non-Plan Rs.	Total Rs.
To Academic Expenses			
Pay & Allowances of Academic Staff	—	61,01,872.50	61,01,872.50
Field Excursion	2,62,153.23	12,454.00	2,74,607.23
To Honourarium for Lecture			
Birbal Sahni Memorial Lecture	—	500.00	500.00
To International Programmes			
Deputation Abroad	1,83,781.00	—	1,83,781.00
To Expenses of Services Ancillary to Research			
Pay & Allowances of Aux. Technical Staff	1,52,227.00	18,54,899.50	20,07,126.50
Chemicals, Glasswares & Photogoods	3,32,994.41	47,433.32	3,80,427.73
Library expenses	—	38,336.78	38,336.78
Maintenance of Apparatus, equipment & workshop machines	2,52,114.50	35,453.50	2,87,568.00
Museum expenses	39,680.40	13,981.20	53,661.60
To Publication Expenses			
The Palaeobotanist	—	66,732.90	66,732.90
Annual Report	—	62,901.85	62,901.85
Gondwana Symposium	39,850.90	—	39,850.90
To Travelling & other Allowances			
Governing Body, Scientific & Evaluation Meeting & Selection Committee Meeting, etc.	1,42,946.45	47,754.50	1,90,700.95
Attending Scientific Meetings & Conferences in India	25,362.05	89,229.45	1,14,591.50
Training of staff	—	3,500.00	3,500.00
Reimbursement of Medical Expenses	2,63,784.10	37,463.20	3,01,247.30
Overtime Allowance	22,362.00	19,547.75	41,909.75
Leave Travel Concession	84,414.00	13,773.10	98,187.10
Reimbursement of Tution Fee	10,020.00	11,460.00	21,480.00
Ad-hoc Bonus	10,995.00	68,960.00	79,955.00
To Pension Expenses			
Superannuation Allowances & Pension	—	13,61,294.00	13,61,294.00
Pension Contribution	—	1,440.00	1,440.00
Leave Salary	—	1,18,494.40	1,18,494.40
To General Expenses			
Pay & Allowances of Administrative Staff	1,58,464.00	20,58,811.30	22,17,275.30
Telephone & Trunk Call	—	50,029.40	50,029.40
Postage Expenses	—	89,549.70	89,549.70
Advertisement Expenses	40,474.20	81,202.00	1,21,676.20

# of Palaeobotany, Lucknow

for the Year ending 31st March, 1994

Income	Plan Rs.	Non-Plan Rs.	Total Rs.
Revenue Account			
By Grant from Govt. of India	46,38,000.00	1,22,00,000.00	1,68,38,000.00
By Grant from U.P. Government		—	—
By Sale Proceeds of Priced Publications			
The Palaeobotanist		2,84,611.00	2,84,611.00
Monographs		300.00	300.00
Symposia		35.00	35.00
Gondwana Symposium		600.00	600.00
A Catalogue of Indian Fossil Plants		26,301.00	26,301.00
Seward Memorial Lecture		5.00	5.00
Birbal Sahni Memorial Lecture		—	—
IV IPC Proceedings		—	—
Picture Post Cards		215.00	215.00
Aspects & Appraisal of Indian Palaeobotany		700.00	700.00
By Miscellaneous Receipts & Recoveries			
Misc. Receipts	192.00	38,475.50	38,667.50
V.S. Room Charges		27,335.00	27,335.00
Application Fee		4,712.00	4,712.00
Licence Fee		3,752.00	3,752.00
Telephone Receipts		572.50	572.50
Pension Contribution		—	—
S.E.M. Facilities		1,000.00	1,000.00
Electricity Receipts		1,066.00	1,066.00
Interest on Conveyance Advance		31,639.00	31,639.00
Interest on House Building Advance		21,268.00	21,268.00
Interest on Savings Bank Account/TDR		1,81,031.30	1,81,031.30

Expenditure	Plan Rs.	Non-Plan Rs.	Total Rs.
Assistance to Canteen	—	8,427.70	8,427.70
Hot & Cold Weather Charges	8,364.00	—	8,364.00
To General Expenses			
Petrol & Mobil Oil	62,944.42	9,982.90	72,927.32
Electricity	3,80,917.28	29,231.80	4,10,149.08
Municipal Taxes	—	33,786.00	33,786.00
Insurance of Vehicles & Library	—	19,602.00	19,602.00
Uniform to staff	49,606.95	12,014.00	61,620.95
Printing & Stationery	1,53,116.00	19,454.80	1,72,570.80
Hospitality Expenses	—	12,698.95	12,698.95
Misc. Expenses	7,24,455.78	1,35,196.13	8,59,651.91
Railway freight & carriage	—	1,047.00	1,047.00
To Maintenance Expenses			
Building	—	26,147.15	26,147.15
Garden	—	59,949.90	59,949.90
Vehicle	77,064.88	4,838.00	81,902.88
Repair & Renewals	3,66,374.92	3,783.75	3,70,158.67
To other Expenses			
Audit Fee	—	5,000.00	5,000.00
Legal Advice	—	4,917.50	4,917.50
To Prof. Birbal Sahni Research Scholarship	52,088.00	—	52,088.00
Emeritus Scientist	83,200.00	—	83,200.00
Golden Jublee Expenses	15,013.50	—	15,013.50
(I) Excess of Income over Expenditure	6,43,423.03	1,50,466.37	7,93,889.40
(II) Excess of Expenditure over Income	—	—	—
Total	**46,38,192.00**	**1,28,23,618.30**	**1,74,61,810.30**

For **Singh Agarwal & Associates**
Chartered Accountants
Sd/-

(Mukesh Kumar Agarwal)
Partner

Sd/-

J.C. Singh
(Accounts Officer)

Income	Plan Rs.	Non-Plan Rs.	Total Rs.
Total	**46,38,192.00**	**1,28,23,618.30**	**1,74,61,810.30**

Sd/-

S.C. Bajpai
(Registrar)

Sd/-

Dr. R.S. Tiwari
(Director)

Birbal Sahni Institute of

Statement of account of various Projects tenable at Birbal Sahni Institute

Particulars	Opening Balance as on 1.4.1993 Rs.	Receipts Rs.	Total Rs.
DST Project (Dr B.S. Venkatachala)	765.69	—	765.69
DST Project (Dr 'Mrs' Chhaya Sharma)	48,366.57	—	48,366.57
DST Project (Dr H.P. Gupta)	72,962.40	60,000.00	1,32,962.40
DST Project (Dr A. Bhattacharya)	—	1,10,000.00	1,10,000.00
DST Project (Dr R.K. Kar)	—	1,45,000.00	1,45,000.00
DST Project (Dr P.K. Maithy)	—	1,25,000.00	1,25,000.00
Senior Research Fellowship (Sri O.P. Singh)	2,511.40	—	2,511.40
DST Workshop	—	80,000.00	80,000.00
Total	**1,24,606.06**	**5,20,000.00**	**6,44,606.06**

For **Singh Agarwal & Associates**
Chartered Accountants
Sd/-
(Mukesh Kumar Agarwal)
Partner

Sd/-
J.C. Singh
(Accounts Officer)

Palaeobotany, Lucknow

of Palaeobotany, Lucknow for the year ending 31st March, 1994

Recurring Expenditure & Refunds Rs.	Capital Expenditure Rs.	Total Rs.	Closing Balance as on 31.3.1994 Rs.
765.69	—	765.69	—
48,366.57	—	48,366.57	—
64,614.80	49,414.00	1,14,028.80	18,933.60
—	—	—	1,10,000.00
—	—	—	1,45,000.00
—	—	—	1,25,000.00
2,511.40	—	2,511.40	—
80,000.00	—	80,000.00	—
1,96,258.46	**49,414.00**	**2,45,672.46**	**3,98,933.60**

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
Dr R.S. Tiwari
(Director)

Birbal Sahni Institute

C.D. Pant Fund and

Particulars		Last Year's Balance Rs.	Interest earned Rs.	Total Rs.
A.	Miscellaneous Donation Fund	23,453.82	2,464.24	25,918.06
B.	A.C. Seward Mem. Fund	21,291.18	2,250.80	23,541.98
C.	C.L. Katiyal Mem. Fund	6,545.72	728.02	7,273.74
D.	P.C. Bhandari Mem. Fund	6,715.85	731.05	7,446.90
E.	P.K. Srivastava	5,669.63	625.59	6,295.22
F.	B.S. Research Award	42,052.45	4,776.55	46,829.00
G.	Prof. T.M. Harris Endownment	13,770.17	1,524.66	15,294.83
Total		**1,19,498.82**	**13,100.91**	**1,32,599.73**
	C.D. Pant Mem. Fund	3,812.06	391.04	4,203.10
	Total	**1,23,310.88**	**13,491.95**	**1,36,802.83**

For **Singh Agarwal & Associates**
Chartered Accountants
Sd/-
(Mukesh Kumar Agarwal)
Partner

Sd/-
J.C. Singh
(Accounts Officer)

# of Palaeobotany, Lucknow

Donation Fund Account 1993-94

Investment Rs.	Expenditure Rs.	Net Balance Rs.
25,900.00	—	18.06
22,900.00	500.00	141.98
7,200.00	—	73.74
7,400.00	—	46.90
6,200.00	—	95.22
46,800.00	—	29.00
15,200.00	—	94.83
1,31,600.00	**500.00**	**499.73**
4,000.00	—	203.10
1,35,600.00	—	**702.83**

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
Dr R.S. Tiwari
(Director)

Birbal Sahni Institute

Receipts and Payment Account

Receipts	Plan Rs.	Non-Plan Rs.	Total Rs.
To Opening Balance :			
Bank Account			
Non-Plan Revenue	0.00	795.67	795.67
Group Insurance Scheme	0.00	250.00	250.00
Plan Revenue	3,04,800.16	0.00	3,04,800.16
Deposits A/c	2,000.00	5,000.00	7,000.00
Plan Capital	21,62,778.73	0.00	21,62,778.73
Deposits	5,000.00	0.00	5,000.00
Donations	0.00	3,210.88	3,210.88
Cash Account			
Non-Plan Revenue	0.00	102.45	102.45
To Government of India Grants for			
(i) Revenue	46,38,000.00	1,22,00,000.00	1,68,38,000.00
(ii) Capital	53,62,000.00	0.00	53,62,000.00
To Government of U.P. Grants for Revenue			
To Receipts on Capital Accounts			
C.P.W.D., Lucknow			
Cost of Cement			
Refund of Advance			
Deposit (Security)	2,000.00	0.00	2,000.00
To Sale Proceeds of Publications :			
The Palaeobotanist	0.00	2,84,611.00	2,84,611.00
Monographs	0.00	300.00	300.00
Symposia	0.00	35.00	35.00
Catalouges	0.00	26,301.00	26,301.00
Aspects & Appraisal of Indian Palaeobotany	0.00	700.00	700.00
Seward Memorial Lectures	0.00	0.00	0.00
Birbal Sahni Memorial Lectures	0.00	5.00	5.00
Silver Jubilee Memorial Lectures	0.00	0.00	0.00
Gondwana Symposium	0.00	600.00	600.00
IV I.P.C. Proceedings	0.00	0.00	0.00
Picture Post Cards	0.00	215.00	215.00
To Administrative Receipts			
Income Tax	0.00	2,94,934.00	2,94,934.00
Insurance Premium Salary Savings Scheme	1,217.40	2,40,139.46	2,41,356.86
G.P.F. Subscription	40,968.00	27,35,671.00	27,76,639.00
Recovery of GPF Advance	3,800.00	5,41,321.00	5,45,121.00
Interest on GPF Investment	0.00	9,83,312.00	9,83,312.00
Recovery of BSIP Co-operative Credit Society	11,307.00	2,79,902.00	2,91,209.00

# of Palaeobotany, Lucknow

for the Year ending 31st March, 1994

Payment	Plan Rs.	Non-Plan Rs.	Total Rs.
By Capital Accounts			
Works & Building	5,49,706.00	0.00	5,49,706.00
Research Apparatus & Equipments	1,50,213.00	0.00	1,50,213.00
Equipment for services Ancillary to Research	0.00	0.00	0.00
Library	4,64,931.71	0.00	4,64,931.71
Museum	25,072.55	0.00	25,072.55
Photography	0.00	0.00	0.00
Workshop Equipment	0.00	0.00	0.00
C-14 Laboratory	134.00	0.00	134.00
Plant & Machinery	0.00	0.00	0.00
Furniture & Fixture	1,320.00	0.00	1,320.00
Vehicle	2,93,227.09	0.00	2,93,227.09
Office Misc. Equipment	1,41,603.00	0.00	1,41,603.00
Interest on TDR transferred to Revenue	1,69,376.30	0.00	1,69,376.30
Computer Printer	1,30,656.50	0.00	1,30,656.50
Geological thin Section	13,11,345.00	0.00	13,11,345.00
A.C. Unit	6,60,560.50	0.00	6,60,560.50
Power Load	3,99,744.00	0.00	3,99,744.00
By Deposit Account			
Earnest Money	0.00	0.00	0.00
By Pay & Allowances :			
Pay (Academic)	0.00	28,67,810.50	28,67,810.50
Pay (Technical)	67,265.00	8,19,063.50	8,86,328.50
Pay (Administrative)	69,740.00	9,09,587.30	9,79,327.30
D.A.	1,32,668.00	41,58,435.00	42,91,103.00
C.C.A.	7,518.00	2,30,533.00	2,38,051.00
H.R.A.	28,800.00	9,40,537.00	9,69,337.00
I. Relief	4,700.00	89,617.00	94,317.00
Overtime Allowance	22,362.00	19,547.75	41,909.75
Medical Reimbursement	2,63,118.10	39,463.20	3,02,581.30
Reimbursement of Tution Fee	10,020.00	11,460.00	21,480.00
Leave Travel Concession	94,544.00	3,373.10	97,917.10
Ad-hoc Bonus	10,995.00	68,960.00	79,955.00
By Travelling Allowance			
Governing Body Selection Committee & others	1,40,346.45	47,754.50	1,88,100.95
Field Excursion	2,87,460.47	4,654.00	2,92,114.47
Deputation Abroad	2,69,281.00	0.00	2,69,281.00
Attending Conference & Meetings in India	25,362.05	94,679.45	1,20,041.50
Golden Jubilee	15,013.50	0.00	15,013.50
Training of Staff in India	0.00	3,500.00	3,500.00

Receipts	Plan	Non-Plan	Total
	Rs.	Rs.	Rs.
G.S.I.	5,190.00	1,41,250.00	1,46,440.00
Leave Salary	0.00	0.00	0.00
Application Fee	0.00	4,712.00	4,712.00
SEM Facilities	0.00	1,000.00	1,000.00
Electricity Receipts	0.00	1,066.00	1,066.00
V.S. Room Rent	0.00	27,335.00	27,335.00
Telephone Receipts	0.00	572.50	572.50
Licence Fee	0.00	3,752.00	3,752.00
To Misc. Receipts			
Misc. Receipts	192.00	38,475.50	38,667.50
Pensionary	0.00	0.00	0.00
Deputation Abroad	0.00	0.00	0.00
D.S.T. Workshop	80,000.00	0.00	80,000.00
To Recoveries of Loans & Advances			
Recovery of Festival Advance	0.00	44,900.00	44,900.00
Recovery of Conveyance Advance	0.00	1,27,726.00	1,27,726.00
Interest on Conveyance Advance	0.00	31,639.00	31,639.00
Recovery of House Building Advance	0.00	2,52,580.00	2,52,580.00
Interest on House Building Advance	0.00	21,268.00	21,268.00
To Deposit Account			
Security Deposit	13,000.00	5,000.00	18,000.00
To Donation & Endownments			
Interest on CDP A/c	0.00	391.04	391.04
Interest on Donation A/c	0.00	13,100.91	13,100.91
Donation Maturity Proceeds			
Donation A/c	0.00	16,000.00	16,000.00
CDP A/c	0.00	1,000.00	1,000.00
To Misc. Receipts on Capital Account			
Interest on TDR	1,69,376.30	0.00	1,69,376.30
Interest on TDR transferred from Plan	0.00	1,69,376.30	1,69,376.30
Interest on Savings Bank	0.00	11,655.00	11,655.00
To Group Insurance received from LIC	0.00	96,534.00	96,534.00
DST Project			
(Dr H.P. Gupta)			
Opening Balance	72,962.40	0.00	72,962.40
Grants from DST	60,000.00	0.00	60,000.00
DST Project			
(Dr A. Bhattacharyya)			
Grants from DST	1,10,000.00	0.00	1,10,000.00
DST Project			
(Dr R.K. Kar)			
Grants from DST	1,45,000.00	0.00	1,45,000.00
DST Project			
(Dr P.K. Maithy)			

Payment	Plan Rs.	Non-Plan Rs.	Total Rs.
By Maintenance of Property			
Building	0.00	26,147.15	26,147.15
Garden	0.00	59,949.90	59,949.90
Apparatus & Equipment	3,57,022.10	47,323.50	4,04,345.60
Vehicle	77,064.88	4,838.00	81,902.88
Repairs & Renewals	3,82,384.92	3,783.75	3,86,168.67
By Contingencies			
Telephone & Trunk Call charges	0.00	50,029.40	50,029.40
Municipal Taxes	0.00	33,786.00	33,786.00
Postage	0.00	94,549.70	94,549.70
Advertisement	40,474.20	81,202.00	1,21,676.20
Hot & Cold Weather charges	8,364.00	0.00	8,364.00
Petrol & Mobil Oil	60,444.42	9,982.90	70,427.32
Electricity charges	3,80,917.28	29,231.80	4,10,149.08
Insurance of Vehicles & Library	0.00	46,100.00	46,100.00
Liveries of Sub. Staff	49,606.95	12,014.00	61,620.95
Printing & Stationery	1,52,716.00	19,454.80	1,72,170.80
Hospitality Expenses	0.00	12,698.95	12,698.95
Misc. Expenses	6,31,822.33	1,62,004.13	7,93,826.46
Chemical & Glassware	3,06,220.41	1,03,521.17	4,09,741.58
Assistance to Canteen	0.00	8,427.70	8,427.70
Library Expenses	0.00	50,282.78	50,282.78
Museum Expenses	39,680.40	13,981.20	53,661.60
Legal Advice	0.00	4,917.50	4,917.50
Medical Advice	0.00	0.00	0.00
Audit Fee	0.00	5,000.00	5,000.00
Railway Freight	0.00	1,547.00	1,547.00
DST Workshop	80,000.00	0.00	80,000.00
By Publications			
The Palaeobotanist	0.00	66,732.90	66,732.90
Annual Report	0.00	62,901.85	62,901.85
Gondwana Symposium	39,850.90	0.00	39,850.90
By Academic Expenses			
B.S. Memorial Lectures	0.00	500.00	500.00
B.S. Research Scholarship	52,088.00	0.00	52,088.00
S.M.L. (out of Donation Account)	0.00	500.00	500.00
By G.P.F. Account			
G.P.F. Subscription	40,968.00	27,35,671.00	27,76,639.00
G.P.F. Interest transferred to G.P.F. A/c	0.00	9,83,312.00	9,83,312.00
Recovery of GPF Advance	3,800.00	5,41,321.00	5,45,121.00
Emeritus Scientist	83,200.00	0.00	83,200.00
By Miscellaneous			
Income Tax Remitted	0.00	2,94,934.00	2,94,934.00
G.S.I.	0.00	96,534.00	96,534.00
G.S.I. Payment Recovered from staff	5,190.00	1,41,250.00	1,46,440.00

Receipts	Plan Rs.	Non-Plan Rs.	Total Rs.
Grant from DST	1,25,000.00	0.00	1,25,000.00
DST Project			
(Dr Mrs Chhaya Sharma)			
Opening Balance	48,366.57	0.00	48,366.57
CSIR Research Fellowship			
(Mr O.P. Singh)			
Opening Balance	2,511.40	0.00	2,511.40
DST Project			
(Dr B.S. Venkatachala)			
Opening Balance	765.69	0.00	765.69

Payment	Plan Rs.	Non-Plan Rs.	Total Rs.
S.S. Insurance Premium remitted	1,217.40	2,40,139.46	2,41,356.86
BSIP Co-operative Society	11,307.00	2,79,902.00	2,91,209.00
By Loans & Advances			
Festival	0.00	42,000.00	42,000.00
Conveyance	1,37,100.00	0.00	1,37,100.00
House Building	2,02,809.30	0.00	2,02,809.30
By Pension & Superannuation			
Pension, Family Pension and Gratuity	0.00	13,61,294.00	13,61,294.00
Leave Salary	0.00	1,18,494.40	1,18,494.40
Pension Contribution	0.00	1,440.00	1,440.00
By Investment			
Donation A/c	0.00	31,000.00	31,000.00
C.D.P. A/c	0.00	1,500.00	1,500.00
By Deposit Account			
Refund of Security Money	0.00	8,000.00	8,000.00
G.S.I. Payment	0.00	0.00	0.00
DST Project			
(Dr H.P.Gupta)	1,14,028.80	0.00	1,14,028.80
DST Project			
(Dr Mrs Chhaya Sharma)	48,366.57	0.00	48,366.57
CSIR Research Fellowship			
(Mr O.P. Singh)	2,511.40	0.00	2,511.40
DST Project			
(Dr B.S. Venkatachala)	765.69	0.00	765.69
Closing Balance (Bank)			
Revenue	4,92,032.50	4,06,482.67	8,98,515.17
Capital	33,98,265.38	0.00	33,98,265.38
Savings Bank A/c	5,000.00	0.00	5,000.00
Deposit A/c	15,000.00	2,000.00	17,000.00

Receipts	Plan Rs.	Non-Plan Rs.	Total Rs.
Total	**1,33,66,235.65**	**1,86,06,738.71**	**3,19,72,974.36**

For **Singh Agarwal & Associates**
Chartered Accountants
Sd/-

(Mukesh Kumar Agarwal)
Partner

Sd/-

J.C. Singh
(Accounts Officer)

Payment	Plan Rs.	Non-Plan Rs.	Total Rs.
BSIP Group Insurance	0.00	250.00	250.00
CDP Account	0.00	203.10	203.10
Donation Account	0.00	499.73	499.73
DST Projects			
Dr H.P. Gupta	18,933.60	0.00	18,933.60
Dr A. Bhattacharyya	1,10,000.00	0.00	1,10,000.00
Dr R.K. Kar	1,45,000.00	0.00	1,45,000.00
Dr P.K. Maithy	1,25,000.00	0.00	1,25,000.00
Closing Balance (Cash)	0.00	127.97	127.97
Total	**1,33,66,235.65**	**1,86,06,738.71**	**3,19,72,974.36**

Sd/-

S.C. Bajpai
(Registrar)

Sd/-

Dr. R.S. Tiwari
(Director)