

*Annual Report*  
2004-2005



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**November 2005**

We are grateful to the  
Department of Science and Technology,  
Government of India, New Delhi,  
to  
the Governing Body  
and  
the Research Advisory Council  
of the Institute for  
continued support and guidance



With  
Best Compliments

N.C. Mehrotra

Naresh C. Mehrotra  
*Director*

## Contents

Foreward .....	(i)
Executive Summary .....	(ii)
Organisational Structure	
Governing Body .....	1
Research Advisory Council .....	2
Finance and Building Committee .....	3
Organisational set-up .....	4
Research	
Thrust areas, Projects and Components .....	5
Additional Research Contributions .....	27
Collaborative Work .....	29
Sponsored Projects .....	34
Recognition .....	36
Representation in Committees/Boards .....	37
Lectures delivered .....	39
Deputation/Training/Study/Visit in India/Abroad .....	41
Deputation to Conferences/Symposia/Seminars/Workshops .....	43
Papers presented at Conferences/Symposia/Meetings .....	44
Consultancy/Technical Assistance rendered .....	46
Units	
Publication .....	47
Library .....	48
Museum .....	49
Herbarium .....	50
Electronic Data Processing .....	51
Section Cutting .....	51
Foundation and Founder's Day Celebrations .....	52
National Science Day .....	53
Distinguished Visitors .....	54
Reservations and Concessions .....	54
Status of Official Language .....	55
The Staff	
Scientists .....	57
Technical Personnel .....	58
Administrative Personnel .....	58
Appointments and Promotions .....	60
Research Papers published .....	61
Abstracts published .....	65
General Articles/Reports published .....	68
Papers accepted for publication .....	70
Audit and Accounts .....	72

## Foreword

Established in 1946, the Birbal Sahni Institute of Palaeobotany (BSIP) is dedicated to develop and promote the science of Palaeobotany. The organisation has since grown into a premier research centre devoted to all relevant aspects of fundamental and applied Palaeobotany, keeping in view its multiple dimensions in enriching Botanical and Earth System sciences.

It is my pleasure to present the Annual Report of the BSIP for the year 2004-05. It provides a summary of the research and various other activities of the Institute. A general overview of the research contributions is presented followed by a summary of the highlights so that it serves the purpose of a reference material with a list of scientific publications. The targets defined under various projects/components have been by and large met and the details of research work conducted are incorporated. Collaborative research with other scientific and academic institutions has been very active both nationally and internationally. A MOU between Institute and Geological Survey of India (Coal Wing) has been signed for palynological and petrological studies of selected areas of Gondwana coal basins. Steps for long-term major collaborations with Oil and Natural Gas Corporation Limited, Delta Studies Institute, Visakhapatnam, Wadia Institute of Himalayan Geology, Dehradun, National Institute of Oceanography, Goa and National Center for Antarctic and Ocean Research, Goa in the field of Quaternary palaeoclimate and Industrial application of Palynology have been taken and are at various stages of formulation of MOU. The Institute also provided expertise to various academic institutions and scientific organisations.

Constant support and guidance received from the Chairman and Members of the Governing Body and the Research Advisory Council have been quite encouraging in shaping the research activities of the Institute. I express my sincere thanks and gratitude to all of them.

It is since the last month of period of report that I took over as Director of this Institute, which has been my alma matter. The progress of the Institute reported in the Annual Report is the outcome of concerted efforts of Institute staff. In this context, I would like to record my sincere appreciation to the efforts of Dr. Jayasri Banerji who has been looking after the duties of then Director (Officiating) till February, 2005.

The report has been compiled by the Research Planning and Coordination Cell and brought out by the Publication Unit with inputs from scientific, technical and administrative personnel.



**N.C. Mehrotra**  
Director



## Executive Summary

The research activities of the Birbal Sahni Institute of Palaeobotany (BSIP) are categorized under 14 projects. Research work has been carried out under the umbrella of five Thrust Area Programmes— 1) Precambrian biotic events, 2) Gondwana floristics, palaeoclimate and palaeoecology: relevance to breakup of Gondwanaland, 3) Biopetrology of coals and its relevance to coal bed methane, 4) Palaeobiology of Phanerozoic basins and its bearing on hydrocarbon potential, and 5) Quaternary vegetation, eustatic sea level changes, global climate change and anthropogenic impact, besides certain Special Activities.

The academic activities of the Institute during 2004-05 include publication of 86 research papers, 56 scientific abstracts, and 32 reports/articles, besides 43 research papers, which are accepted for publication. Two scientists have been deputed abroad under inter-academy exchange programme of INSA. One scientist visited China on invitation, and another six scientists and one technical officer have been deputed for attending various conferences. Several scientists (23) and technical personnel (3) were deputed to attend different national and international conferences/ seminars/ workshops held in the country and 37 research papers were presented at different centers of India.

### Important Research Contributions

- Microfossils and carbonaceous mega remains recovered from the Sirbu Shale Formation exposed in Pathana Nala (near Maihar, MP) do not support the existence of Pc-C boundary in the section, established earlier through isotope studies.
- The distribution of microorganisms in Mesoproterozoic Jaradag Fawn Limestone (Semri Group) exposed in the Son Valley suggests that the precipitates were mainly deposited inorganically without active participation of cyanobacteria.
- Palynomorph assemblages from various coal-bearing Gondwana sequences of Birbhum, Rajmahal, Sohagpur, Ib-river, and Wardha-Godavari valley coalfields were analysed for biostratigraphic dating and correlations.
- Plant fossils investigated from various Gondwana successions of South Rewa, Mahanadi, Satpura, Wardha, Pranhita-Godavari, etc. basins have helped in interpreting floristic evolution and palaeoecology of the regions.
- It is inferred that the Early Cretaceous leaves of *Ginkgo* from Jabalpur Formation are evolutionary advanced than the deeply dissected leaves of *Ginkgoites rajmahalensis* of other basins.
- The possible presence of calamitalean axis possessing alternating grooves at the nodal region and Cordainthus-type of seeds indicate the presence of extra-gondwanic elements in Satpura Gondwana Basin.
- An impression specimen of ?Lichen/Fungi found on coniferous wood interpreted as the evidence of mutualism or saprophytic habit during Cretaceous in the Rajmahal flora.
- Recovery of a new species of *Circoporoxyylon* has further supported floral similarities of Rajmahal and Kota wood assemblages.
- Variety of azonate and gulate megaspores has been identified from Barakar and Raniganj formations of Godavari Valley coalfields.
- Coals from Rajmahal and Wardha basins and lignite from Neyveli field have been evaluated for their maceral characterization in relation to economic suitability and CBM potentiality.

- Plant remains (wood, leaves and fruit) investigated from various Tertiary beds of Kachchh, Manipur, Himachal Pradesh, Uttaranchal, Darjeeling, South India, etc. have helped in interpreting floristics, palaeoecology, and phytogeography of the regions.
- Palynoflora from various Tertiary sequences of Rajasthan, Kachchh, north-east India, K-G basin, etc. investigated for stratigraphic zonation and correlation.
- Diversified calcareous algal flora has been studied from the Palaeocene Ninniyur Formation, Ariyalur (TN) in relevance to palaeoenvironmental significance.
- The *Apectodinium* dinocyst peak is integrated with negative carbon isotope excursion in the Jathang Hill Section, Mawsynram Plateau (Meghalaya) and used to identify the global Palaeocene-Eocene Thermal Maximum (PETM) Event. Palaeocene/Eocene boundary in the section is demarcated as per the latest concepts. Presence of Sparnacian (latest Palaeocene) sediments is identified for the first time in this region. Occurrence of impersistent coal horizons in Khasi Hills is supposed to be related to the global extreme warming event associated with PETM.
- Several Palaeosol horizons, characterized by lateritic horizon associated with iron oolitic bands, have been identified in the basal part of Subathu Formation from Nilkanth and Tal valley areas (Uttaranchal).
- Pollen analysed sediment cores/samples from Shahdol District (MP), Chilka Lake (Orissa), Mandi District (HP), Kumaun Himalaya, and around Dilli Colliery (Assam) for depicting Quaternary vegetation and climatic phases.
- Presence of reworked palynomorph (?Permian) trapped in Antarctic continental ice sheet proves the nearness of the existing sedimentary rocks.
- Archaeobotanical studies related to ancient plant economic practices carried out from certain archaeological excavation sites of Uttar Pradesh to generate considerable information on agricultural economy and other botanical remains.
- Tree ring analysis data of deodar (*Cedrus deodara*) samples from Uttarkashi (Uttaranchal) shows that the age of oldest sample extends back to 1287 AD, helping in maximizing the climate signals in mean tree-ring chronology.
- Reconstructed three major palaeolakes in the Ladakh region. Also studied soft-sediment deformation structures and established a chronology for the palaeo earthquake that may have hit the region during the Late Quaternary times.
- Ultrastructure studies have been carried out on fruits/seeds of some species of *Terminalia* of family Combretaceae to understand developmental stages of the pericarp and other details.
- Radiocarbon dating of certain palynologically analysed samples was done. Besides, designed a mini glass system that can determine precisely the carbon content of a small quantity of sediment sample (about 150 mg).

### **Memorandum of Understanding**

As per the MOU signed between Institute and Geological Survey of India (Coal Wing), initiated collection and studies of samples of different coalfields of the country with the objective of intra-/inter-basinal correlation through high-resolution stratigraphic and palynological, and coal petrological studies on selected areas of Gondwana coal basins. The Institute already has an MOU with Oil and Natural Gas Corporation to work on the palynostratigraphy and source rock potential studies of Siwalik and Subathu sediments of Himachal Pradesh, and Quaternary palynological studies of K-G Basin.

Steps for long term major collaborations with Oil and Natural Gas Corporation (on source rock palynology), Delta Studies Institute, Visakhapatnam (on delta/basin modelling in relation to hydrocarbon exploration), Wadia Institute of Himalayan Geology, Dehradun (on Himalayan stratigraphy), National Institute of Oceanography (on Quaternary palaeoclimate of marine coastal areas) and National Center for Antarctic and Ocean Research, Goa (on Antarctica palaeoclimate study) have been taken and are at various stages of formulation of MOU/discussions. Certain Private Sector Oil majors have also approached Institute for biostratigraphical studies.

### **Commemoration & Memorial Lectures**

On the occasion of 58<sup>th</sup> Foundation Day of the Institute, Professor P. Ramachandra Rao of Banaras Hindu University (Varanasi) delivered the 8<sup>th</sup> Jubilee Commemoration Lecture on *Trees: An Engineer's Delight* at the Institute on September 10, 2004.

On Founder's Day (November 14<sup>th</sup>), Professor A.K. Singhvi of Physical Research Laboratory (Ahmedabad) delivered the 34<sup>th</sup> Birbal Sahni Memorial Lecture on the topic *The Human Dimension of Geosciences*. Professor S.K. Tandon of University of Delhi (New Delhi) delivered the 50<sup>th</sup> Sir Albert Charles Seward Memorial Lecture on *Stratigraphic Records of Late Quaternary Climate Shifts in the Thar and its Margins*.

### **National Events**

Like every year, Institute celebrated Independence Day and Republic Day. The National Science Day has been observed in accordance with directions from the DST with the theme being 'Celebration of Physics'. Few lectures, and a debate competition, a collage competition, a Face-to-Face programme on 'Tsunami' for school students, and a speech-competition on the topic 'Space Science is a Luxury for India' for degree-students were organized at the Institute. The National Technology Day has also been observed as open house. A lecture on this day was delivered by Sri G.S. Srivastava, Ex-Dy. Director General, GSI on *Geoscientific Database Management*.



## Organisational Structure

### Governing Body

#### *Chairman*

##### **Professor J.S. Singh**

Professor of Botany  
Department of Botany  
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Varanasi 221 005

#### *Members*

##### **Professor V.S. Ramamurthy**

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##### **Shri Arun Sharma** (up to 24.02.2005)

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& Financial Adviser or his Nominee  
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##### **Professor S.B. Bhatia**

Former Professor of Geology  
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#### *Members (Ex-officio)*

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Lucknow University  
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##### **Director**

Botanical Survey of India  
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#### *Member-Secretary (Ex-officio)*

##### **Director,**

Birbal Sahni Institute of Palaeobotany  
Lucknow 226 007

#### *Non-Member Assistant Secretary (Ex-officio)*

##### **Registrar,**

Birbal Sahni Institute of Palaeobotany  
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## RESEARCH ADVISORY COUNCIL

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Former Professor of Botany  
University of Allahabad  
Allahabad 211 002

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Department of Botany  
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Emeritus Professor, Dept. of Botany  
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Osmania University, Saifabad  
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## FINANCE AND BUILDING COMMITTEE

### ***Chairman (Ex-officio)***

**Professor J.S. Singh**  
Chairman, Governing Body  
Birbal Sahni Institute of Palaeobotany  
Lucknow 226 007

### ***Members***

**Shri Arun Sharma** (up to 24.02.2005)  
**Shri K.P. Pandiyan** (w.e.f. 25.02.2005)  
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### ***Member (Ex-officio)***

### ***Director***

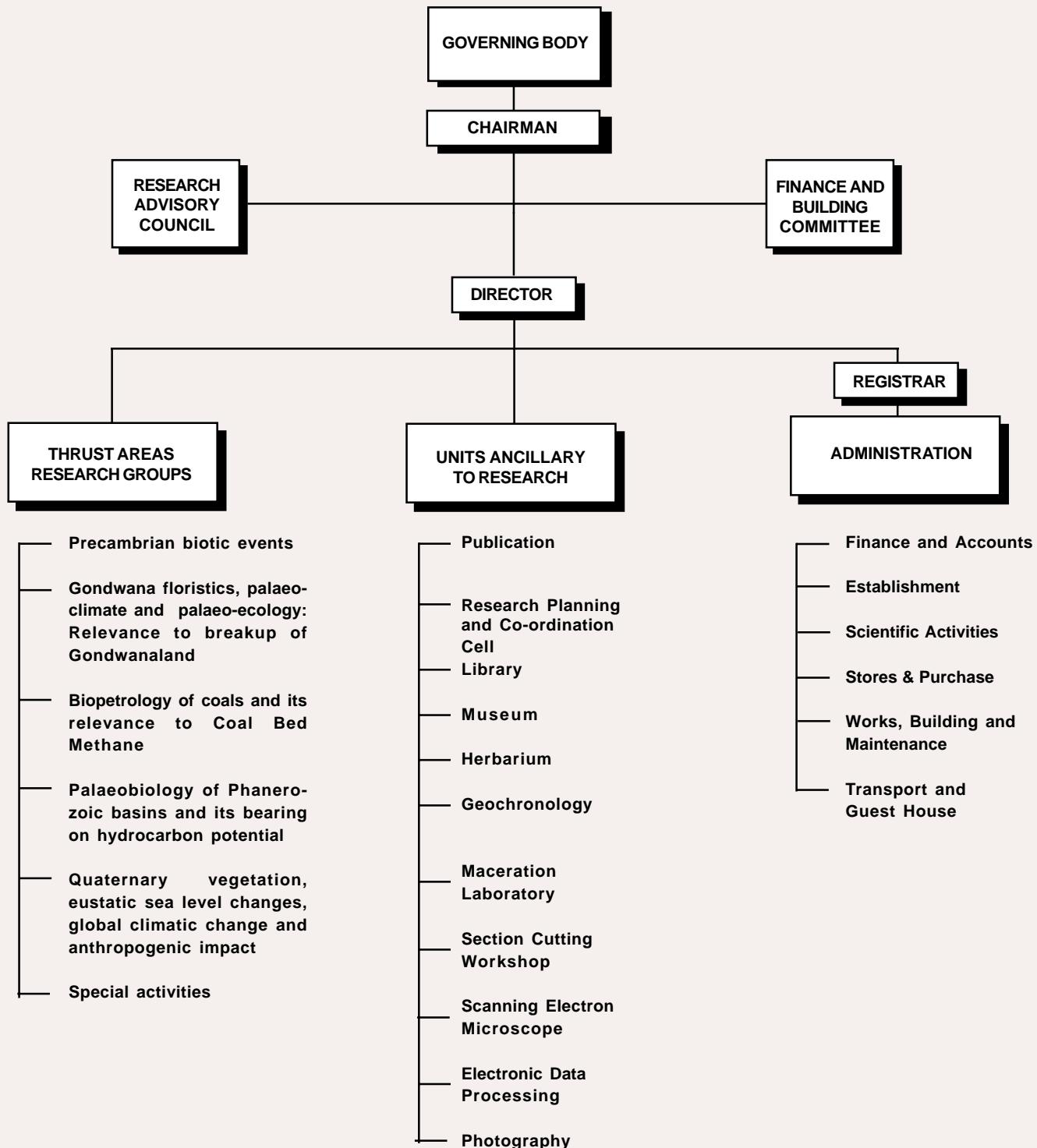
Birbal Sahni Institute of Palaeobotany  
Lucknow 226 007

### ***Non-Member Secretary (Ex-officio)***

**Registrar**  
Birbal Sahni Institute of Palaeobotany  
Lucknow 226 007



## ORGANISATIONAL SET-UP





## Research

### Thrust Area: PRECAMBRIAN BIOTIC EVENTS

#### Project 1: Biodiversity and Sedimentary history in Meso-Neoproterozoic sediments of Vindhyan and Chhattisgarh Supergroups

##### *Component 1: Biodiversity in Meso-Neoproterozoic sediments of the Vindhyan Supergroup*

**S**tudied microfossils and carbonaceous mega remains from the Sirbu Shale Formation, exposed in Pathana Nala near Maihar, Satna District (Madhya Pradesh). The carbonaceous mega remains are *Chuaria*, *Tawuia* and *Beltinia*. Organic walled microfossils belonging to the genera *Leiosphaeridia atava*, *L. incrassatula*, *L. gigantia*, *Trachyhystrichoides ovalis*, *Baltisphaeridium perrarum*, *Synsphaeridium*, *Nucellosphaeridium minuta*, *Octoedryxium* sp., *Lophosphaeridium*, *Vandalosphaeridium* sp. and *Strictosphaeridium* were also recovered. Based on isotope studies the other workers have opined that *Pc-C* boundary lies in this section, whereas this study does not support their contention.

**Manoj Shukla**

Further studies of the Jaradag Fawn Limestone Formation (~1.6 Ga) of the Semri Group exposed in the Son Valley show diversified microbial assemblage and carbonate precipitate patterns. *Eoentophysalis* is the dominant organism in the assemblage that appeared to have formed the laminae of stromatolitic cherts. Dominance of *Eoentophysalis* is analogous

to modern stromatolites growing in arid intertidal to supratidal habitat where in modern *Entophysalis* is commonly found associated with the stromatolitic laminae. Co-occurrence of these microbes and precipitates probably can be related to depositional environments of the Mesoproterozoic tidal flats with high carbonate saturation. Distinct patterns of the precipitation can be attributed to Mesoproterozoic timescale. Petrological observations on Jaradag Fawn Limestone Formation suggest that it contains carbonate precipitate patterns that are subsequently silicified and preserved in bedded and stromatolitic cherts that are typical of peritidal carbonates of Mesoproterozoic age. The distribution of microorganisms suggests that the precipitates were deposited inorganically without active participation of cyanobacteria except *Eoentophysalis*, which contributed in the formation of stromatolitic chert (cyanobacterial mat).

The carbonaceous mega remains studied on the Olive Shale Formation of the Semri Group exposed in Newari region of the Sonbhadra District have revealed the presence of probable bryophytic remains in the assemblage. Detailed studies are in progress.

**Mukund Sharma**

##### *Component 2: Biodiversity in Meso-Neoproterozoic sediments of the Chhattisgarh Supergroup*

Studied the shale and chert samples belonging to Tarenga Formation (upper part of Raipur Group) from the Kodwa village, Durg District. Both carbonaceous macro- and microfossil forms are recorded. The carbonaceous macrofossils belong to Chuarid and Longfengshanid groups. Also recovered some additional organic-walled microfossils (OWM) comprising cyanobacterial remains and acritarchs. The cyanobacterial remains- both coccoid and simple, coiled with or without mucilaginous sheath and branched trichomes

belonging to the chroococcaceae, oscillatoriaceae and stegonemataceae families are noticed. The acritarchs belong to genera *Leiosphaerida*, *Baltisphaeridium*, *Grammarginata*, *Micrhystridium*, and *Beudingeriisphaeridium* of Sphaeromorphida and Sphaerohystrichomorphida subgroups in the present assemblage. The dominance of the acanthomorphs in the assemblage indicates terminal Proterozoic age and interferences of two distinct environments for the upper part of the Chhattisgarh Supergroup.

**Rupendra Babu**



## Thrust Area: GONDWANA FLORISTICS, PALAEOCLIMATE AND PALAOECOLOGY: RELEVANCE TO BREAKUP OF GONDWANALAND

### Project 2: Floral evolution and Biostratigraphic significance in Damodar and Son-Mahanadi basins

#### *Component 1: Palynostratigraphy and patterns of evolution in palynofloras through Permian and Mesozoic sequences in Damodar-Panagarh-Birbhum Basin*

Worked out detailed spore-pollen species distribution in the lithosequence comprising coal horizon and Mesozoic successions (in bore-hole DPD-3) from Deocha-Pachami area, Birbhum Coalfield (WB). In this strata (about 692.00 m thick), very quick changes in spore-pollen compositions have been observed, that has resulted in the identification of the basal most Permian (Talchir Formation) and Barakar Formation- a time transgressive lithounit (Lower Permian to Lower Triassic). The Dubrajpur Formation

encountered in DPD-3 represents Upper Jurassic strata, having hiatus at its base. This hiatus extends in stratigraphy from Mid Triassic to Mid Jurassic. To decide the biostratigraphic status of Dubrajpur Formation in sub-surface Mesozoic Succession from Deocha-Pachami area palynological study has also been done on strata (particularly of approx. 128 m thick), encountered in bore-holes DPD-3, 6 and 15. The data put forth a big gap of Lower to Middle Jurassic in the studied sequence.

Vijaya

#### *Component 2: Floristics, biostratigraphy and palaeoenvironmental studies of the Gondwana sediments in Sohagpur Coalfield*

Carried out palynological analysis of samples from bore-hole SNB-2 and demarcated Early Permian (Lower Talchir) palynoassemblage at 826.15 to 586.45 m depth, showing dominance of *Plicatipollenites*, *Parasaccites* in association with striate bisaccate and a few trilet spores. At depth 579.60 to 278.30 m, an Early Permian (Lower Barakar) palynoflora have

been recorded, which shows dominance of *Scheuringipollenites* followed by striated bisaccates and a few taeniate pollen. The preservation of spores and pollen was very poor at the contact zones of the three dykes (at 372.85-482.65 m, 519.25-521.25 m, and 547.00-550.85) encountered, and they were black in colour, which may be attributable to the thermal effect.

Ram Avatar

#### *Component 3: Morphotaxonomy, floristics, evolution, biostratigraphy and palaeo-environmental studies of Ib-River Coalfield (Orissa) and Mand-Raigarh Coalfield (M.P.)*

Completed chemical processing of samples from bore-holes IBL 3, 5 and 9 (Lakhanpur Area), Ib-river Coalfield, but could not find enough palynospores for dating and correlation. Also completed processing of surface samples collected from

the tributary of Hasdo-river, near Baikunthpur village. Carried out scanning of important palynotaxa, and prepared photo plates for interpretation of the results (Talchir palynoflora).

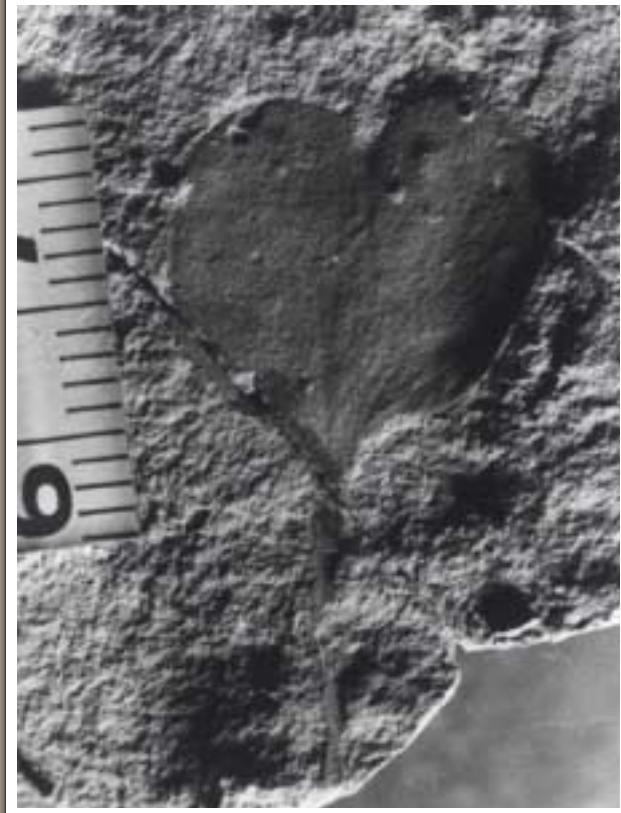
K.L. Meena

#### Component 4: Palaeofloral and dispersed organic matter characterization in Early Cretaceous deposits of central India

The Early Cretaceous deposits exposed at clay mine cut section near Chhoti Pali village and environs (Umaria district) embody Ginkgolean leaves and ovules attributed to *Ginkgo* and *Ginkgoites*, resembles with extant genus *Ginkgo biloba*. The extant *Ginkgo biloba* shows several ancestral fossil records. The Early Cretaceous deposits of Jabalpur Formation embody bilobed compressed leaves; while other recorded forms from older deposits show transitional features in evolutionary lineage. These fossil forms retained primitive as well as advanced vegetative features that coexisted during long geological time span. An evolutionary trend is also visible in Ginkgolean seeds as the mature ovules grow in size and numbers are reduced due to reduction in number of ovules and pedicles. They tend to become contiguous by virtue of shortening and eventual loss of pedicles. Therefore, it is inferred that the Early Cretaceous leaves of *Ginkgo* from Jabalpur Formation are evolutionary advanced than the deeply dissected leaves of *Ginkgoites rajmahalensis* of other basins.

Studied another Early Cretaceous deposits (carbonaceous shale) exposed at nala cut section on the way from Chandia to Umrar River. This shale embody well preserved plant fossils belonging to *Ptilophyllum* flora, spore-pollen and organic matters, while upper sandstone layer contain disarticulated pieces of skeletons (?tetrapods).

Well-diversified and well-preserved plant fossils are collected from blackish-gray shale exposed in mine cut section at Belkher (Amravati District, MS). They are represented by *Matoniidium indicum*, *Cladophlebis indica*, *Ptilophyllum cutchense*, and *P. acutifolium*. *Taeniopteris spatulata*, *Brachiphyllum sehoraensis*, *Elatocladus plana* and *Araucarites cutchensis*. The flora shows dominance of pteridophytes and conifers. Comparative analysis suggests that



Leaf with petiole of fossil *Ginkgo biloba* from Jabalpur Formation

the flora is coeval to Dhragdhara, Gadeshwar and Himmatnagar floral assemblages of western India. Macerated about 50 samples collected from Jhala, Tekan and Machrar River section for palynofacies study. Slides of productive samples have been made and scanned.

**Madhav Kumar & Neeru Prakash**

#### Component 5: Morphotaxonomy, floristics, biostratigraphy and palaeoecological studies in Korba and Hasdo-Arand coalfields

Processed, photographed (56 specimens) identified, and studied megafossil specimens (around 230) collected from southern part of Korba Coalfield (Chhattisgarh State). Seven species of *Glossopteris* viz., *G. communis*, *G. indica*, *G. browniana*, *G. maculata*, *G. taeniodes*, *G. euryneura* and *G.*

*feistmantelli* along with the taxa *Gangamopteris obliqua*, *Noeggerathiopsis hislopii*, *Lidgetttonia mucronata* and *Venustostrobus* sp. have been identified. The overall assemblage suggests an Upper Barakar age to this flora.

**K.J. Singh**



## Project 3: Vegetational patterns, Palaeogeography and Palaeoenvironmental analysis of Satpura-Wardha-Godavari and Gujarat-Rajasthan basins

### Component 1: Palaeobotany, evolution, biostratigraphy and palaeoecology of Gondwana sediments of Wardha-Godavari Basin

**S**ystematically described and finalised study on megafossils from Kamthi Formation of Bazargaon-Satnaori and Semda areas of Kamptee Coalfield, Wardha Basin. The assemblage comprises equisetales, viz. *Trigygia speciosa*, *Schizoneura gondwanensis*, equisetalean axes, filicales- 2 species of the genus *Neomariopteris* (*N. hughesii*, *N. polymorpha*), glossopteridales- 21 species of the genus *Glossopteris*, two scale leaves, a seed taxon- *Maheshwariella* sp., and cordaitales- *Noeggerathiopsis* sp. The assemblage is similar to that of Raniganj Formation of Damodar Basin and indicates an Upper Permian age.

Macerated samples from Barakar Formation of Majri, Hindustan Lalpath, Durgapur, Padampur and Ballarpur collieries

(Wardha Valley) for recovery of palynomorphs. The samples have yielded a rich assemblage of palynofossils. Quantitative and qualitative study is in progress (with Neerja Jha). Also studied palynomorphs from Permian Gondwana Sequence of Umrer Coalfield, Nagpur district. The microspores assemblage (22 genera and 40 species) is characterized by dominance of radial monosaccates (chiefly *Parasaccites*) and subdominance of non-striate disaccates (chiefly *Scheuringipollenites*). Presence of *Crucisaccites* and *Cahleniasaccites* is also recorded. Karharbari palynozone has been demarcated in lithologically designated Barakar Formation. A paper has been finalized on the aspect (with Neerja Jha & A. Rajanikanth).

Rajni Tewari

### Component 2: Palynology of Gondwana sediments of central and southern parts of Godavari Basin and its phytogeographic significance

Early Triassic palynoassemblage recorded at 140.50 m in bore-hole SSP-133 shows high percentage of taeniate-cingulated cavate miospores, viz. *Lunatisporites*, *Lundbladispora* and *Densoisporites* along with presence of stratigraphically significant taxa *Chordasporites*, *Klausipollenites*, *Lunatisporites* and *Playfordiaspora*. Striate disaccates decline at this level. Occurrence of megaspores is also noticed.

Identified a variety of azonate and gulate megaspores from Barakar and Raniganj formations of Kachinapalli and Gundala areas of Godavari Valley coalfields. Detailed study is in progress (with Rajni Tewari). Late Permian (Raniganj) palynoflora has been recorded in equisetalean axes bearing sediments in bore-hole MSP-21 (at 142.5-143.0 m).

Neerja Jha

### Component 3: Biostratigraphy and palaeoenvironmental studies in Wardha and northern part of Godavari Valley Coalfield

Work could not be reported due to sudden demise (in June 2004) of A.P. Bhattacharyya.

### Component 4: Morphological and evolutionary significance of Satpura Gondwana flora and their bearing in stratigraphy, palaeoecology and palaeoenvironment

Carried out the morphotaxonomical analysis, description, identification and comparison of different types of seeds belonging to different species of *Cordaitacarpus*, *Samaropsis*, *Alatocarpus*, *Cornucarpus*, and two new types showing long stalk and large size (>2 cm in diameter). The affinity and affiliation of *Arberiella*-type of sporangium has also been discussed. The possible presence of calamitalean axis possessing alternating grooves at the nodal region and Cordainthus- type of seeds indicate the presence of extra-gondwanic elements in Satpura Gondwana Basin. The finding

further supports the presence of mixed flora in the typical flora of Gondwana represented by *Botrychiopsis*, *Buriadua*, *Rubidgea* along with the glossopterid forms. The different types of flora at successive horizons have been discussed to examine the palaeophytodiversity trends in Indian scenario. It has been observed that there is direct and indirect bearing of palaeobotanical investigations in the conservation of present day biodiversity. Further study is under progress. A field work was also undertaken to different areas of Pench-Kanhan Valley and Pathakhera Coalfield for fresh collection of plant fossils.

A.K. Srivastava



### Component 5: Mesozoic terrestrial ecosystems of peninsular India

Xylotomical investigations on petrified woods of Kota Formation brought out abundance of Podocarpean and Araucarian members. Recovery of a new species of *Circoporoxylon* further support floral similarities of Rajmahal and Kota wood assemblages. Taphonomic studies on leaf assemblages of Gangapur Formation indicate allochthonous

nature of deposition of plant parts. Preservational anomalies noticed were attributed to micro-environmental factors. Preferential segregation of Equisetalean axes confined to certain locales suggests niche preference. Terrestrial phytoecosystems of East Coast were assessed for taphonomic inferences.

**A. Rajanikanth**

### Component 6: Palaeofloristics of the Jurassic-Cretaceous sequences of Gujarat and Rajasthan

Study of fossil flora from *Isoetites*-rich locality near Than in Surendranagar District (Gujarat) revealed the presence of algal mat bearing strata as well as strata with bryophytic remains—*Thallites* over and above the *Isoetites*-bearing strata. The algal mat is composed of *Vaucheria*-like algal filaments, which at places are overlain by the remains of *Cladophlebis kathiawarensis*, *Brachiphyllum* sp., etc. The overlying layer contains *Thallites*. It seems that these algae were growing in pockets in the shallow water remains of the drying up ancient

pond, which ultimately got preserved in the form of algal mat in small patches. After complete depletion of water, when marshy habitat was developed, the *Thallites* started growing over it. These *Thallites* got preserved over the sediments on which these were growing to give the *Thallites*-bearing strata. These evidences clearly indicate that fresh water condition was prevailed at the time of deposition in studied area.

**B.N. Jana**

## Project 4: Floral evolution and Biostratigraphy of Rajmahal Basin

### Component 1: Terrestrial megafloral change during Mesozoic in Rajmahal Basin

Carried out megafloral investigation of petrified and impression specimens recovered from Hiranduba and Sonajori localities. An impression specimen of ?Lichen/Fungi has been found on coniferous wood showing evidence of mutualism or

saprophytic habit during Cretaceous in the Rajmahal flora. Besides impressions, study of structurally preserved petrified seeds and other plant remains are also in progress.

**Jayasri Banerji & A.K. Ghosh**

### Component 2: Biostratigraphy of Gondwana sediments in Rajmahal Basin

A search for presence of marker species in the subsurface Mesozoic (Dubrajpur and Rajmahal formations) sequence shows presence of *Triporoletes reticulates*, *Aequitriradites spinulosus*, *A. verrucosus*, *Ruffordiaspora australiensis*, *R. purbeckensis*, *Coptospora microgranulosa*, *C. kutchensis*, *C. verrucosa*, *Januasporites spinifer*, *J. spinulosus*,

*Contignisporites glebulentus*, etc. The palynoflora observed in bore-hole RJHC-1 is diversified and rich in comparison to that recorded in bore-holes RJKS-1, RJSJ-7 and RJSJ-8 of Brahmini Coalfield of the basin.

**Archana Tripathi**



## Thrust Area: BIOPETROLOGY OF COALS AND ITS RELEVANCE TO COAL BED METHANE

### Project 5: Origin, Depositional environment and Economic potential of Indian Coal and Lignite deposits

#### *Component 1: Biopetrological and geochemical characterization of Indian lignites*

Processed 20 selected samples collected from lignite and associated sediments from different areas of Gujarat and Rajasthan for petrological and geochemical characterization. Petrological study under fluorescence mode shows typical association of alginite with this material. This indicate their probable oil generating potentiality. They are also rich in huminite group of macerals (humocollinite, humodetrinite). The lignites show higher reflectance (0.218-0.468) in comparison with Neyveli lignite (0.208-0.246). Typical cut section of rootlet, consisting of phlobaphanic

microconstituents, has also been recorded from Neyveli lignite suggesting their vegetal source. Besides some leaf cut sections show crassi-cutinite. Preliminary study of FTIR characterization of resins shows carbonyl peaks suggesting their low rank nature. Fresh collection of lignites (through channel sampling technique) were made from the newly opened mine sections of Mine IA, Mine I and Mine II of Neyveli area and a few bore core samples from Mannargudi area to understand the pattern of maceral variance in time and space.

Rakesh Saxena

#### *Component 2: Biopetrological investigations on coals of Wardha-Godavari Valley coalfields in relation to coal bed methane*

Completed the possessing of coal samples for petrological study of the coals from Phukeshwar area and Kayar Block, Wardha Valley Coalfield, Maharashtra. The elemental study of the coals from Junad Open Cast Mine of this coalfield has revealed that these coals contain low frequency of sulphur as compared to the coals of the adjoining Telwasa Mine.

O.S. Sarate

#### *Component 3: Petrological evaluation of Rajmahal Basin coals in relation to economic potentiality and depositional history*

Compiled maceral, microlithotype and vitrinite reflectance (rank) data of the coals (representing seams— IV and V) encountered in bore-hole CM-109 from Hura Coalfield. The sub-bituminous A to high-volatile bituminous C stage ( $R_o$  max. 0.40-0.54%) coals are found to be rich in trimacerite and of mixed type (inertinite- as well as vitrinite-rich) associated with dispersed mineral matter, indicating inferior quality for selective utilization. Observation under blue light excitation have shown appreciably high amount of hydrogen-rich macerals (liptinite + perhydrous vitrinite), chiefly constituted by sporinite (spores-pollen) and liptodetrinite (detritus). High amount of hydrogen-

rich macerals in the coals render them suitable for liquefaction.

Finalized microconstituents and rank data of the coals (representing seams I-VIII) encountered in bore-hole RCH-3 from Chuperbhita Coalfield. Various compositional models utilizing the data have been prepared for assessing the coal types and related conditions of deposition of seams. In general, these sub-bituminous A to high-volatile bituminous C stage coals are of mixed types. Study under fluorescence mode showed high concentration of hydrogen-rich macerals in these coals.

Alpana Singh & B.D. Singh

#### *Component 4: Petrological investigation of coals from Jhilimili-Sonhat-Sohagpur coalfields (Son Basin) in relation to coal bed methane and carbonization properties*

Due to instrumentation problems the specified work could not be carried out. Instead, a Collaborative-Consultancy Programme on Sohagpur coals has been taken up with Central Mining Research Institute (Dhanbad). Investigations on bore-hole coal samples were carried out for macerals and their association, characterization, and mineral matter association

were studied and also done photomicrography. Range of reflectance on samples was also measured. In addition to that measurement and study of microcleat on certain coal blocks were carried out. The report was finalized and communicated.

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



### Component 5: Petrographic atlas of Indian coals and lignites

Searched and recorded the maceral exsudatinitite on a large number of coal pellets for their correct identification and proper characterization. Computer-scanned hundreds of photomicrographs (exposed under normal and fluorescent lights) of macerals of Indian coals and lignites, besides associated mineral

matter in order to compile them in the form of an atlas. Photomicrography on coal pellets and scanning of photomicrographs and their trimming and sharpening through computer was also done.

**B.K. Misra & B.D. Singh**

## Thrust Area: PALAEOBIOLOGY OF PHANEROZOIC BASINS AND ITS BEARING ON HYDROCARBON POTENTIAL

### Project 6: Palaeofloristics, Evolutionary trends and Palaeoenvironment of Late Cretaceous-Cenozoic basins

#### Component 1: Tertiary floristics of north-western peninsular India

Studied 50 wood samples (thin sections) from the Tertiary sediments of Bhavnagar and Kachchh districts of Gujarat. Identified a few wood samples from the Plio-Pleistocene sediments of Piram Island (Bhavnagar). The identified woods represent the modern genera *Cynometra*, *Diospyros*, *Ficus*, *Millettia*-*Pongamia*, *Cassia* and a palm wood.

From the Eocene deposits of Vastan lignite mine, Surat, 4 types of dicotyledonous woods have been identified. In addition, palynological investigation of Vastan samples is

undertaken (with J.P. Mandal), and recovered a rich palynoassemblage dominated by angiospermous pollen. Some of the important taxa identified are— *Acanthotricolpites*, *Dracaenopollis*, *Florschuetzia* (Rhizophoraceae), *Proxapertites*, *Spinizonocolpites* (*Nypa*), etc. The assemblage suggests deposition of lignite in deltaic conditions under brackish water influence and prevalence of warm, humid tropical climate.

**J.S. Guleria**

#### Component 2: Palynology, facies analysis, palaeoclimatic and palaeoenvironmental studies on Palaeocene-Eocene sediments in Rajasthan Basin

Carried out comprehensive study of palynofloras recorded from Giral lignite mine and those from bore-holes drilled near Kapurdi and Jalipa in Barmer district, with an aim to correlate sequences. Palynological assemblage from the lignite mine and that from the bore-hole MJ-4 are very similar as, both of these exhibit coastal elements as the dominant constituents. The assemblage is marked with profuse occurrence of monosulcate pollen assignable to different species of *Spinizonocolpites*. These forms possess an extended sulcus parallel to the polar axis and exhibit spinulate exine. This pollen, in all probabilities is related with modern brackish water Palm

*Nypa*. Other significant monosulcate pollen taxa present in the assemblage are *Kapurdipollenites gemmatus* and *K. baculatus*. These pollen also possess an extended sulcus but are distinctly different in exinal characters. Affinity of these pollen with those of *Nypa* can not be ruled out. Another interesting monosulcate form is *Retiverrumonosulcites barmerensis*. The sulcus in this pollen is small and is characteristically bordered with clavae of varying sizes. It is significant to note that these forms are confined to the Barmer Basin only.

**S.K.M. Tripathi**

#### Component 3: Tertiary floristics of peninsular India from Ratnagiri, Neyveli, Kerala, Bahur Basin (Pondicherry) and the adjoining areas

Carried out sectioning and investigation on 50 carbonised woods collected from Ratnagiri beds, Neyveli lignite and Kerala. Investigated fossil fruits and leaves from Ratnagiri, Payangadi mines (Kerala) and Neyveli, and identified some of fossil leaves, fruits and seeds after comparing them with their modern counterparts at CNH (Howrah). Further study is in progress. SEM study of fossil leaves and seeds/fruits is also in process. Further contribution of fossil leaves from Neyveli

lignite is in process. Undertook a field work in Kerala (Varkala, Cannanore, Payangadi, Kundra, Quilon), Tamil Nadu (Neyveli lignite), Pondicherry and adjoining areas and collected varied plant megafossils (fruit, leaves, carbonized and petrified woods). Sorting and documentation of fresh materials have been completed. Sectioning of remaining woods, seed/fruits and morphological/SEM study of leaf cuticles will be continued.

**Anil Agarwal**



#### Component 4: Palaeofloristics of sedimentary sequences associated with Deccan Traps

Studied plant and animal remains from the Deccan Basalts of Khandwa district (MP) near Onkarmandhata temple. A unique fossilization of tree trunk of palm wood, fragmentary palm leaf, algal remains and fungal and pteridophytic spores are found in random cut basalt section. The fauna includes

*Physa prinsippii* and microgastropods. The fossilization is by typical vesicular basalt with characteristic ophiolitic structure. They seem to be in the initial stages of silicification when they were engulfed by sudden lava flows.

Rashmi Srivastava

#### Component 5: Palynology of the Deccan Intertrappean sediments: Implication and correlation

The section exposed (3-15 m, Mahadek Formation) near the village Pungtung (in Pynursla Plateau, Khasi Hills, Meghalaya) contains about 2-3 feet thick carbonaceous shale band sandwiched in between sandstone, which was found to be palynologically productive. The assemblage comprises of *Cyathidites australis*, *Cyathidites minor*, *Todisporites major*, *Todisporites minor*, *Biretisporites potoniaei*, *Lygodiumsporites eocenicus*, *Intrapunctisporites pachyexinus*, *Concavisporites concavus*, *Azolla cretacea*, *Contignisporites bellus*, *Microfoveolatosporites mahadekensis*, *Lycopodiumsporites speciosus*, *Dictyophyllidites* spp., *Cicatricosisporites* spp., *Appendicisporites* spp., *Contignisporites assamicus*, *Triporoletes reticulatus*, *Araucariacites australis*, *Ariadnaesporites intermedius* and other porate and colpate angiosperm pollen. It is deduced that *Ariadnaesporites*,

*Triporoletes*, *Minerisporites*, *Azolla* and *Cicatricosisporites* are common marker taxa of both marine and non-marine Maastrichtian sediments of India. *Aquilapollenites*, *Gabonisporites* and *Mulleripollis* are restricted to the Intertrappean deposits. *Araucariacites australis* is the most dominant species in the marine Late Cretaceous deposits of Meghalaya, which suggests the existence of moderately high hinterland near the depository basin. The assemblages recovered from both Intertrappean deposits and its equivalent deposits of Meghalaya are dominated by pteridophytic spores and indicate a uniform warm and humid climatic conditions during the deposition of the Late Cretaceous sediments. Deccan intertrappean rock samples are also collected from Rangareddy district, Andhra Pradesh and Gulbarga district, Karnataka for palynological study.

R.S. Singh

#### Component 6: Evolution and diversification of the flowering plants in the Assam-Arakan Basin during Tertiary

Investigated the leaf impressions from the Disang sediments of Manipur in detail and finalized a paper on the same (jointly with J.S. Guleria and R.K.S. Hemanta et al. of Manipur Univ.). The paper describes for the first time a rich megafloral assemblage from the Upper Disang (Late Eocene) and Lower Barail (Early Oligocene) sediments of Imphal Valley. The assemblage consists of two types of palm leaves, 16 types of dicotyledonous leaves, one type of fruiting axis, a leguminous fruit and a bark impression, which indicate the existence of warm and humid tropical vegetation at the time of deposition.

R.C. Mehrotra

Fruiting shoots of flowering plant from the Early Oligocene sediments of Imphal Valley, Manipur





### Component 7: Study on Tertiary plant megafossils of north-west Himalayas

Investigated some leaf remains from the Lower Miocene sediments of Dharamsala, Himachal Pradesh. Fossil leaves belonging to 6 families and 7 genera have been reported from the Kasauli Formation. The genera are— *Semecarpus* (Anacardiaceae), *Chukrasia* and *Heynea* (Miliaceae), *Tephrosia* (Fabaceae), *Mallotus* (Euphorbiaceae), *Donax* (Marantaceae)

and *Poacites* (Poaceae). Among these remains of first five genera have been reported for the first time from the area. The floral remains indicate existence of a tropical low land vegetation in contrast to the present day cooler vegetation in the area.

**J.S. Guleria & Rashmi Srivastava**

### Component 8: Siwalik Foreland Basin: Floristics, evolutionary pattern and climate

Carried out morphotaxonomic study of plant fossils from Siwalik of Darjeeling district (WB), which reveals the presence of some more taxa showing their close resemblance with extant taxa of families— Anonaceae, Flacourtiaceae, Dipterocarpaceae, Sterculiaceae, Malvaceae, Burseraceae, Sapindaceae, Anacardiaceae, Fabaceae, Combretaceae, Lythraceae, Rubiaceae, Ebenaceae, Oleaceae, and Apocynaceae. The habit and habitat and present day distribution of modern equivalent taxa indicate that evergreen to moist deciduous elements with medium to large leaves were flourishing during Middle Miocene around Oodlabari and nearby studied areas. Some of the moist deciduous elements are still found to grow there.

A manuscript on plant remains (wood, leaves and fruit) showing similarity with the genus *Dipterocarpus* Gaertn. from

Siwalik of Arjun Khola western Nepal has been prepared. It reveals that the comparable species of the genus *Dipterocarpus* do not grow now in the Himalayan foot hills of India and Nepal, but are presently distributed in the evergreen forests of South east Asian regions. This suggests that after prevailing unfavourable conditions such moist loving species could not survive there. Also collected plant megafossils (woods, leaves, fruits) from different Siwalik sections exposed in Tanakpur and nearby areas of Uttarakhand. Palynological samples were also collected from lower and middle Siwalik sediments. Identification of above 30 leaf impressions of Siwalik sediments has been carried out at CNH (Howrah).

**Mahesh Prasad**

### Component 9: Neogene of sub-Himalayas of Arunachal Pradesh: Palynostratigraphy, floristic pattern and climate

Studied palaeopalynology of Dafla and Subansiri formations exposed on Kimin-Ziro Road, Papumpare district. The palynological rock samples are chemically processed, and yielded very poor pollen-spores. The recovered palynomorphs

are mostly recycled Permian forms—*Rhizomaspora* and *Verticipollenites* with few Tertiary palynomorphs, like *Striatriletes* and *Frasnacritetrus*.

**G.K. Trivedi**

## Project 7: Palynostratigraphy and Palaeoenvironment of Cenozoic basins of peninsular India

### Component 1: Palynological investigation of the Eocene sediments of Shillong Plateau

Undertook traverses along Tura-Dalu Road in West Garo Hills district and Siju-Baghmara Road in South Garo Hills district (Meghalaya) to understand the stratigraphic set-up of the area and to collect samples from the Siju, Rewak and Kherapara formations for palynological studies. Macerated 34 samples from the Rewak Formation of Siju-Baghmara Road Section. Scanning of slides and photodocumentation and study of palynofossils have been taken up. The important palynotaxa

recorded are— *Cyathidites australis*, *Striatriletes susannae*, *Intrapunctisporis intrapunctis*, *Polypodiisporites ornatus*, *Polypodaceaesporites major*, *Retitricolpites* sp., *Densiverpulollenites eocenicus*, *Pellicieroipollis langenheimii*, *Operculosculptites* sp. etc., besides dinoflagellate cysts. The study is in progress.

**R.K. Saxena & G.K. Trivedi**



## Component 2: Palynological study of Tertiary sedimentaries and its bearing on the evolution of palynoflora of Kachchh Basin

Palynoassemblage recovered from the early Eocene sediments exposed near Waghopadar village is rich both in number and variety. Quantitatively, angiospermous pollen grains dominate over the spores. Dinocysts are absent in the assemblage. Morphotaxonomic study of the palynotaxa has

been taken up. A few important elements of the assemblage are *Paripollis broachensis*, *Lakiapollis ovatus*, *Arengapollenites achinatus*, *Spinizonocolpites baculatus*, *Tricolpites reticulates*, *Striocolporites striatus*, *Cheilanthoidspora monoleta*, *Pellicieroipollis langenheimii*.

J.P. Mandal

## Component 3: Tertiary palynostratigraphy and palaeoecology of east coast of India

Completed chemical processing of samples from Pangidi and Duddukuru (K-G Basin), Niniyur, Kallamedu and Adnankurichi Limestone mines of Ariyalur area (Cauvery Basin). Morphotaxonomy, identification and data interpretation of spore-pollen recovered from Adnankurichi mines and Niniyur sections have been taken up and continued. The important genera recorded are— *Lygodiumsporites*, *Palmidites*, *Liliacidites*, *Retitricolporites*, *Graminidites*.

Palynological investigations on the MECL Sellur bore-hole, Tiruvarur district (Tamil Nadu) has been completed. The assemblage consists of 18 genera and 28 species of algal and

fungual remains and angiosperm pollen. The important genera are— *Botryococcus*, *Inapertisporites*, *Polyadosporites*, *Palmidites*, *Iridacidites*, *Meliapollis*, *Tamilipollenites*, *Cuddaloripollis* and *Tricolporopilites*. On the basis of palynological data, the age of the sediments is assigned to Early Miocene. The data depict a tropical (warm and humid) climate with plenty of rainfall during the time of deposition. Palynofossils belonging to lowland, freshwater swamp and water edge and sandy beach elements have been identified. The deposition took place in a far sea-shore environment with sufficient fresh water.

M.R. Rao

## Component 4: Palynostratigraphy and palynofacies analysis of Tertiary sediments of Upper Assam Basin

Macerated 50 samples from mine cut section exposed at Tirap Colliery (Tikak Parbat Formation, Late Oligocene), district Margherita. The palynoassemblage recovered from coal, carbonaceous shale and clay samples contain spores of *Striatiletes* complex, *Pteridacidites* sp., *Cyathidites minor*, *Dictyophyllidites kyrtomatus*; pollen of *Hibisceaeppolis* sp., *Tricolpites reticulates*, *Polyadopollenites miocenicus*, *Malvacerumpollis* sp., etc. The fungal fruiting bodies of *Phragmothyrites* sp., *Pluricellaesporites* sp. and some reworked Permian saccate pollen grains have also been identified in the assemblage. The DOM has been identified as: structured terrestrial, biodegraded terrestrial, amorphous, resins,

black debris and brown phytoclasts, etc. The relative abundance of the organic matter shows that frequency of biodegraded terrestrial and amorphous is higher in the base of the section. The resin globules and black debris are next to them. While samples from upper beds display rich black debris followed by structured terrestrial, biodegraded, amorphous and resins. The results indicate that during the deposition of basal sequence reducing condition was prevalent which was gradually replaced by moderate reducing-oxidizing towards the top. The overall palynoassemblage and palynofacies data show deltaic-swampy set up under subtropical regime.

Madhav Kumar

## Component 5: Palynological investigation of Miocene sediments of Tripura and Mizoram

Palynoassemblage recovered from Upper Bhupan Formation of Chownge section, Southeastern zone of Mizoram are assigned to an early Miocene age, based on the occurrence of tropical-subtropical stratigraphical marker taxa (*Malvacearumpollis*, *Pteridacidites*, *Hibisceaeppollenites*, *Compositoipollenites*, *Alnipollenites*, *Lygodiumsporites*, *Todisporites* etc.). The presence of *Spinizonocolpites echinatus* referable to *Nypa* suggests a shoreline inhabitant.

The occurrence of salt loving taxon *Polyporina*, which today belongs to a coastal marsh vegetational community, supports the presence of tidal swamps near the area of deposition. The diversity of angiosperm palynotaxa, which forms the bulk of assemblage, is thought to indicate a dense low land vegetation cover. The sediments were deposited in marginally marine evident under influence, as indicated by the presence of rare dinoflagellates. The Upper Bhupan Formation is mainly



composed of coarse upward succession of shale, sandstone, interbedded siltstone and greyish cross bedded sandstone, interpreted to be deposits of delta distributary channel in the proximity of shoreline. Also undertook a field trip to Mizoram

and collected rock samples (350) to study the spores-pollen and vegetation relationship in the region. The photodocumentation of related specimens of fossils are also done.

**B.D. Mandaokar**

## Project 8: Marine micropalaeontology of Mesozoic-Cenozoic basins: Implications on Palaeoenvironment and Sea Level changes

### **Component 1: Jurassic nannofossils from western Indian continental shelves and their palaeobiogeographic implications**

Prepared and studied 70 samples representing Chari, Katrol and Umia formations from Jara, Jumara, and Keera Domes (Kutch). Besides, samples from Lakhapar section, Umia Plant Bed and Panandhro were also prepared. A well preserved and diverse nannofossil assemblage comprising *Ansulaspheara helvetica*, *Biscutum constans*, *Cyclagelospheara margerelii*, *Ethmorhabdus gallicus*, *Lotharinguis crucicentralis*, *L. sigillatus*, *Podorhabdus grassei*, *Stephanolithion bigotii*, *S. hexum*, *S. speciosum*, *Thoracosphaera saxeae*, *Watznaueria barnesae*, *W. britannica*, *W. manivitae* and *W. ovata* is recovered from glauconitic mudstones representing non-gypsiferous unit from the base of Jara Dome section. The non-gypsiferous shales are underlain by gypsiferous shales and carbonaceous shales and

are overlain by three characteristic highly fossiliferous Oxfordian age ammonite containing bands of Dhosa oolite capping the section with intermittent hard calcareous shales. The gypsiferous, non-gypsiferous and Dhosa oolite in ascending order represent Chari Formation and only the non-gypsiferous shales is rich in cosmopolitan and substitute marker and other units are practically devoid of nannofossils.

Presence of age diagnostic nannofossil taxa, viz *A. helvetica*, *S. bigotii*, *S. hexum*, *W. manivitae* in the assemblage allows correlation with *A. helvetica* (NJ 12) and *S. bigotii* (NJ 13) of late Callovian age. Finalized a manuscript on calcareous nanofossils from the Bhuj Member lacking any datable marine fossils. Also visited IIT, Mumbai for consultation and discussion with Dr. S.K. Biswas on problems related with Kutch Mesozoics.

**Jyotsana Rai**

### **Component 2: Micropalaeontology of fossil algae from Late Cretaceous-Early Palaeocene sequence of Cauvery Basin**

Studied palaeoenvironmental significance of calcareous algae from the Ninniyur Formation (Palaeocene) in Ariyalur District of Tamil Nadu. The algal flora is diversified and is represented by Corallinaceans (Lithophylloids, Mastophoroids and Melobesiods), Sporolithaceans, Geniculate Corallines, Solenopores and Dasyclads. As a whole Corallinaceans are preponderant in this calcareous algal assemblage. The

assemblage of the lower unit of Ninniyur Formation indicates shallow shelf facies, i.e. back-reef environment with low energy condition. The composition of the algal forms recorded from the middle unit of the formation is indicative of middle-shelf, low energy environment, whereas, assemblage of the upper unit indicates patch-reef environment in the close vicinity of near-shore, lagoonal to tidal, medium energy environment.

**A.K. Ghosh**

### **Component 3: Dinoflagellate cysts and palynofacies study of the Upper Cretaceous-Palaeocene succession of the south Shillong Plateau: Implications to palaeoenvironment and relative sea level changes**

New morphotypes representing early Wetzelieloid taxa are recorded in the Jathang Hill dinocyst assemblage. The forms, showing overlapping characters between *Apectodinium* and *Rhombodynium* may represent a new genus having a significant bearing on the evolutionary lineage of this biostratigraphically important dinoflagellate cyst group.

Dinoflagellate cyst productive levels have been identified in the Latmawksing Hill and Siju-Rewak Sections. Documentation of palynomorphs and dinoflagellate cysts from Tura-Dalu Section is carried out.

**Rahul Garg, Khwaja Ateequzzaman & Vandana Prasad**



A manuscript highlighting biostratigraphic potential of dinoflagellate cysts in the Maastrichtian-Danian succession of Khasi Hills is finalized. FAD/LAD of significant marker cosmopolitan taxa are documented and compared with low latitude global records.

**Rahul Garg & Khowaja Ateequzzaman**

Carried out documentation and detailed morphological study of dinoflagellate cyst assemblages recovered from closely sampled Jathang Hill Section with specific reference to the global warming event across the Palaeocene-Eocene boundary. The *Apectodinium* peak is closely integrated with negative carbon isotope excursion, matching the global IETM (PETM) Event. Palaeocene/Eocene boundary in the section is demarcated as per the latest concepts. Presence of Sparnacian sediments is identified for the first time in this region. Relative proportion of *Apectodinium*, other dinoflagellate cysts, palynomorphs and organic matter are documented and a palynofacies distribution chart has been updated, indicating short-lived marine pulses in a coastal swamp setup. Occurrence of impersistent coal horizons is supposed to be related to the global warming event associated with IETM. An integrated chronostratigraphic scheme for the Palaeocene/Eocene boundary section of Khasi Hills is proposed. Manuscript is revised as per the referee's suggestions, incorporating Carbon isotope data.

Carried out palynofacies study based on the

characterization of various organic matter types and their relative proportion in the vertical section of Palaeocene-Eocene succession of Cherrapunji and Jathang sections. On the basis of relative proportion of different palynofacies constituents, the succession of both areas is subdivided into 4 palynofacies units- I, II, III, IV, facilitating interpretation of the depositional environment and relative sea level changes. The sandy shale and bioturbated horizon of the lower horizon of Cherrapunji section corresponds to Unit I and is considered as a retrogradational sequence of the Transgressive Systems Tract. The bioturbated horizon in this unit is interpreted as mfs or maximum starvation or downlap surface. The palynofacies characteristics of foraminiferal limestone of Cherrapunji and lower part of Lakadong Sandstone of Cherrapunji and Jathang sections represent the Unit II are indicative of decelerating sea level and corresponds to High Stand Systems Tract. The gradual increase in the terrestrial organic matter, mangrove palynomorphs and dinoflagellate cysts in the Palynofacies Unit III of Cherrapunji and Jathang sections points towards establishment of restricted marine lagoonal environment of deposition during Early Transgression. The sharp increase in marine component of Unit IV indicates inundation of the shelf and increased water depth with reducing environment of deposition as a result of the maximum transgression.

**Vandana Prasad, Rahul Garg & Khowaja Ateequzzaman**

#### **Component 4: Palynostratigraphy and palaeoenvironment analysis of the Lower Tertiary rocks, N-W Himalayas: Implication to palaeoclimate and foreland basin evolution**

Carried out palynostratigraphical study of the Lower Tertiary sediments of Dharamsala and its adjoining areas of Himachal Pradesh. Rock samples (353) belonging to 22 measured stratigraphic sections were processed for the study. Processed samples are mostly unproductive or extremely poor in palynofossils. However, samples from the Gaj Khad, Manjhi Khad and Churon Khad have yielded rich palynoflora. The palynofloras from the Dharamsala sediments of the Churon Khad and Manjhi Khad are represented by 18 genera and 37 species of algal and fungal remains, pteridophytic spores and gymnospermous and angiospermous pollen grains. The assemblage is represented by *Striatriletes*, *Polypodiaceasporites*, *Polypodiisporites*, *Compositoipollenites*, *Monoporopollenites*, *Pinuspollenites*, etc. Quantitatively, algal zygospores are the most dominant element in the assemblage. Significant taxa of the palynoflora have been compared to those of the extant members of the families, viz. Cyatheaceae, Dicksoniaceae, Osmundaceae, Schizeaceae, Parkeriaceae, Polypodiaceae, Arecaceae, Poaceae, Sapotaceae and Mimosaceae. The data have been interpreted throwing light on its dating potential and environment of deposition. The preponderant occurrence of coniferous pollen grains particularly represented by the members of Abietinae indicates definite Neogene affinity of the palynofloral assemblage. The sediments seem to have been deposited under fresh water conditions.

Morphotaxonomical study of the recovered palynofossils from the Eocene sediments exposed along Manji Khad (near Kunihara) has been partly done along with the selective photography of the palynofossils. Also undertook a field work for systematic collection of palynological samples as well as for field observations of Dharamsala and Subathu formations of Dharamsala and its adjoining areas.

**Samir Sarkar**

Palynofacies studies along with sedimentological studies (in collaboration) were performed in the Subathu Formation of Nilkanth and Tal valley areas of Uttarakhand for the detailed palaeoenvironmental interpretation as well as sea level changes in this region. Several Palaeosol horizons have been identified in the basal part of Subathu Formation in the studied areas. The paleosols are characterized by lateritic horizon associated with iron oolitic bands. It is suggested that the high precipitation and warm and humid climate of Late Palaeocene resulted in the constant influx of water that resulted in the chemical and physical weathering and leaching of soluble material and accumulation of insoluble residue. The XRD analysis in collaboration indicates dominance of Kaolinite and Smectite clay mineral.

**Vandana Prasad**



## Project 9: Palaeofloristics and Palaeoclimate of Andaman and Nicobar Basin

### Component 1: Neogene microfloristics of Andaman and Nicobar Islands and their stratigraphic sequence

Finalized biostratigraphic studies utilizing diatoms and silicoflagellates of Late Neogene deposits from Sawai Bay

(Neill Island) and Long (Havelock Island) formations.

**Anil Chandra (till December 2004)**

### Component 2: Palaeomangroves and palaeoclimate in Andaman and Nicobar Islands during Quaternary period

The palynological studies of 25' exposed Quaternary section in R.K. Puram, Little Andaman (BS-1595;  $36,550 \pm 870$  yrs. BP) exhibited the history of mangrove development and sea level changes since 36,000 yrs BP. Three major palynological zones were identified exhibiting stable sea levels required for

the establishment of mangrove forest. Overall Late Quaternary pollen data recording mangrove evolution in Andamans show similarity with the data sets obtained from Eastern Indonesia and Northern Australia.

**Asha Khandelwal**

## Thrust Area: QUATERNARY VEGETATION, EUSTATIC SEA LEVEL CHANGES, GLOBAL CLIMATE CHANGE AND ANTHROPOGENIC IMPACT

## Project 10: Quaternary vegetation, Palaeoclimate and Palaeoseismosity

### Component 2: Studies on palaeovegetational and palaeoclimatic changes in Madhya Pradesh using pollen proxy records

Completed pollen analysis of a 1.3 m deep sediment core from Jalda, Shahdol District, depicting 3 vegetational and climatic phases, based on the fluctuations in major arboreals and non-arboreals. Phase I is marked by the presence of tropical deciduous sal forests mainly constituted of *Shorea robusta* associated with *Madhuca indica*, *Emblica officinalis*, *Sapotaceae*, *Schrebera* and *Butea* under moist climatic condition. Subsequently (Phase II), the sal forests became sparse as indicated by the considerable decline in *Shorea robusta*. However, its associates remained more or less same. This change in the vegetational composition signifies that a relatively less moist climate prevailed in the region. Finally (Phase III) the sal forests got diversified as demonstrated by the improved frequencies of *Shorea robusta* along with

*Madhuca indica*, *Lagerstroemia*, *Emblica officinalis* and *Buchanania*. This increase in the forest floristics might have occurred due to enhancement in precipitation.

Pollen analysed 10 core samples from a 2.5 m deep sediment core from Jogi-chhapar, Shahdol District. The pollen assemblage obtained has revealed that *Shorea robusta*, *Madhuca indica*, *Lagerstroemia*, *Terminalia*, *Butea*, *Syzygium*, *Sapotaceae*, *Anacardiaceae* etc. are the major tree taxa. Grasses, sedges, *Tubuliflorae*, *Ranunculaceae*, *Cheno/Am.* etc., are the prominent constituents of herbaceous complex. The preponderance of fern spores envisages their origin from the local sources. The overall floristic composition suggests the presence of tropical deciduous forests in the region.

**M.S. Chauhan**

### Component 3: Studies on Quaternary vegetation and climate of western Himalayas

Studied multidisciplinary aspects of lacustrine sediments from Sukha Tal (Naini Tal District), Kumaun Himalaya to understand the knowledge of temperate zone since Early

Holocene (around  $8700 \pm 170$  yrs BP). The investigated profile is comprised of silty-clay with or without sand, granules and pebbles. Palaeontological evidences show that in earlier part



of sequence (Early–Middle Holocene) the studied area had no Molluscs, but near onset of Late Holocene numerous specimens came in to existence, indicating change in climate to suitable humid conditions. Geochemical analysis shows that in the beginning of sequence (Early Holocene) the area had high representation of organic matter and low carbonate contents, reflecting humid climate. Subsequently (around Mid Holocene), organic matter became low and carbon contents high, indicating change in climate towards dry conditions. Thereafter (around Late Holocene), organic matter again became high and carbonate contents low, reflecting restoration of humid conditions at the region.

Pollen analysis reveals that in the beginning of sequence the area had predominance of non-arboREALS with poor presence of arboreals (mainly *Pinus*) but soon after arboreals (particularly *Quercus* and *Pinus* with their associates, i.e. *Ericaceae*, *Ulmus*, *Carpinus*, *Betula*, *Celtis*, *Picea* and *Ephedra*, etc.) showed marked enhancement with corresponding fall in non-arboREALS and resulted in establishment of mixed oak forest with warm and humid climate. Such forest continued onwards but faced considerable decline in Middle Holocene and re-expansion near onset of Late Holocene, indicating deterioration and again amelioration of climatic conditions respectively. Data generated from different analyses broadly corroborate with each other.

**Asha Gupta**

#### **Component 4: Palaeoclimatic studies in Schirmacher Oasis, east Antarctica using palynological as well as chronological parameters**

Pollen analysis of 10 bulk ice samples from continental ice sheet and 5 water samples from glacial melt reflects poor occurrence of transported air borne pollen, fungal spores, diatoms and algal filaments. Presence of reworked palynomorph (?Permian) trapped in huge ice sheet proves the nearness of the existing sedimentary rocks. The generated palynodata will be helpful for Antarctic ice core study. A 0.8 m sediment profile of Long lake II reflected two fold climatic oscillations, i.e cold and humid – warm and humid. Due to less carbon content radiometric dates are not feasible. More deeper sediment cores from polar region are required. 2 foliose lichen patches out of 6

were productive as evidenced by few grasses, desmids, algal filaments and fungal fruiting body. Out of 8 moss peat samples, only 3 from near vicinity of Russian Research Station (East Antarctica) indicate occurrence of transported grass pollen along with other local elements, like desmids, algal filaments, fungal spores, etc. One-meter silty clay exposure from huge moraine cone was not dated due to less carbon content and samples were barren except a few diatoms and fungal spores. 8 moraine samples did not show any significant palynological result.

**S.K. Bera**



Occurrence of reworked palynomorph in continental ice sheet is indicative of nearness of Gondwana sedimentary rocks in Eastern Antarctica.



**Component 5 : History of mangrove vegetation in India: Mahanadi Delta**

Pollen analysed 10 samples from profile (BS-1152  $\pm$ 30,625 yrs. BP) collected from Bhagwanpur (Orissa). The samples exhibited varying frequency of palynodebris, such as pollen, spores, dinoflagellate cysts, microforaminifera, pseudoschizea, etc. The encountered core mangroves taxa included *Rhizophora*, *Sonneratia*, *Heritiera*, *Avicennia*, *Excoecaria*, etc. The hinterland taxa, such as *Holoptelca*, *Salvadora*, *Emblica*, Oleaceae, and Fabaceae were recorded along with Poaceae, Chenopodiaceae/Amaranthaceae, Cyperaceae, etc.

*Asha Khandelwal*

**Component 6 : Climate and vegetational succession in tropical forests of Mikir plateau and upper Assam plain, North East India during Quaternary**

Pollen analysis of 10 moss cushion and subsurface soil samples from across the Dilli river around Dilli Colliery, Dibrugarh District signifies the existing of tropical deciduous forest as evidenced by the palynoassemblage recovered from the sediment. Occurrence of degraded pollen-spores along with adequate fungal spores and filaments in the sediments indicates the microbial activity during sedimentation. The further palynological study of two one-meter soil sections exposed near Dilli river is in progress. A manuscript entitled 'Pollen rain in and around Dilli Colliery, Assam' is finalized.

*S.K. Bera*



A view of Independence Day Celebrations 2004



## Project 11: Proxy climatic signals from Marine and Coastal sediments during Late Quaternary

### ***Component 1: Dinoflagellate cysts from marine sediments as proxy indicators of palaeoenvironmental changes along the western shelf of India during Late Quaternary***

**S**tudy of low frequency organic walled dinoflagellate cyst assemblages from surface sediment samples from shallow depths (~50 m) revealed enhanced proportion of *Tuberculodinium vancomoae* having preference for lower salinity and warm water. It may be useful as indicator of warm and humid conditions with enhanced precipitation (related to rainfall/monsoon).

Processing of 5.5 m core samples (Gravity core GC 7; 2 cm interval), (provided by Dr. Rajiv Nigam, NIO, Goa) was taken up to study down core variations in specific dinoflagellate cyst associations, especially Protoperidinioid group and open marine forms (belonging to Gonyaulacoids), besides allochthonous terrestrially derived organic matter.

**Rahul Garg & Khowaja Ateequzzaman**

### ***Component 2: Algal evidence for Late Quaternary palaeoenvironment changes in the Bengal Basin***

Processed 73 samples belonging to 7 profiles of Sarsanka lake, East Midnapur district for algal remains. A total of 53 diatom taxa belonging to 22 genera were identified in the sediments. Significant constituents of the assemblages are *Amphora* spp., *Nitzschia* spp., *Rhopalodia* spp., *Mastogloia* spp., *Synedra* spp., *Surirella* spp., *Cyclotella* spp., *Coccinodiscus* spp., *Biddulphia* spp., *Thalassiosira* spp. Several species of diatoms were examined under SEM.

Continued analysis of surface sediment diatom assemblages in depth profiles along the Ramnagar Khal towards Mohana to describe the relationship between species distribution and salinity and waterdepth of deposition. Preliminary data interpretation was made. The diversity of the diatom flora in the surface sediments is much lower near the

mouth of Mohana than the inner part of the Ramnagar Khal. The decrease in number of species is related to the increase in salinity southward. The composition of the diatom assemblages varies significantly from Ramnagar towards Mohana. According to their distribution in the sediments three main ecological groups have been distinguished. Also undertook a field trip to Digha and Sarsanka areas and collected 3 cores from Sarsanka Lake. For the understanding of modern algal distribution pattern in the region, 29 surface soil samples as well as water samples from different depth and salinity level were collected. Hydrological data were also collected from 10 different environmental setups using soil and water analysis kit

**Samir Sarkar**

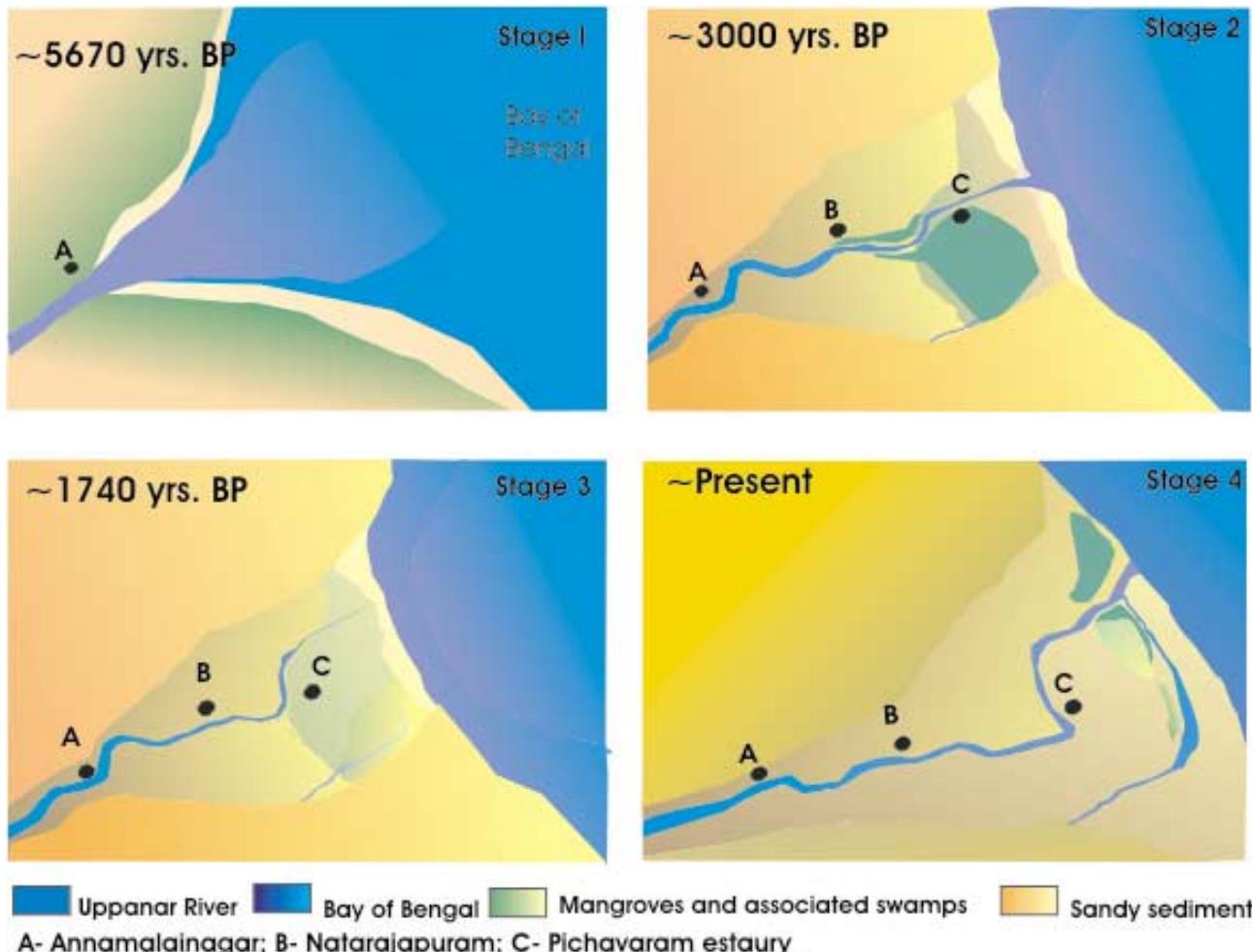
### ***Component 3: Quaternary mangrove vegetation, environment, climate, ecology and sea level changes in south-east coast of India***

Studied two sedimentary soil profiles from Kolleru lake area. The lake is separated from the Bay of Bengal in the east by about 11 km stretch of Kaikalur sand ridges and swales extending between the Krishna and Godavari river delta. The soil sediments from Kolleru lake area ranging from 1.5 to 2 m depth from the ground surface dates back to  $2600 \pm 100$  yrs. BP. Palynological results show Late Holocene lacustrine deposition and no mangrove pollen or any other marine forms were recorded. The north-eastern flank of the lake joins the sea through a narrow 20 km long Upputeru channel. Near its mouth, the mangroves are only a millennium old.

A 7 m soil section from Annamalainagar dates back to

5640  $\pm$  100 yrs. BP. Evidences of mangroves here are at 3.5 m below mean sea level indicating a paleoshoreline 18 km inland from the present shoreline. The mangrove line receded 8 km seawards reaching Natarajapuram in ~2000 yrs. span. Therefore, in the beginning of Late Holocene mangroves occupied a larger area than present. Deterioration of mangroves since Late Holocene was also accompanied by its migration towards the northeast of the estuary. Also surveyed and collected surface soil and core samples from Adyar/ Cooum estuary, Ennore Creek and environs (Chennai), Cuddalore and adjoining Pichavaram estuary.

**Anjum Farooqui**



Estuarine Evolution and the shrinking mangroves in the active northern part of Cauvery delta since ~ 5670 +/- 120 yrs BP : A palyno-chronostratigraphical record

## Project 12: Palaeoethnobotanical investigations of Archaeological sites

**Component 1: Palaeoethnobotany: Ancient man, plants and environment in north and north-western India- Studies of botanical remains from the ancient sites at Tokwa in District Mirzapur, UP**

Carried out investigations on the carbonized remains recovered through archaeological excavations during 2003 at Neolithic Tokwa. The evidence generated from a wide range of cultural deposits at different depths, datable from 2200-1500 BC, revealed the cultivation of rice, barley, bread wheat, dwarf wheat, lentil, field pea, grass pea, green gram, moth bean, horse gram, linseed and Indian mustard. Associated with these crop plants, the remains of the seeds and fruits of weeds and other taxa have also been identified as belonging to *Vicia sativa*, *Coix lachryma-jobi*, *Setaria* cf. *glauca*, *Chenopodium album*, *Fimbristylis* sp., *Emblica officinalis*, *Ziziphus nummularia* and *Annona* cf. *squamosa*. Among these carbonized remains the evidence of *Annona* cf. *squamosa*

(custard apple), a native of South America is to be reckoned within the context of Indian Archaeology. Quite a good number of wood charcoal pieces were processed for section cutting. Anatomical features preserved in some of them led to specific identification of the elements of deciduous forest, such as *Terminalia bellerica*, *Tectona grandis*, *Syzygium* cf. *cumini*, *Streblus asper*, *Madhuca indica* and *Bambusa* sp.

Prepared draft manuscript on the plant remains of Ahar Culture (3000-1500 BC) from Ojiyana, Bhilwara district, Rajasthan. Undertook field excursion to ancient site at Jognia Khera, Kurukshetra district, Haryana to participate in the archaeological excavations and a rich collection of carbonized material was collected.

**A.K. Pokharia**



## Component 2: Palaeoethnobotany: Ancient man, plants and environment in north and north-western India- Studies of botanical remains from ancient sites in UP

Undertook field visit to two ancient sites at Ahirua Rajarampur (tehsil Chhibramau) and Siyapur (tehsil Tirwa), district Kannauj, where excavations were carried out under the UGC-Project "Archaeology of Ganga Plain". Archaeobotanical materials were collected in fairly good amount from cultural deposits of Painted Grey Ware (PGW), Northern Black Polished Ware (NBPW) and Kushana Period. Site at Siyapur had additional deposit of pre-PGW. Both the sites are situated at a distance of 80 km on the bank of river Ishan, a tributary of Ganga. From Kumhar Tal, lying at the southern end of the mound at Ahirua Rajarampur, soil samples were also collected from a 4 m deep sedimentary profile for palyno-investigations.

Carried out morphological investigation of seed and fruit remains from above ancient sites (approx. 1000 BC-300 AD) to build up plant economy practiced by the ancient settlers and the regional ecological conditions in the past. The field-crop finds belong to cereals (barley, rice, ragi millet, kodon-millet), pulses (lentil, khesari/grass-pea, field pea, green gram, black gram, horse-gram/kulthi, aconite/moth bean), seeds of oil yielding plant (field brassica), jujube, and Leguminous fruits; seeds of silk-cotton fibre. Both the sites exhibit similar ancient plant economy at the present preliminary stage of investigations. Total 28 types of weeds and wild taxa recovered so far, belong to wild grasses— blue stem grass, wild oat, crow-foot grass, barnyard grass (sawan), goose grass, panicum grass, blue or Meadow grass; sedges— flat sedge, spikerush sedge, fimbristylis sedge, bulrush, etc. Other finds are of tick-clover/savivan, indigo, hairy indigo, blue alfalfa, sweet clover (safed

senjhi), piazi, mullein, common vetch, pigweed, white goose-foot (bathua), day-flower faint, lalsabuni, night-shade; labbibi (khat-palak), sleepy catchfly which grows as a field weed.

*Dactyloctenium aegyptium* (crow-foot grass) and all the sedges, *Commelina benghalensis* (day-flower faint), *Trianthema portulacastrum* (lalsabuni) may have been the weeds in summer group crops like rice; whereas *Indigofera hirsuta* (hairy indigo), *Melilotus alba* (sweet clover, safed senjhi), *Vicia sativa* (common vetch), *Amaranthus* sp. (pigweed), *Chenopodium album* (white goose-foot, bathua) represent the weed components in winter crops like wheat and barley in the ancient agriculture at the site. *Verbascum thapsus* (mullein) is occasional member along water channels, whereas *Polygonum barbatum*, *Rumex dentatus* (labbibi, khat-palak) representing moist and swampy localities in the surrounding of habitational deposits.

Chemical processing and palyno-investigations were also carried out of soil samples from Kumhar Tal in the vicinity to reconstruct palaeovegetation and palaeoclimate in this dry region of Ganga plain. The upper 2 m profile with clay deposit has revealed palynotaxa of Poaceae, Caryophyllaceae, Leguminosae, Malvaceae (particularly *Sida* sp.), Rutaceae (*Aegle marmelos*), Asteraceae (*Vernonia cinerea*), *Symplocos* sp. (moist element), *Casuarina* sp., *Cedrus* sp., monolete and trilete fern spores, *Spyrogyra* Zygosporae, Acritarchs, *Ceratopteris* (Aquatic fern), Liliaceae (aquatic). The frequency of pollen count starts decreasing with the increase in sand deposit between 2 and 4 m depth downwards.

Chanchala Srivastava

## Project 13: High resolution Climate variability based on Dendrochronological study

### Component 1: Development of high-resolution proxy climate records for the western Himalaya

Completed dating of 20 deodar (*Cedrus deodara*) samples collected from Bhaironghati (Uttarkashi), Uttarakhand. The age of oldest sample extends back to 1287 AD. The previously prepared chronology supplemented with more samples would help in maximizing the climate signals in mean tree-ring chronology. Finalized a manuscript on spring temperature reconstruction extending back to AD 1226.

R.R. Yadav

Carried out pollen analysis from 2 m deep sediment profile (10 samples) from Parashar Lake, Mandi District (HP). The pollen assemblage has revealed the good representation of conifers, viz. *Pinus*, *Cedrus*, *Abies*, *Picea* together with the broad-leaved taxa (*Quercus*, *Alnus*, *Betula*, *Ulmus* and

*Lonicera*). On the other hand grasses, sedges, Chenopodiaceae/ Amaranthaceae, *Artemisia*, Caryophyllaceae and Rosaceae are the major constitute of ground flora. Also pollen analysed 6 surface samples from Tundabhuji area, located in the alpine belt of Kullu District. The alpine steppe elements (grasses, sedges, *Artemisia*, Rosaceae, *Impatiens*, *Polygonum*, etc.) are recorded in good frequencies. The broad-leaved taxa (*Rhododendron*, *Betula*, *Alnus* and *Salix*) are met within moderate to low values. The excessively high frequencies of conifers (*Pinus*, *Abies*, *Cedrus* and *Picea*) denote the transportation of their pollen by upthermic winds from the adjoining temperate belt. Prepared a draft of paper entitled "Vegetation and climatic shifts in the alpine belt of Himachal Pradesh during last 1300 years".

M.S. Chauhan



## Component 2: Analysis of climatic changes based on multi-proxy data during last 1000 years from peninsular and Himalayan regions

Measured ring width of *Cedrus deodara* collected from the Kinnaur and adjoining areas and prepared tree-ring chronologies from several sites. Also measured ring width from tree cores of *Tectona grandis* from the Nilambur (Kerala) and a chronology, extending from 1813-2003 AD, has been prepared. The Mean Vessel Area (MVA) chronology of Teak made through Image Analysis has been analysed further to understand temporal relationship with climate. The study shows that MVA of Teak at Hoshangabad, the central part of India exhibits positive correlation at June, but negative in May with the precipitation, and with the temperature correlation is negative

in February. However, at the southern part of India, Parambikulam (Kerala), MVA has positive correlation during May and negative in February and March with precipitation; and with temperature, May is found negative.

Pollen analysis made from a 130 cm deep profile (SKYS) at the left bank of Rukti River, (3500 m masl) Sangla, Himachal Pradesh covering almost entire Holocene shows that during early to mid Holocene climate was warm and moist and later, i.e. since 3000 yrs. B.P it was comparatively drier.

Amalava Bhattacharyya

## Project 14: Special Activities

### Component 1: Accretionary evolution, tectonics and palaeoclimate in Lahaul-Spiti, Ladakh and eastern Karakoram regions: Study based on tectonics, geochemistry, sedimentology, petrography, magnetostratigraphy and palaeobotanical evidences

Finalized a paper based on palynological studies "First record of Middle-Late Jurassic palynomorphs from Lamayuru complex, Indus Suture Zone, Ladakh". It was observed that Jurassic palynomorphs recovered from Khangral village were reworked from Zanskar-Lamayuru Complex Tethyan realm and transported through the Lamayuru to Nindam Basin during ongoing geodynamic processes operative within the India-Asia trench forearc subduction complex between Cretaceous-Palaeocene time span. Another paper "Miocene palynological assemblage from Nindam Formation, Ladakh Himalaya and its implication on palaeoenvironment" highlighted the occurrence of reworked Permian and Mesozoic spore-pollen and *in situ* palynomorphs consisting of microthyriaceous, ascostromata and bisaccate pollen, assignable to Lower Miocene assemblage. Tropical to sub-tropical climate is deduced during the deposition of these sediments. The mega fossil, collected from Hemis Gompa, about 50 km SE of Leh, Indus Suture Zone ~500 NNE of Gompa, identified as *Amesoneuron hemisiensis*, a new fossil palm leaf from Ladakh. Detailed study is in progress. Maceration of samples from Chiktan Nala and Fotula areas has been completed. Quantitative analysis and photodocumentation and compilation of data are in progress.

Finalized a paper entitled "Quaternary geology, tectonics and distribution of palaeo- and present- fluvio/glacio lacustrine deposits in Ladakh, NW Indian Himalaya" study based on field observations. Shyok river valley, situated in the trans Himalayan region of NW India, has numerous well preserved fluvio-lacustrine Quaternary sediment deposits. Continuous sedimentation and lowering of the lake base resulted into thick deposition in the late Quaternary times. Being in the vicinity of the Karakoram fault, which has a right lateral shift of rate of 10.7

+-0.7 mm/year (Chevalier et al., 2005), it is presumed that tectonic/seismic activities may have been responsible for blocking the river flow and thereby transforming into a lake. Later due to either excessive water/sediment load or tectonic/seismic activity, the lake water drained out and the region regained its original river valley status. The coupled effect of continuous upliftment and river incision has exposed > 1000 m of these deposits.

Based on seismicity in the region and preliminary data on geochemistry, mineralogy and mineral magnetic studies of ~50 m thick sequence at different intervals as the entire section stands out a vertical cliff which is inaccessible and covered by debris flow with tens to hundreds of meters of boulder beds. Three levels of soft sediment deformation structures in the middle part are recorded at ~26,960, ~24,300 and ~21,000 yrs BP indicative of 3 major seismic tremors in the region, probably due to the Karakoram fault activation. In general, the sediment is silty/clayey in nature with rare sandy beds. Quartz, feldspars, mica with little Illite/chlorite are the major constituents. Poor sorting and low Chemical Index of Alteration values (CIA ~55-60) indicate the dominance of mechanical weathering and nearby source region of the sediment. The presence of secondary  $\text{CaCO}_3$  precipitates at the bottom and top parts and high magnetic susceptibility values in the top part suggests intermittent warmer phases.

Finalized another paper "Weathering of rocks in Ladakh region of India: implications to tectonics and climate". Freezing and thawing, diurnal temperature variation and frost action are the dominant mode of weathering in Ladakh region. Secondary clay mineral formation is insignificant. Consequently, there is little chemical change even up to the most weathered stage. The little variation in chemical distribution is rather related to



physical disintegration and redistribution through limited melt water supply, which produces little chemical variation but its amount is so small that it does not carry the elements to long distance. Moreover the dry and high velocity wind precipitates the dissolved load at different stages indicated by sudden enrichment of highly mobile elements (Ca, Na) in differentially weathered samples. The identical nature of chondrite normalized REE patterns further support the redistribution of elements within the system itself. Although lichen/microbe induced

chemical weathering is producing cation depleted residual material but their distribution is so localized that it does not affect the overall composition. The almost similar values of CIA at a given site suggest that the regolith is nothing but the ground up rock mass and has not attained any level of chemical maturity. All these signatures clearly indicate that ongoing uplift and cold dessertic climate is supporting only physical weathering processes in this region.

**Ram Awatar, Anupam Sharma, Rajeev Upadhyay  
(till 19.07.2004) & Binita Phartiyal**

### **Component 3: Growth ring studies in fossil woods and their significance in palaeoclimate**

Carried out data collection on the occurrence of growth rings in Deccan Intertrappean and Neogene woods.

**J.S. Guleria**

Growth ring studies on petrified woods of Kota Formation brought out various thickening patterns of tracheidal walls. Variations in the size of tracheidal cells examined suggest micro-physiological influence.

**A. Rajanikanth**

### **Component 4: Floral diversity and ecology of Mahuadhanr beds, Chachhari Valley, Palamu**

Completed interpretation of result based upon floral data generated and compilation of work. Also visited Herbarium of Botanical Survey of India (Central Circle), Allahabad for comparative study of recovered fossil leaves.

**G.P. Srivastava (till September 2004)**

### **Component 5: Cryptic morphology of seeds/fruits of the flora of Karnataka (western Ghats) using SEM/TEM techniques and bearing on ecology**

Carried out SEM studies of fruits/seeds of some species of *Terminalia* of family Combretaceae. In general, it is noticed that the seeds are solitary or paired, elongate-cylindric or fusiform in shape, suspended by funicle in the small cavity of thick woody endocarp. A sort of differentiation has been noticed in the mesocarp. It is thin-walled, with sclerotic cells and sub-reticulate or sub-spiral thickening. *T. arjuna* has large ellipsoidal cells with spiral thickening, *T. balarica* possesses sclerotic cells with scattered reticulate thickening, *T. cattapa* has densely scattered cells abundant near exocarp and sub-reticulate, and in *T. tomentosa* sclerotic cells are smaller in size and arranged in a thick sub-spiral. The testa is thin, brown and composed of cuboid to sub-cuboid cells, which are not lignified in all the species.

Ultrastructure studies have been carried out on fruit pericarp in *Terminalia arjuna* to understand developmental stages of the pericarp. A very thin layer of cuticle covers the outer surface of pericarp—the epicarp. The epicarp is developed from the outer epidermis of the ovary wall. The cells are highly meristematic. The cell cytoplasm is dense and granular with ribosomes in abundance and other organelles like mitochondria,

endoplasmic reticulum and chloroplast nucleus. The shape of the mitochondria shows great variation from round to ovate to elongate with a shallow depression on the periphery of certain mitochondria. Endoplasmic reticulum consists of long tubular structures covered with ribosomes, and short smooth flattened vesicular structures. Cisternae of the endoplasmic reticulum are seen closely attached to the plasmalemma and at certain regions the cisternae tip seems to be dilated to form vesicles, which are liberated into the cytoplasm. Chloroplasts are round, oval, elongated and are distributed on the peripheral part of the cytoplasm. The grana fret work is not found to be well-organized in the proplastids, but in mature pericarp it is well-developed. Plastoglobules and ribosomes are observed with starch grains. Lipid bodies are present and are electron opaque. The nucleus is rounded oval in shape with a double membrane structure; nucleolus is seen near the periphery. The chromatin material is found attached to the inner membrane of nuclear envelop. Vacuoles are not observed in the young stages but in mature cells vacuoles are observed of various sizes. Fusion between the adjacent vacuoles is frequent. Nucleus is seen in the center or near the tangential walls.



Developing chloroplast showing starch grains and lipid bodies (Fruit Pericarp)

In mature fruit, cells of the epicarp become thick-walled and covered with thick corrugated cuticle. The cells consist of a central large vacuole and relatively less dense peripheral cytoplasm; the latter has abundance of endoplasmic reticulum. Mitochondria are seen in large numbers. Chloroplast contains

1-2 starch grains. The abundance of ribosome and ribosome-studded endoplasmic reticulum in the cytoplasm suggests a high rate of protein synthesis. The presence of ribosomes in chloroplasts indicates the protein synthesis capability of chloroplasts.

**Usha Bajpai**

#### **Component 6: Aerobiology in relation to pollen production, dispersal and preservation of pollen grains**

Added more data in manuscript entitled "An atlas of air-borne pollen grains of Lucknow plants and their allergenic significance". Collected some fresh polleniferous material to study pollen production per anther. Photo-documentation of

air-borne pollen grains, graphical presentation of annual pollen data, correlation of air-borne pollen incidence with meteorological data and as well as with the patients of allergenic history visiting KGMC are continued.

**Asha Khandelwal**

#### **Component 7: Floristic and ethnobotanical studies of Bastar (Chhattisgarh) and Shahdol (MP) districts and automation of herbarium using software**

Studied 1,190 plant specimens collected from Pushprajgarh Range of Anuppur Forest Division (Shahdol district). This range is characterized by hilly terrain and undulating topography. People inhabit a very small plain area scattered throughout the range. Several rivers, channels, nallah and ponds are the source of water of this area. The climate of

the area is slightly cooler and moist. The area comprises sub-tropical vegetation with pure sal forest, mixed forest, scrubs, grassland and aquatic vegetation. Identified 285 plant species belonging to 165 genera of 108 families from the above collection. All the plant specimens have been processed and poisoned with insecticide and fungicides.



Finalized a paper on Ethnobotanical studies of Baiga and Gond tribes. Collected data of about 8 plant species (living and fossil) from published literatures for Herbarium database.

The photo-documentation and computer scanning of about 112 extant and 60 related specimens of fossil and archaeobotanical samples have also been done.

**D.C. Saini**

### ***Component 8: An isotope and geochronometry based approach to decipher palaeoclimate records in Indian lake sediments and its synthesis with pollen based information***

Finalised work on collected Loktak Lake samples to decipher palaeoclimate and prepared a manuscript. The results indicate climatic change to drier conditions about 640 years ago in that region as evidenced in pollen records. The reduction in domination of aquatic vegetation with time is also evidenced in the increased carbon to nitrogen ratio in later years. The

work of pollen analysis was extended to another sedimentary deposit Motiya dol (in Madhya Pradesh) and corroborated with  $^{14}\text{C}$  date, measurements of carbon, nitrogen, as well as of other elements using EDX to facilitate comparison. The C/N ratio in this lake's sediments is much higher than the Loktak samples. More analyses on these samples are in progress.

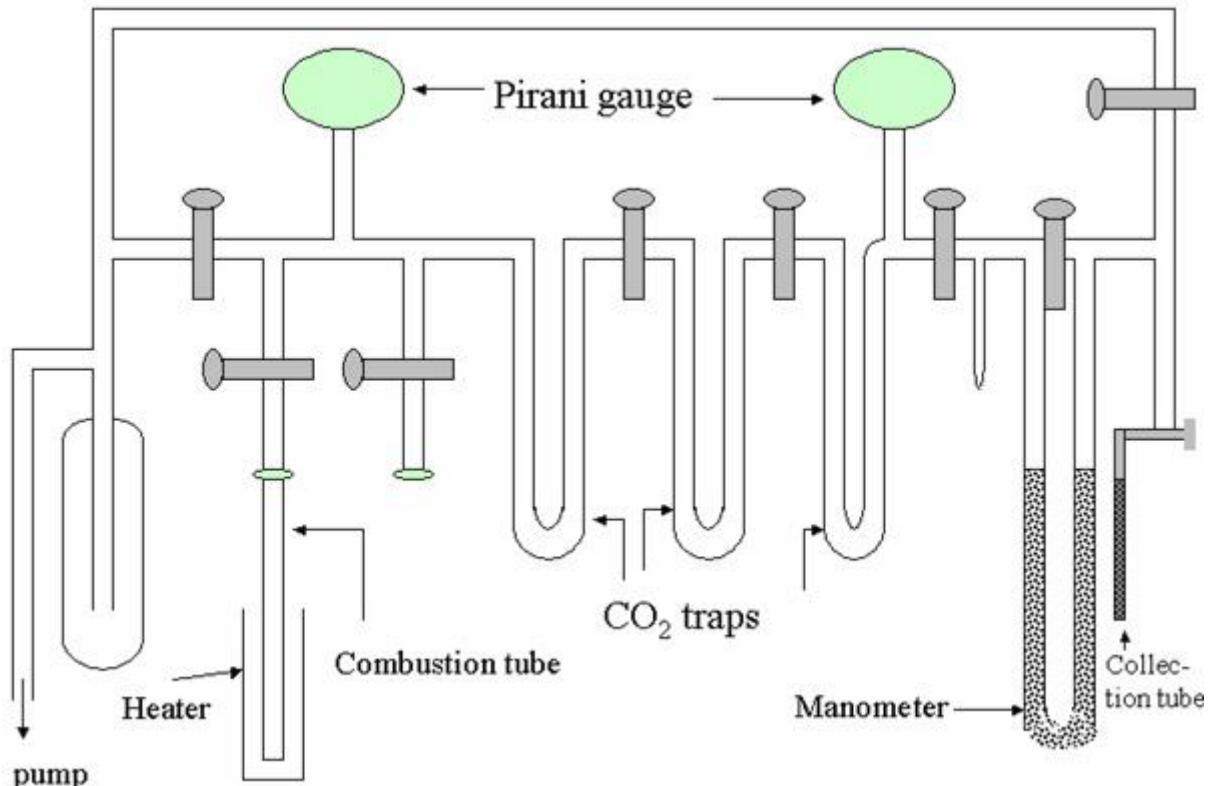
**C.M. Nautiyal & M.S. Chauhan**

### ***Component 9: Radiocarbon dating of deposits relating to Quaternary geological and archaeobotanical investigations and chemical analysis of sediments for palaeoenvironmental and palaeoclimatic studies***

A total of 175 samples have been processed for radiocarbon dates that include one oxalic acid standard and six background samples. Out of these, 83 samples belonged to the Institute, while 12 and 80 samples were dated on collaboration and payment basis respectively. However, among all these samples as many as 20 samples could not be dated due to the

very poor yield of  $\text{CO}_2$ . This situation prompted to design a mini glass system (see Fig. below) that can determine precisely the carbon content of a small quantity of sediment sample (about 150 mg). The measured carbon content helps to decide for further processing of the same sample.

**Supriya Chakraborty (Team work)**



System for the determination of carbon content in sediment organic matter



### **Component 10 : Stable isotope mass spectrometry laboratory for palaeoenvironmental studies**

The proposal for establishing a Stable Isotope Ratio Mass Spectrometry Laboratory has been revised in more cost effective way. It was proposed that only a sample processing lab (of Rs. 3-4 lacs) can be set up but no mass spectrometer.

The samples can be processed in this laboratory and can be analysed in some other laboratory equipped with a mass spectrometer.

**Supriya Chakraborty**

### **Component 11 : Establishment of Palaeobotanical-Geochemical laboratory**

The matter to establishment of laboratory has been initially discussed and subsequently presented before the Research Advisory Council of the Institute. The RAC

recommended that further action on the issue may not be taken for the time being.

**Anupam Sharma**

### **Emeritus Scientist Project**

#### **Project : Lake sediment pollen analytical studies in Rajasthan to reconstruct the vegetational history and climatic changes since Last Glacial Maximum (LGM).**

**K**eoladeo National Park (Ghana), Bharatpur— Prepared the pollen diagram of the pollen analysed 4.4 m deep profile collected from Ghana. Studies have revealed very interesting past history of this wetland. According to the local belief and the available records, the wetland is not more than 300-400 yrs old, but the palynological investigations have shown that 20,000 yrs ago or may be even beyond a big lake existed at the site, which today has turned into a shallow depression. It has also indicated that Bharatpur region had enough rainfall to feed this big lake. Subsequently, the lake gradually turned too shallower due to fast silting, lesser rainfall, climatic change, etc. Studies have also revealed that the earlier thickly forested (dominated by *Holoptelea*) scenario has been changed into the scrub jungles presently seen around the wetland.

**Bharatpur Bird Sanctuary (Ghana)**— Pollen analysis of some samples from another 2.6m deep trench profile from the same wetland area have yielded good assemblage of pollen/spores.

**Moti Jheel**— Pollen analysed 3.35 m deep dug out trench profile from Moti Jheel situated about 2 km from Ghana wetland and prepared a pollen diagram. This jheel area is presently under cultivation. It is revealed that this flat land too was a lake about 6,000 yrs ago and beyond ( $^{14}\text{C}$  date of 5230+ 460 yrs BP at 3.00 m depth). It was most probably connected with the main Ghana Lake in the remote past (deeper samples remain to be collected for pollen analysis). The studies have shown that around 6,000 yrs ago the area was occupied by savannah type vegetation, represented mainly by Poaceae, Cyperaceae, Chen/Ams, Urticaceae, Brassicaceae, *Holoptelea* etc. and it compares well with the upper part of the Ghana Pollen diagram.

Preliminary pollen analysis of trial samples collected from Buda Pushkar and Foy Sagar (Ajmer) lake sites have demonstrated that the profiles are palynologically productive. Detailed pollen analytical investigations of the two sites can be undertaken. Preliminary investigations from Senthal Sagar, Ramgar Jheel and Chhaparwale Sagar (Jaipur) sites have revealed poor pollen productivity.

**Chhaya Sharma**



## Additional Research Contributions

**C**ompleted the palynological studies of subsurface strata (Raniganj and Parsora formations) from two bore-holes (SSM-1 and 2) of Mahuli-Mahasop area, Singrauli Coalfield (southern extension), Chattisgarh. In all, 5 assemblages have been identified, which suggest deposits of latest Permian (Assemblage I, in SSM-2), earliest Triassic (Assemblage II, in SSM-2), and late Triassic (Assemblage I, SSM-1; Assemblage III, in SSM-2; Assemblage II, in SSM-1) in age. Thus, the Permo-Triassic boundary is inferred between 542.00 and 537.00 m in bore-hole SSM-2, whereas the occurrence of marker paleosol horizon at 509.50 m in the same bore-hole determines the lithological break between the top of the Raniganj and the basal Parsora Formation. Absence of the major part of Early and Middle Triassic deposits is also proved palynologically. The results have been compiled and finalized.

Visited the Geological Survey of India office at Kolkata to discuss the modalities of MOU between BSIP and GSI and plan for the field work and collection of samples in coal-bearing Gondwana basins. Traversed the Brahmini River Section, Talcher Coalfield, Orissa and collected samples for palynological studies.

**Archana Tripathi & Vijaya**

Finalized a paper entitled "Palynostratigraphy and depositional environment of Lower Gondwana sediments in Raigarh Basin Chhattisgarh". Lower and upper Karharbari palynoflora have been identified in the assemblage. Besides, it has also been observed that cold climate with medium to high humidity was prevailing during the deposition of Early Permian sediments in this coalfield.

**Ram Avatar**

Studied Lower Gondwana carbonaceous sandy shale exposed along the Umrar River and adjoining hillocks near Umaria (MP) for palynoflora and organic matter. The OM contents comprise rich black debris, biodegraded, amorphous and structured terrestrial matter, mainly composed land derived plant fragments. The palynoflora exhibit two palynozones—the basal most sequence is characterized by a dominance of *Callumispora* and *Jayantisporites*, while the younger is represented by the dominance of *Parasaccites*-*Plicatipollenites* and zonate triletes in association with striate-bisaccate pollen affiliated to the Lower and Upper Karharbari miofloras respectively.

**Ram Avatar, Madhav Kumar & Neeru Prakash**

Study of micro-cleats and micro-structures in non-banded Tertiary coals of Assam and Meghalaya was carried out in order to ascertain the influence of maceral on their nature and pattern.

**B.K. Misra**

A thallus section has been recorded from the coal petrographic pellet representing the Queen Seam of Koyagudem area of Godavari Valley Coalfield (Andhra Pradesh). The anatomical features of the specimen show very close resemblance with the Marchantiales Group of the Bryophytes.

**O.S. Sarate & Navita Budhraja**

Investigations on the plant megafossils from the Siwalik of Koilabas, Nepal reveals the presence of some new taxa, viz, *Clinogyne dichotoma* (Marantaceae), *Ochno squarroso* (Ochnaceae), *Berchemia hamosa* (Rhamnaceae) and *Glochidion arborens* (Euphorbiaceae) in the area.

**Mahesh Prasad & H.D. Dwivedi (BSRS)**

Palynological study in the Siwalik sediments of Koilabas (Nepal) has been carried out for the first time. A palynoassemblage consisting of algal and fungal remains, pteridophytic spores, gymnospermic and angiospermic pollen recovered from the area. A warm and humid tropical–subtropical climate has been inferred during the deposition of sediments.

**M.R. Rao, Mahesh Prasad & E.G. Khare**

A catalogue, including all records of spores and pollen from the Indian Tertiary sediments published after 1988 up to 2004, has been prepared and is being finalized for publication. This will update the earlier catalogue on Indian Tertiary spores and pollen (Saxena 1991), which includes spore-pollen records published up to 1988.

**R.K. Saxena & G.K. Trivedi**

Analysis of an early Eocene palynoassemblage recovered from a bore-hole BGG-3 drilled by Coal wing GSI in Birbhum Coalfield (West Bengal) is in progress. The assemblage is rich and the distributional pattern of taxa is being analysed to interpret environment of deposition. Presence of mangrove elements, like *Spinizonocolpites*, *Paleosantalacaepites* indicates that marginal marine conditions extended into the interior of West Bengal up to Birbhum district.

**J.P. Mandal & Vijaya**

A nannofossil assemblage comprising *Coccolithus eopelagicus*, *Cribrocentrum reticulatum*, *Cyclicargolithus floridanus*, *Helicosphaera seminulum*, *Reticulofenestra dictyoda*, *R. coenura*, *R. minuta*, *Sphenolithus moriformis*, *S. predistentus*, *Discolithina* sp., *Pemma basquensis*, *Cyclococcolithus kingii*, *Zygrahablithus bijugatus*, *Lanternithus minutus*, *Discoaster?* *Tani*, *Blackites* sp., and *Lithostromation simplex* is documented from Dilini River section of South Shillong Plateau. Out of 46 samples only one sample (DN 16) showed presence of datable but little recrystallized nature of nannofossils. The discoasters and helicoliths most useful for dating Palaeogene sequences are



notably absent due to recrystallization but abundance of cosmopolitan marker *Cr. reticulatum* and presence of *S. predistentus* and *Cy. floridanus* the assemblage is assigned to NP 17 Zone (emended Discoaster saipanensis Zone, Rai 1988) of Bartonian age.

**Jyotsana Rai & Rahul Garg**

Studied paddy field indicator diatoms and rice and grass phytolith in the Lahuradewa Lake sediments in Ganga plain. The studies indicate that the rice cultivation started during 7000 yr BP in this region. Due to their extremely resistant nature to decay phytolith studies are now being carried out as a new palaeoecological tool for deciphering palaeoclimatic fluctuation in dry regions of Ganga basin.

**Vandana Prasad**

Studied heterogeneity of coralline red algae and their implications on palaeoenvironment from the late Palaeocene sequence of South Shillong Plateau. The assemblage is represented by the genera *Lithoporella*, *Lithothamnion*, *Mesophyllum*, *Sporolithon*, *Corallina* and *Jania*. On the basis of abundance and diversity of these corallines it has been interpreted that the algal forms thrived in a shallow warm, tropical to subtropical environment and the sea water was moderately agitated, sunny and clear.

**A.K. Ghosh**

Prepared a research note dealing with remarkable condition— pollen inside pollen, observed in *Salvia leucantha* Cav. (Lamiaceae) and its possible reason. *Salvia leucantha* is native to Mexico and has been naturalized in India in subtropical and temperate zones of Himalaya. Its polleniferous material,

procured from Kumaun showing polymorphism of pollen, i.e. 4 to 11-colpate, spiraperturate, dyad and triad) has also shown several pollen snaring another pollen. The receptor and embedded pollen are of same as well as of different types. The number of embedded pollen is often one but occasionally 2-3 or more pollen may also occur inside one receptor. Such a surprising condition can not be natural but the outcome of conventional technique, i.e. acetolysis followed by centrifugation used for the palynological investigations.

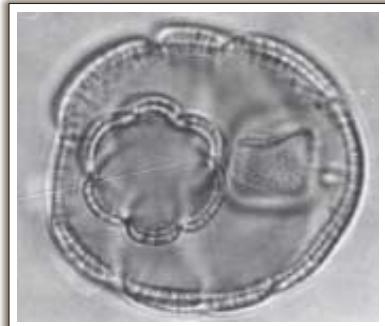
**Asha Gupta**

SEM/TEM studies on biodegradation of cuticle membranes (CM) have shown degree of cuticle preservation. In one type of pteridosperm CM was highly stratified at fine structure level, which shows resistance to biodegradation.

**Usha Bajpai**

Received four samples as per the project work Fifth International Radiocarbon Inter-comparison programme conducted by the University of Glasgow, Glasgow. The samples- Barley mash (VIRI-A), seed (VIRI-B), Barley mash (VIRI-C), and another seed (VIRI-D) have been analysed and the result will be sent shortly.

**Supriya Chakraborty**





## Collaborative Work

**A** diversified assemblage of organic-walled microfossils comprising 36 forms of the benthic and planktonic forms (cyanobacteria, acritarchs and Vase shaped microfossils) has been recovered in petrographic thin sections from the lenses and bedded chert belonging to Buxa Dolomite exposed near Igo Bridge, Daring-Basar road in West Siang District of Arunachal Pradesh including one new species. In this, assemblage 17 taxa of cyanobacterial remains belonging to Chroococcaceae, Nostocaceae and Oscillatoriaceae; 18 forms of Acritarchs belonging to Sphaeromorphida, Scaphomorphida and Sphaerohystrichomorphida subgroups; and one Vase shaped microfossils (*Melanocyrtium hexodiadema*) are present. The present assemblage of microbiota compares well with the known assemblage from the latest Proterozoic/Vendian sediments of northwest and central Lesser Himalayas (India) and its equivalent sediments in other parts of the world. Presence of both benthic and planktonic forms in the assemblage indicates deposition in lagoonal tidal flat condition, whereas contact with open sea was occasionally available.

The petrographic thin sections of Buxa dolomite, from Kameng area and the Menga window in the Upper Subansiri District also shows presence of non-mineralized sponges. These sponges are being reported for the first time from the locality. The assemblage of these fossil specimens represents three types of extinct sponge forms. The present forms are simplest metazoans having numerous small pores on their body surface and hence justify their placement in Phylum Porifera (Pore bearers). They show cellular grade constructions and loose aggregation of cells bound into soft tissues. All sponges have skeleton which provides them strength and rigidity. From the study, we believe that the ancient sponges may not be having the mineralized skeleton made by spicules and forms with the organic skeleton and morphology similar to existing forms may be found in ancient sediments.

**Manoj Shukla & Rupendra Babu [& V.C. Tewari (WIHG, Dehradun) & Prabhat Kumar (Lucknow)]**

Recorded an assemblage of microbial remains comprising cyanobacteria, multicellular tissue of algal thalli (thallophytes) belonging to Rhodophyta, Acritarchs and Vase shaped microfossils (VSM) from the phosphatic black chertlentiles and shale partings associated with quartz arenite of Chambaghat Formation in the Kamlidhar Syncline, Sirmaur District, Himachal Lesser Himalaya. Presence of VSMs, a Rhodophyte *Wengania* and the decreasing diversity of microplanktons, viz., medium sized leiospherids and few acanthomorphs indicates a Terminal Proterozoic age for these sediments.

**Manoj Shukla & Rupendra Babu [& V.K. Mathur & D.K. Srivastava (GSI, Northern Region, Lucknow)]**

Initiated collection and studies of surface and subsurface samples of different coalfields of India with the objective of intra-/inter-basinal correlation through high-resolution stratigraphic and palynological studies on selected areas of Rajmahal-Birbhum, Damodar Valley, Son Valley, Mahanadi Valley, Satpura, and Wardha-Godavari Valley basins. Ceratin coal samples from Son Valley have also been received for petrographic study.

### MOU between BSIP & GSI (Coal Wing)

Proposed and finalized a mission oriented collaborative project with Singreni Collieries Company Limited to study the palynostratigraphical aspect of coal-bearing sequences (NJ) and to take up biopetrological study of the coals from some selected areas (OSS) of the Godavari Valley Coalfield. Visited the area for procurement of samples, scientific discussions, and consultation of literature and reports. Completed processing of samples from different bore-holes—MSP-25 (25 samples), A/335 (22 samples), MSP-27 (11 samples), and MSP-26 (25 samples). Carried out quantitative analysis of samples from MSP-25 and results are communicated to SCCL.

**Neerja Jha & O.S. Sarate [& SCCL (Kothagudem, Andhra Pradesh)]**

Albian limestone building algae of the Kallakudi Formation, (Dalmiapuram), Cauvery Basin have been analysed for their palaeoecological significance. Eight species of calcareous algae – *Parachaetetes asvapati*, *Sporolithon* sp., *Lithothamnion* sp., *Lithophyllum* sp., *Pseudoamphiroa propria*, *Neomeris cretaceae*, *Salpingoporella verticelata* and *Agardiolopsis cretaceae* are recorded. Among these *P. propria* and *S. verticelata* are first records from the Indian lithological succession. Distribution of these forms under lagoonal to reefoidal environments have been traced. The reported assemblage represents admixture of updwelling and non-updwelling marine seasonal floras of Albian times in the Cauvery Basin.

**A. Rajanikanth [& P.K. Mishra, S. Kishore & S.K. Singh (Botany Dept., Lucknow University) & A.K. Jauhri (Geology Dept., Lucknow University)]**



*Sporolithon* sp



Prepared a paper on the intertrappean plant and animal remains in the Deccan basalts of Khandwa, Madhya Pradesh. The reported biota represent palm woods and leaves remains (*Palmostylon*, *Amesoneuron*), fungal spores, pteridophytic spores and tissues of algal and higher plants, in addition to moisture loving molluscs (*Physa prinsippii*) and microvertebrates.

**J.S. Guleria & Rashmi Srivastava [& K.S. Mishra**  
(GSI, Hyderabad)]

Palynological studies on shale and lignite samples from Matasukh and Kashnau, Nagaur, Rajasthan were initiated. Lignite samples yielded a rich and diversified assemblage, dominated by angiosperm pollen. The assemblage is characterized by high frequency of pollen belonging to the family Miliaceae. The recovered palynoflora resembles closely with those recorded from Late Palaeocene and Early Eocene sequences of Barmer and Bikaner basins of western Rajasthan and Matanomadh Formation of Kutch. Based on the present assemblage the studied sequence of Marh Formation is dated as Late Palaeocene in age. Most of the modern counterparts of the palynofossils are tropical to subtropical in present day distribution.

**S.K.M. Tripathi [& S.C. Mathur** (J.N.V. University, Jodhpur)]

Finalized a paper on the plant megafossils from Siwalik sediments of Suraikhola. Comparison of morphological features between the fossils and extant taxa reveals that they are comparable to 31 species belonging to 18 angiospermous and one pteridophytic families. Of these 22 species are new to the Tertiary flora of Indian subcontinents. The analysis of floral assemblage of different horizons of Suraikhola sequence indicates that the Lower Siwalik Formation (Bankas and Chorkhola) have evergreen to semi-evergreen elements. An increase of deciduous elements in the composition is noticed towards towards the close of Middle Siwalik and the beginning of Upper Siwalik formations. This change in the vegetation pattern of different formations reflects the change in climatic condition through the ages during Mio-Pliocene times.

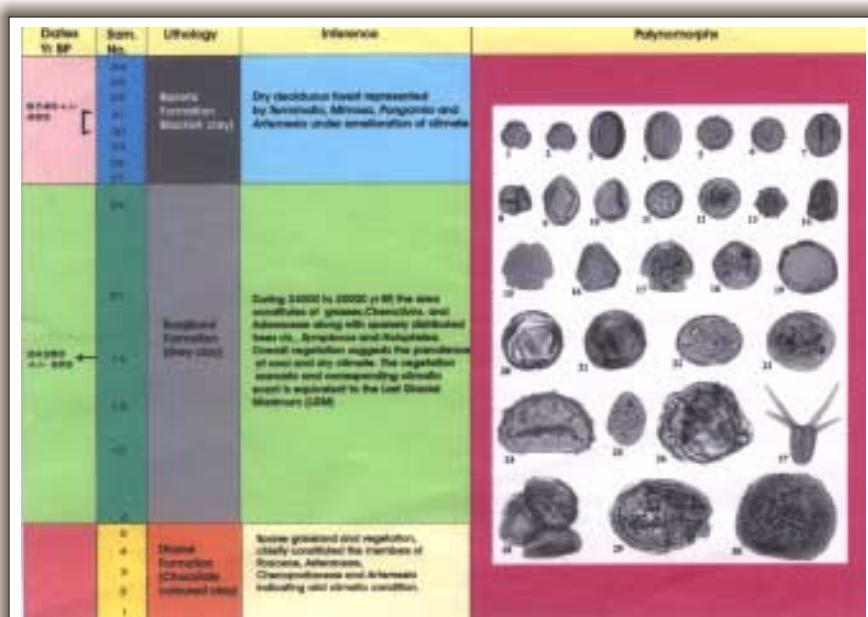
**Mahesh Prasad [& S.M. Pandey** (M.L.K. College, Balrampur)]

*Palaeobotanical study on the fossil woods from Java Island, Indonesia*—From the collected fossils from different localities, viz., Cidokom, Genteng, Gobang, Pasirketug, Sepang Sindey Tegal and Tenjo, about 50% woods belong to Dipterocarpaceae. Few woods are identified as *Dellinea* (*Delliniaceae*), *Polyalthia* (*Annonaceae*), *Terminalia*

(*Combretaceae*) and *Anisoptera*, *Dipterocarpus*, *Dryobalanops*, *Shorea* (*Dipterocarpaceae*), *Cynometra* (*Fabaceae*), and *Croton/ Mallotus* (*Euphorbiaceae*). Fungal infection is also observed in two wood samples. Further work is in progress.

**Rashmi Srivastava**  
[& Noriko Kagemori & Kazuo Terada (Japan) &  
Yance Mandang & Sapri Hadiwisastra (Indonesia)]

*Search for hominid fossils and lithics in the Siwaliks and Narmada Valley of India*—Collected 37 samples (7 from Dhansi, 26 from Surjkund, 5 from Baneta formations) from cliff sections of Hathnora and adjoining areas. Radio carbon dating was done for the sample (SF-16) of Surjkund Formation (date is  $24280 \pm 390$  yrs BP) and another sample (BF-3&4) of Baneta Formation (9701 yrs BP) at the BSIP. On the basis of pollen/spores recovered in all the samples it could be inferred that during 24000 to 20000 yrs BP, the area might have covered with open vegetation constituted of grasses, Chenopodiaceae/ Amaranathaceae and Asteraceae along with sparsely distributed trees (*Symplocos* and *Holoptelea*). The overall vegetation assemblage is suggestive for the prevalence of cool and dry climate regime during the period of sediment accumulation. The record of marshy elements, such as sedges (Cyperaceae) and *Polygonum* together with the aquatic elements *Potamogeton* and *Typha* and algal remains (*Spirogyra*



Preliminary Quaternary Palaeoclimatic inferences from Narmada Valley, Madhya Pradesh

and *Zygnuma*) denotes the existence of water bodies/ponds/lakes in the close proximity of the site of investigation. This vegetation scenario and corresponding climatic event is equivalent to the Last Glacial Maximum episode, which has been globally witnessed between 18000 to 22000 yrs BP.

**M.R. Rao [& Rajeev Patnaik** (Panjab Univ., Chandigarh)]



The palynological investigation of the Siwalik sediments exposed at west of Tapt Kund near Rehar on Lamahi-Nepalganj road in Kapilwastu district (Nepal) yielded a total of 28 genera and 39 species, an assemblage dominated by fungal spores and conidia followed by gymnospermous, pteridophytic and angiospermous elements. Occurrence of a low rainforest type of vegetation is suggested during the sedimentation of Siwalik rocks. A brief comparison with known Siwalik palynoflora from various parts of India and Nepal allows us to suggest that the age of the palynoflora is Late Miocene. The palynoflora indicates a subtropical humid climate due to the dominant occurrence of fungal spores and conidia. Continued finalization of work on the Palynostratigraphical study of the Siwalik sediments of ArjunKhola and its adjoining areas of Central Nepal.

**Samir Sarkar (& G. Corvinus)** (Nepal Research Center, Kathmandu, Nepal)]

Carried out palynological investigation of the Subathu Formation exposed at Rajpura in the Punch district of J&K. The recorded palynofloral assemblage consists of dinocysts, spores, pollen, fungal and algal remains. Quantitatively, dinoflagellate cysts are the major constituents of the assemblage. Some of the dominant taxa are— *Homotryblium*, *Glaphyrocysta*, *Cordosphaeridium* and *Operculodinium*. The palynofossils are suggestive of Early Eocene age. Fossil insects were also recorded for the first time from the Subathu Formation along with these palynofossils. Critical morphotaxonomic analysis was also carried out on the genus *Leiosphaeridium* recovered from the Subathu sediments exposed near Muthal, Udhampur district.

**Samir Sarkar [& G.M. Bhatt]** (Jammu University, Jammu)] Carried out chemical processing of 246 samples (depth 4285-90-10-20 m) of Janauri Well-2 in connection with project *Palynostratigraphy and source rocks potential studies of Siwalik and Subathu sediments of Himachal Pradesh and their correlation with subsurface Tertiary sequence of Punjab Plains*. 54 samples are proved to be palynologically productive. However, the samples are extremely poor in palynofossils. Samples from depth levels: 3375-80 m, 3540-45 m, 3625-30 m, 3705-10 m, 3725-30 m and 3730-35 m are comparatively rich in palynofossils.

The palynofossils recovered consists of pteridophytic spores, gymnospermous and angiospermic pollen grains and algal colonies. Fungal spores and sclerotia have also been recovered at several levels. The pteridophytic spores are referable to Parkeriaceae (*Striatriletes*), Cyathiaceae (*Cyathidites*), Polypodiaceae (*Polypodiisporites*, *Polypodiaceaesporites*), Lycopodiaceae (*Lycopodium-sporites*). Among pteridophytic spores *Striatriletes* constitutes the most predominant taxon. The gymnospermous pollen are referable to Pinaceae (*Pinuspollenites*, *Abiespollenites*, *Laricoidites*). The angiospermous pollengrains are referable to both monocotyledonous and dicotyledonous taxa. The monocotyledonous pollen are referable to Palmae (*Palmaepollenites*) and Gramineae (*Monoporopollenites*).

Dicotyledonous members are Mimosaceae (*Polyadopollenites*), Malvaceae (*Malvacearumpollis*) and Nymphaeaceae. Fresh water alga represented by *Pediastrum* has been found.

**Samir Sarkar [& ONGC (Dehradun)]**

Studied two vibracores from southern flank (Core I - 2.9 m) and north-western flank (Core II - 2 m) of Iskapalli lagoon for vertical lithological variations in relation to depositional environments and mangrove vegetation influenced by the past coastal dynamics, the northern part of the wave dominated Penner delta (Andhra Pradesh). Palynological results show evidence of mangroves in the middle of Late Holocene (2090 yrs BP) that later declined. A gradual north-western shift of the estuary and mangroves is manifest in the sedimentary sequence of younger age (1640 yrs BP).

Studied 19 surface soil samples from Godavari delta and one Off Shore core samples dated 4600 yrs BP. The surface samples studied belong to subtidal (sublittoral) to least intertidal (littoral) coastal zone. Since this zone is periodically submergent and/or an emergent environment was stressful for organisms. However was biologically populous because of the availability of abundant nutrients. Samples represent important sub-environment of the delta during seasonal hydroperiods that indicate variable influence of brackish water-fresh water revealed by the consistency of palynomorphs. The gravity core soil samples (Off Godavari: SK-23, 3.5 m), deposited since 4600 +/- 240 yrs BP, indicate 4 successive cycles of relative sea level highstand system tract (HST). The percentage of marine palynomorphs, abundant Copepod egg shells, fragments of Scolecodonts, linings of Foraminifera. Fresh water-brackish water forms and terrestrial clastic forms recorded in succession since middle Holocene indicate two intermittent cycles of relative HST and LST tract until ~2300 yrs BP. Later, a longer period of LST was recorded punctuated by a brief period of abundant *Botryococcus* colony and other fresh water algal forms sometime around 1650 +/- 100 yrs BP. A period since last millennium shows HST with its peak coinciding with the Medieval Warm Period and then reducing gradually.

**Anjum Farooqui [& T.Y. Naidu & Rajashekhar Reddy (DSI, Visakhapatnam)]**

Studied 3 core samples (62 samples) from Bet Dwarka Island dated Middle and Late Holocene, which showed cyclicity in climate and sea level changes during Holocene. Two cycles of relative sea level rise were recorded with the help of palynology— i) ~ 4000 yrs BP, and ii) ~1800 yrs BP (i.e. 2<sup>nd</sup> century AD). Low percentage of mangroves suggests sparse population in the island or its far distance from the depositional site. The fall of 2<sup>nd</sup> century human habitation (evident by Kushana coins found here) could be due to intermittent rise and fall of sea level creating deltaic instability.

**Anjum Farooqui [& A.S. Gaur & K.H. Vora (NIO, Goa)]**

International project- *Holocene evolution of Chilka Lake, anthropogenic impact and pollution problems*: Accomplished the pollen analysis of deepest core CHI 9



(7.80 m) from Chilka Lake, dated back to  $11,245 \pm 180$  yrs. BP. The statistical analysis of data and eco-based arrangement of plants, such as core and peripheral mangroves, mid land, upland taxa, drifted and re-worked taxa have been done. Prepared the pollen diagram exhibiting relative values of different palynomorphs recovered from the profile. The palynological results of several other investigated Mid-Late Holocene profiles (Balugaon, Rambha, Nalabana, Dangmal, Bhowania) could be correlated with the upper portion of CHI 9. The synergistic approach of geochemical studies (carried out by one of the collaborators, Prof. D.W. Zachmann) with palynology in CHI 9 profile would help in understanding the problem of degeneration of mangroves related with eutrophication and chemical pollution in the water of Chilka. Eight samples from another core (CHI 51) have been chemically processed, which were also collected by Dr. Scharf and Prof. M. Mohanti from the lake.

**Asha Khandelwal [& Burkhard Scharf**

(UFZ Centre for Environment Research, Germany)]

Accomplished pollen analysis a 2.8 m deep trench profile from Lahuradewa Lake, Sant Kabir Nagar District (UP). The study has shown that around 9500-8700 yrs BP, open vegetation mainly comprised of grasses, sedges, *Artemisia*, Cheno/Am. with scanty trees, viz., *Holoptelea*, *Aegle marmelos* and *Terminalia* occurred in the region under cool and dry climate. Between 8700-5700 yrs BP, a few more trees, such as *Bombax*, *Emblica officinalis* and *Lagerstroemia* invaded the open vegetation in response to amelioration of climate. The retrieval of cerealia and other culture pollen implies the inception of agricultural practice in the region. Around 5700-2600 yrs BP, the considerable enhancement of *Bombax* together with *Holoptelea*, *Terminalia*, *Madhuca indica*, etc. envisages the establishment of groves of forests with the onset of humid climatic condition. Between 2600-1400 yrs BP, the climate turned more humid as well indicated by the enrichment of the groves of forests in floristic diversity. Since 1400 yrs BP onwards the groves of forests became sparse owing to change of climate from humid to relatively less humid.

**M.S. Chauhan & A.K. Pokharia [& R. Tiwari (U.P. State Archaeology) & I.B. Singh (Lucknow University)]**

Carried out pollen analysis of 10 samples from three sediment cores from the ancient water reservoirs comprising 4 from Devrajpur (1.12-3.08 m depth) and 3 each from Nagauri (0.23-1.38 m) and Karondih (0.21-1.72 m) located adjacent to archaeological sites in Vidisha district (Madhya Pradesh), dating back to 2<sup>nd</sup> century BC. The pollen assemblage has portrayed the presence of open vegetation constituted of grasses, Cheno/Am., Asteraceae, together with scattered trees of *Madhuca indica*, *Lagerstroemia*, *Terminalia*, *Barringtonia*, *Syzygium*, etc. during the course of sediment deposition. The meagre presence of trees could be attributed to the exploitation of the forests by the ancient settlers, in order to fulfill their various requirements. All the areas were under intense agricultural practice as evidenced from the recovery of cerealia and other culture pollen taxa. The frequent presence of pollen of aquatic

plants, viz., *Potamogeton*, *Lemna*, *Typha*, etc. and fresh-water algae denotes that the water reservoirs were quite large in expanse.

**M.S. Chauhan [& Julia Shaw (Oxford, England)]**

Palynological analysis made from 125-meter deep profile from Lamayuru palaeolake, Ladakh, Trans-Himalayan Region provides a broad idea of temporal succession of vegetation vis-à-vis climatic changes during last glacial period. This profile covers major part of the last glacial period since the base of it has been assigned to a  $^{14}\text{C}$  date around 35 ky BP. The study shows that migration of trees or scrubby taxa within steppe took place around 35 ky and later period when climate was comparatively less arid than before and its further increase around 22 ky BP might have happened under much favourable climatic conditions. Subsequently climate had turned to be cooler and drier with the expansion of steppe taxa. Pollen grains of conifers recorded in this region might be of extra local origin as these are also recorded in the modern pollen spectra of the region far away from their sources at the lower sub-alpine and temperate forest.

**A. Bhattacharyya [& B.S. Kotlia (Nainital)]**

Pollen analysed from several subsurface sediments of exposed lacustrine sediment section from Polour, Iran. The study provides a broad idea of temporal succession of vegetation vis-a-vis climatic changes during middle part of the last glacial period. It has been recorded that climate was comparatively moist (less arid) around 33-35000 year BP when there was development of open forest within the prevailing steppe vegetation under semi arid environment during major time span of last glacial period.

**A. Bhattacharyya [& Habib Alimmmhammadian & Ashok Sahni (Chandigarh)]**

Investigated micromorphological features of five seeds of the genus *Rhododendron* of Ericaceae collected from Sikkim Himalaya. *R. campylocarpum* shows regular ridges and grooves on the outer walls with densely arranged pits, *R. ciliatum* has pits arranged at intervals, *R. dalhousiae* has slit like pits, *R. glaucophyllum* has densely arranged pits like *R. campylocarpum* but smaller in size, and *R. griffithianum* shows longitudinally arranged small pits. The data is important for taxonomy within the genus *Rhododendron*.

**Usha Bajpai [& Sandeep Kumar (G.B. Pant Institute, Gangtok)]**

SEM study of the cuticle membrane has shown distinct variation in species of the genus *Citrus* belonging to the family Rutaceae. The shape of the cells varies from irregular, polygonal to pentagonal with undulated or smooth anticlinal walls, group of thick walled cells present, which varies in number in some species. Trichomas are present only on the lower surface or on the margins.

**Usha Bajpai [& C.L. Verma (Lucknow University)]**



Analysis of pollen, C/N ratios and  $\delta^{13}\text{C}_{\text{OM}}$  from a 1.2 m sediment profile collected from a palaeolake deposit from Sangla, Kinnaur (HP) provides climatic history over the last 9800 yrs of this region. The C/N ratios until 4000 cal yr BP indicate that the organic matters were predominantly from the aquatic production. This is also supported by the pollen data when climate was warm-moist. Subsequently, the lake level started to fall due to decrease in summer monsoon rainfall. This decrease in lake level has been manifested in the carbon isotopic ratio of the OM that showed a +2‰ change. This is the time when  $\delta^{13}\text{C}_{\text{OM}}$  attained a value of -23‰, being the maximum for the available record. Subsequently the lake underwent a few dry and humid phases until about 1000 cal yr BP and got completely desiccated around 800 cal yr BP due to the emergence of dry phase. This is also reflected in pollen data when there is sudden increase of pine pollen along with Chenopodiaceae.

**S. Chakraborty & A. Bhattacharyya [& S.K. Bhattacharya (PRL, Ahmedabad)]**

Carried out pollen analysis of 10 samples from sedimentary core of Sambhar Lake, Jaipur. It has revealed the dominance of non-arboreal over arboreal depicting scrub type of vegetation. Exotic taxa such as *Pinus*, *Alnus* have also been encountered. Further studies are in progress.

**Chhaya Sharma [& Rajiv Sinha (IIT, Kanpur)]**

Completed pollen analysis of a 1.4 m deep profile from Bakhira Tal, Kabirnagar. Preliminary investigations have revealed that this lake is palynologically productive. Detailed palynological investigations can be undertaken from this lake collecting deeper profile from a suitable site.

**Chhaya Sharma [& P.N. Shah (NRSA, Lucknow)]**

Finalized the paper entitled "Soil erosion of a durable Agrosystem during the last two millennia on the Central Ganga

Plain" on Misa Tal profile. Pollen records have revealed that this region experienced low rainfall and occupancy of agriculture as deduced from the sparse pollen of trees, aquatics and culture taxa during 2000 to 1850 yrs BP. Between 1850 and 300 yrs BP, the improvement in trees, aquatics and culture pollen taxa reflects the increase in rainfall and agricultural practices. Since 300 yrs BP onwards, the reduction in rainfall and agricultural prosperity is inferred by pollen evidence.

**Chhaya Sharma & M.S. Chauhan [& I.B. Singh (Lucknow), R. Wasson (Canberra, Australia) & A.K. Singhvi (PRL, Ahmedabad)]**

Finalized a paper entitled "Correlative evidences of monsoon variability, vegetation and Human inhabitation in Sanai Lake deposits; Ganga Plains, India". The pollen, isotope and geochemical studies from the site has depicted dry climatic conditions in the central Ganga Plain during 15000 to 13000 yrs BP. Enhanced humidity around 13000 to 5800 yrs BP led to submergence of marshes and establishment of a large lake as indicated by the increase in warmth-loving aquatic plants and lower  $\text{O}^{18}$  values. This is followed by an arid event during 5000 to 2000 yrs BP and from 1700 yrs BP, there is evidence of climatic amelioration.

**Chhaya Sharma & M.S. Chauhan [& S. Sharma (Germany) & I.B. Singh (Lucknow)]**

Completed pollen analyses of all the 23 lichen/moss cushions from Antarctica and found only 8 samples palynologically productive. The recovered taxa are *Larix*, *Ulmus*, *Alnus*, *Palmae*, *Oldenlandia*, *Poaceae*, *Cheno/Ams.*, *Cyperaceae*, *Brassicaceae* etc. Lower group is represented by recovered spores of fern, moss (in abundance), fungal spores, etc. Besides, a good number of fruiting bodies and cysts have also been recovered. Finalisation of the work is in progress.

**Chhaya Sharma & Shantanu Chatterjee [& D.K. Upreti (NBRI, Lucknow)]**



## Sponsored Projects

**Project— Analysis of Climatic changes and glacial fluctuations using pollen and tree-ring data, in Gangotri Glacial area, Garhwal Himalayas.** (Sponsored by DST, New Delhi, No. ES/91/018/97)

Climate changes during Holocene around the Gangotri glaciers have been made based on pollen supplemented with the magnetic susceptibility and  $\delta^{13}\text{C}$  data from subsurface sediments and tree ring data. The study reveals that around 9000 yrs BP climate was warm-moist which was changed to comparatively drier climatic conditions around 8300-7600 yrs BP. Around 7600-6000 yrs BP, the climate reverted to warm-moist. Subsequently after 6000 yrs BP to around 3000 yrs BP climate again became drier. Around 2000 yrs BP, climatic condition became cooler and moister and further amelioration took place around 1700 yrs BP. Around 1000-850 yrs BP the sharp increase of steppe elements reflect a trend towards drier climatic conditions. During recent times, climate again reverted to warmer conditions reflected by the increase of *Betula*, *Pinus* and other trees. The most salient feature recorded in the study is the sharp rise in magnetic parameter and also the increase of  $\delta^{13}\text{C}$  values around 5000-4000 yrs BP suggesting drier climate. Palynological data also support this. Besides, based on tree ring data of Deodar (*Cedrus deodara*), Blue Pine (*Pinus wallichiana*) and Birch (*Betula utilis*) climatic changes and glacier fluctuations during last several decades around Gangotri glacier have also been studied. It could be hypothesized that the fast retreat of glacier might be cumulative effect of several climatic parameters, which enhance tree growth, i.e. increased precipitation of March-April and June associated with increased winter temperatures and low snowfall. The detailed report has been submitted to DST.

**A. Bhattacharyya & P.S. Ranhotra** (till March 2004)  
[& I.B. Singh (Lucknow) & N. Basvaih (Mumbai)]

**Project— Cretaceous megafloral and coprolitic-derived plant assemblage from the Deccan Trap associated sedimentary sequences in the Dongargaon, Pisdura area Maharashtra.** (Sponsored by DST, New Delhi, No. ESS/23/VES/114/2000 dated July 05,2001)

Based on the palynomorphs and plant tissue fragments recovered from large sized coprolites, interpreted the results related to the potential sources of food exploited by dinosaurs and evolutionary events, besides palaeoecology, during Upper Cretaceous time. A large number of plant fragments (woody tissues, algal remains, cuticles, flowers, seeds and pollen-spores) were recovered from the coprolites, suggesting herbivorous nature of the animals. Discovery of seed-like structure belonging to Arecaceae from dinosaurian

coprolites of Pisdura suggests that they also consumed the palm trees. Discovery of fossil wood-rotters (*Lithoporales zeerabadensis*) woody perennial fungi from Dhar district (MP) and fossil fungi (*Colletrotrichum*, *Phragmothyrites*, *Notothyrites*) from the coprolites pointed out that the dinosaurs lived in tropical-sub-tropical climate. Presence of dicotyledonous woods belonging to Lecythidaceae and Sapindaceae from Lameta Formation signifies the evolution of angiosperms during Maastrichtian time. Occurrence of grass seeds (Cyperaceae) in the Deccan Intertrappean sediments indicates origin and development of grasslands during Upper Cretaceous. The detailed report has been submitted to DST.

**K. Ambwani, Rashmi Srivastava & Debi Dutta** (till February 2005) [& R.K. Kar]

**Project— Tree-line dynamics in highland Himalayas, Himachal Pradesh** (Sponsored by DST, New Delhi, No. 65/SERC/99 dated 15/3/99)

Colonization patterns of *Pinus wallichiana*, *Abies spectabilis*, *Juniperous macropoda* and *Betula utilis* at various sites in western Himalaya show that species have migrated to upper elevations during the past century. However, the rate of migration has varied with species and site. *Pinus wallichiana* has been found to be highly sensitive. Tree growth and climate relationships in Himalayan pine show that October-December temperature conditions are directly related with ring widths. The high temperatures during June show that the temperature may not be the limiting factor for the growth of the trees unlike at northern high-latitude treeline sites where summer temperature is crucial for tree growth. The relationship between tree growth and temperature in *Abies spectabilis* is found to be poor. The *Juniperous macropoda* has been found to be highly sensitive to site conditions. Temperature conditions during the months prior to the growing season are directly related with growth. The detailed report has been submitted to DST.

**R.R. Yadav & Bhasha Dubey** (till September 2004)

**Project— Palynological, biopetrological and dispersed organic matter (DOM) study of Deccan Intertrappean sediments with reference to Cretaceous-Tertiary (K-T) transition.** (Sponsored by DST No. SR/FTP/ES-51/2000)

Continued palynological studies on the Deccan Intertrappean sediments of Anjar (Gujarat) and Padwar (MP), and recorded a diverse palynoassemblage comprising of megaspores and dispersed spore-pollen of pteridophytes, gymnosperms and angiosperms from both the localities. The characteristic palynofossils are *Azolla cretacea*, *Ariadnaesporites ariadnae*, *Gabonisporites vigourouxii*, *Aquillapollenites bengalensis*, *Achrostichumsporites*



*meghalayensis*, *Lycopodiumsporites* sp., *Todisporites major*, *Contignisporites* sp., *Costatheca diskokensis*, *Spermatites ellipticus*, etc. On the basis of these species, a Maastrichtian age has been assigned for the sediments.

A number of epiphyllus and mycorrhizal fungi have been recovered from the dinosaurian coprolites (Group A type Coprolite of Matley, from Pisdura area, Maharashtra). The common forms recorded are *Colletotrichum* cf. *capsici*, *Erysiphe* sp., *Uncinula* sp., *Phragmothyrites eocaenica* and *Glomus* sp. The occurrence of these fungal elements reflects the food habit and environment of the dinosaurs. It is inferred that the dinosaurs might have lived in tropical-subtropical conditions. Also undertook field excursion and collected samples from the Deccan Intertrappean localities at Shahpura, Padwar and Dindori.

**Ratan Kar**

**Project—Long-term climate change in the western Himalaya using high-resolution tree-ring data** (Sponsored by DST, New Delhi, No. ES/48/ICRP/005/2001 dated March 23, 2002)

Tree-ring samples of *Cedrus deodara* and *Juniperus macropoda* from Lahul and Spiti District, Himachal Pradesh were collected during field trip in May-June. The samples were processed for crossdating of growth ring sequences. Ring widths of 45 dated deodar samples were measures and analysed for the preparation of tree-ring chronology.

**R.R. Yadav, Jayendra Singh** (till 25.08.2004),  
**Rajesh Chaturvedi** (till 25.06.2004) & **K.G. Mishra** (since November 2004)

**Project—Analysis of climate changes in north-east India during last several thousand years using pollen and tree-ring data.** (Sponsored by DST, New Delhi, No. SR/S4/ES-15/2002)

Preparation of floating chronology based on analyses of the sub fossil wood collected from Arunachal Pradesh is in progress. Tree-ring chronology of *Tsuga dumosa* (D.Don) Eichler extending from A.D.1421 to 2000. (580 years) from Talley Valley, Lower Subansiri District have been made for tree growth/climate analyses. Tree-ring samples of *Cedrela toona* Roxb. a fast growing deciduous tree collected from Lava forest of Kalimpong subdivision, Darjeeling Himalaya have been analyzed to understand its dendroclimatic potentiality. A 180-year (AD 1824-2003) ring-width chronology of this tree has been made. Analyses of tree growth climate relationship suggest that precipitation during April and May have direct relationship, whereas August, September and October have negative role on the growth of this tree. With temperature, April and August have positive role but it exhibit negative role with February and March. Climatic signal exhibited by Signal-noise ratio has been found to be low, in future collecting larger number of tree-ring

samples of this taxa from adjoining localities of the region may enhance the climatic signal which is necessary for the reconstruction of climate

Pollen, Magnetic susceptibility and  $\delta^{13}\text{C}$  studies from Arunachal Pradesh are in progress.

**A. Bhattacharyya & S.K. Shah [& I.B. Singh (Lucknow) & N. Basvaih (Mumbai)]**

**Project—Reconstruction of Late Quaternary environments in Saurashtra and Mainland Gujarat: A study based on palynofacies analysis** (Sponsored by DST, New Delhi, No. SR/S4/ES-49/2003)

Collected estuarine sediments from coastal areas of Saurashtra and Mainland Gujarat. Carried out a multidisciplinary study— phytolith, palynofacies, magnetic susceptibility (in collaboration) and clay mineralogy (in collaboration) on 2.5 m profile of Late Holocene estuarine sediments of Mahi estuary, Kothiakad locality of Mainland Gujarat for the reconstruction of paleoclimate. The study reveals the presence of 3 climatic fluctuations described here as Phase I, II and III. Phase I (3660-~3400 yrs BP) shows a gradual weakening of SW monsoonal activity overlapped by enhanced winter disturbances that lead to the development of cool climatic conditions. These conditions terminated at the beginning of Phase II (~3400-~3000 yrs BP) with a brief intense warm and humid pulse at 3320 yrs BP due to increased SW monsoonal activity. In Phase III (~3000-2850 yrs BP) SW precipitation fluctuated greatly with considerable increase in warm summer conditions, somewhat similar to the present day climatic scenario in this region. The weak SW monsoonal activity around ~3500 yrs BP also coincides with the global cool and arid phase. The study also discusses the possible link between rise and fall of Harappan phase of Indus civilization and the monsoonal variability during Late mid Holocene in this region.

Several dinocyst rich horizons along with rich terrestrial debris have been identified from the Quaternary sediments near Harshad creek, Saurashtra and estuarine zone near Hansot, Mainland Gujarat.

**Vandana Prasad, Mani Sharma** (till 17.01.2005) & **Vartika Singh** (since 14.02.2005)

**Project—Environment of deposition and biostratigraphy of Early Tertiary lignites of Rajasthan and adjoining areas** (Sponsored by DST, New Delhi, No. SR/S4/ES-75/2003.)

A field trip to Vastan, Surat was undertaken and rock samples were collected for palynological studies. Also jointly undertook a field trip to Barmer and Jaisalmer for collection of samples. Chemical processing of rock samples from Vastan lignite mines was initiated.

**S.K.M Tripathi & Divya Srivastava** (since 12.01.2005)



## Recognition

### Rahul Garg

Invited as Subject Expert for Earth Sciences and Glaciology for selection of projects for the XXIII and XXIV Antarctica Expedition by NCAOR, Goa.

### G.S. Guleria

Chaired a Technical Session at the International Conference on Modern Trends in Plant Sciences with Special Reference to Role of Biodiversity in Conservation held at Amravati (MS) in February 2005.

### Asha Khandelwal

Elected Fellow of the Indian Aerobiological Society.

Chaired a Technical Session of the 13<sup>th</sup> National Conference on Aerobiology held at Institute of Sciences, Nagpur in January-February 2005.

### Binita Phartiyal

Awarded "Dr. Chunnilal Kathiyal Medal - 2004" for the best piece of research work done in the Institute (Scientist - A category).

### M.R. Rao

Invited as Resource Person for the National Workshop on Sequence Stratigraphy organized by the Department of Geology, Bangalore University, Bangalore during November 4-6, 2004.

### Rakesh Saxena

Chaired Session IV- Key Note Lecture on 'Marine sediment based Climatic Variability during Holocene' delivered by Dr. Rajiv Nigam at National Seminar on Geoscience and Environment held at Chennai in January 2005.



Dr G. P. Srivastava, Scientist 'E', retired on 30.09.2004 along with his colleagues



## Representation in Committees/Boards

### Ram Avatar

- Councilor, Executive Council, *The Palaeobotanical Society*

### Rupendra Babu

- Corresponding Member, *International Working Group-IGCP Project-493.*

### S. C. Bajpai

- Member, *UP State Committee for Year of Scientific Awareness-2004.*

### Usha Bajpai

- Member, Executive Committee, *Electron Microscope Society of India.*
- Member, Managing Council, *Indian Association of Palynostratigraphers.*
- Member, *Technical Advisory Committee of U.P. Environmental Concern.*

### Jayasri Banerji

- Vice President, *The Palaeobotanical Society*
- Chief Editor, *The Palaeobotanist.*

### Anjum Farooqui

- Executive Member, *International Society of Environmental Botanist*

### Rahul Garg

- Member, Executive Committee, *The Palaeontological Society of India.*
- Member, Editorial Board, *Journal of the Palaeontological Society of India.*
- Editor, *Geophytology.*

### A.K. Ghosh

- Elected Member, Managing Committee, *Boys' Anglo Bengali Inter College*
- Judge, *District level Children Science Congress-2004,*
- Judge, *State level Children Science Congress-2004,*

### Asha Gupta

- Member, Board of Editors, *Flora and Fauna.*
- Member, Executive Committee, *International Council for Biodeterioration of Cultural Property.*
- Member, Executive Committee, *Society for Plant Research.*

### Asha Khandelwal

- Member, Editorial Board, *Indian Journal of Aerobiology.*
- Member, *International Association of Aerobiology*

### B.K. Misra

- Member, *Bureau of Indian Standards, Solid Mineral Fuel Sectional Committee-PCD-7.*
- Joint Secretary, *Indian Society of Geoscientists.*

### C.M. Nautiyal

- Joint Convenor, *Academic Committee, NCSC-2004.*
- General Secretary, *State Coordination Committee, NCSC-2004.*
- Member, *UP State Committee for Year of Scientific Awareness-2004.*

### Neeru Prakash

- Judge, *12<sup>th</sup> State Level National Children Science Congress-2004*

### Jyotsana Rai

- Members, *Jury, 12<sup>th</sup> State Level Children's Science Congress*
- Member, *Jury, 12<sup>th</sup> State Level Children's Science Congress*

### A. Rajanikanth

- Assistant Editor, *The Palaeobotanist.*
- Editor, *BSIP Newsletter.*
- Member, *National Working Group IGCP Project- 435.*
- Member, *International Working Group IGCP Project- 506.*
- Member, *Research Board of Advisors, ABI, NC.*

### Rakesh Saxena

- Member, *Panel Discussion on Post Tsunami Rehabilitation Scenario, Chennai*

### R.K. Saxena

- Secretary, *The Palaeobotanical Society*
- Member, Editorial Board, *Geophytology.*
- Secretary and Member, Editorial Board, *Indian Society of Geoscientists.*

### Mukund Sharma

- Assistant Editor, *Palaeobotanist*
- Joint Secretary, *The Palaeobotanical Society of India.*
- Corresponding Member, *International Working Group-IGCP Project-493.*
- Editor, *BSIP Newsletter.*

### Manoj Shukla

- Treasurer, *The Palaeobotanical Society*
- Member, Executive Council, *The Palaeontological Society of India.*



- Member, *International and National Working Group- IGCP Project- 493*, The Rise and Fall of the Vendian Biota.
- Judge, State Level *Children's Science Congress-2004*.

#### **B.D. Singh**

-Associate Member, *International Committee for Coal and Organic Petrology (ICCP)*.

#### **Y.P. Singh**

- Panel Judge, *Web Wizard Event of Macfair- 2004*.

#### **A.K. Srivastava**

- Chief Editor, *The Palaeobotanical Society*
- Member, Editorial Board and Treasurer, *Indian Society of Geoscientists*.
- Member, National Organizing Committee, *International Conference on Modern Trends in Plant Sciences with Special Reference to the Role of Biodiversity in Conservation*

#### **Chanchala Srivastava**

- Member, Organizing Committee, Joint Annual Conference-2004: *Indian Archaeological Society, Indian Society for pre-Historic & Quaternary Sciences, Indian History and cultural Society*.

#### **Archana Tripathi**

- Member, Acritarch Subcommission, Commission Internationale de Microflora du Palaeozoique.
- Member, *Spore Pollen Working Group*, CIMP.
- Member, *Subject Expert Committee on Earth and Atmospheric Sciences for WOS-A*, DST.

#### **Vijaya**

- Voting Member, *International Commission on Triassic Stratigraphy*.
- Member, *National Working Group IGCP Project- 434*.

#### **R.R. Yadav**

- Editor, *Geophytology*.



## Lectures Delivered

### BSIP Scientists

#### S.C. Bajpai

- *Solar Energy: An infinite Source of Energy* and *Birbal Sahni Institute of Palaeobotany: A Pioneer Research Institute devoted to Palaeobotany* at University College of Science, Mohanlal Sukhadia University, Udaipur (January 19, 2005).
- *Energy Efficient Buildings for Composite Climates* at Navyug Kanya Post Graduate College, Lucknow (February 21, 2005)

#### A. Bhattacharyya

- *Prospects of Tree-ring and Pollen Data in Analyzing Fluvial Environment* in a DST sponsored Training Programme on Fluvial System at Dept. of Geology, M.S. University, Baroda (November 2004).
- *Dendrochronology and Dendroclimatology and Tree-ring Study in India* in a DST sponsored SERC School on Crustal Deformation and Tectonic Geomorphology Module 1: Concepts in Quaternary Geology at IIT, Kanpur (March-April 2005).

#### Supriya Chakraborty

- *Stable Isotopes Systematic and Radiocarbon Geochronology* (short courses) at the SERC School on "Concepts in Quaternary Geology" sponsored by DST and held at IIT, Kanpur (March 30-31, 2005).

#### A.K. Ghosh

- *Feed back of the 2<sup>nd</sup> Foundation Training Programme for Scientists and Technologists* in the DST sponsored Review/Brain Storming Session– DST Training held at New Gurgaon (October 23, 2004).

#### C.M. Nautiyal

- *Hindi mein janruchi vigyan lekhan* during Hindi Workshop at BSIP (May 20, 2004).
- *Mangal Grah par Manav ki Dastak* (Radio talk) on National Channel in Vigyan Bharati (May 26, 2004).
- *Venus Transit* at Bal Vidya Mandir, Lucknow (June 8, 2004).
- *Science Projects* in Review Workshop on NCSC by VICAS/RVPSP (DST) at Allahabad (August 12-13, 2004).
- *Hindi mein vyavhar* at Kribhco, Lucknow (September 28, 2004).
- *Measurement and Quantitative Evaluation of Scientific Attitude* at National Seminar on Scientific Attitude: Role of Media, Rajasthan University, Jaipur (November 29-30, 2004).
- *Science Communication* (2 lectures) at PA University, Ludhiana (January 13-14, 2005).
- *Physics in Palaeobotany* at LBS PG College, Gonda (February 4, 2005).

#### Neerja Jha

- *Pollen and Spores tell the Age of the Rocks* at Bal Vidya Mandir Senior Secondary School (Charbagh), Lucknow.

#### Asha Khandelwal

- *Pollen allergy* at St. John's College, Agra (September 13, 2004)
- *Jyotsana Rai*
- *Kyon aate hain Bhukamp* at All India Radio, Lucknow.

#### A. Rajanikanth

- *Past Plant Extinctions* at Department of Botany, Jammu University, Jammu (February 9, 2005).
- *Palaeobotany and Allied Sciences* at Lucknow Christian College, Lucknow (February 25, 2005).
- *Empowerment through Information and Biotechnologies* at AIMS Academy, Gonda (March 30, 2005).

#### Rakesh Saxena

- *Coal and Oil Energy* (Key Speaker) at Kishan Ucchatar Madhyamic Vidhyala, Gonda (January 23, 2005)
- *Coal and Lignites* (four lectures) at Geology Department, Punjab University, Chandigarh (March 2005)

#### B. Sekar

- *Isotopic dating techniques and Archaeological Chemistry* (a series of six lectures) at Institute of Archaeology, New Delhi (July 15-16, 2004).

#### Mukund Sharma

- *Inter-relationship (Position and Connection) between South China Block vis a vis Australia and India in SWEAT Hypothesis: Neoproterozoic Biogeography and Organismal Constraints* at IGCP-440 National Workshop, Thiruvananthapuram (November 19, 2004).

#### Y.P. Singh

- *Computer applications* for UGC Sponsored Remedial Coaching Program at Babasaheb Bhimrao Ambedkar University, Lucknow (November 11, 2004).

#### A.K. Srivastava

- *Late Palaeozoic Plant Fossil Assemblages from India* at National Conference on Recent Trends in Botany, Chandrapur (December 19, 2004)

#### G.P. Srivastava

- *Angiosperm taxonomy* (series of 12 lectures) to M.Sc. students at Department of Botany, Lucknow University, Lucknow (April-May 2004)

#### Rashmi Srivastava

- *Origin and Evolution of Indian Forest: A Palaeobotanical Analysis* at Institute of Advanced Studies in Education, Department of Education, Lucknow in an orientation programme for science school teachers (March 8, 2005).



## Lectures by outside scientists

**Professor J.C. Kapur**, Programme Director, Indian Institute of Public Administration, New Delhi

- *e-Governance: Possibilities and Constraints* (August 20, 2004)

**Shri G.S. Srivastava**, Ex-Dy. Director General, Geological Survey of India

- *Geoscientific Database Management* (National Technology Day Lecture; May 11, 2004)

**Prof. Dr. Cheng-Sen Li & Prof. Yu-Fei Wang**, Institute of Botany, Chinese Academy of Sciences, Beijing, China

- *Climate, Vegetation and Landscape in China: Present and Past Conditions* (December 14, 2004)

**Dr. William Wright**, Lamont Doherty Earth Observatory, New York, USA

- *Reconstruction of Asian Monsoon Variability from Tree-rings: A new beginning* (November 03, 2004)

**Dr. Tomasz Zielonka**, Institute of Botany, Krakow, Poland

- *Application of tree-ring studies in understanding the Forest Dynamics in Europe* (November 19, 2004)



Professor J.C. Kapur, Programme Director, Indian Institute of Public Administration, New Delhi delivering a lecture on *e-Governance: Possibilities and Constraints* (August 20, 2004)



## Deputation/Training/Study/Visit Abroad/in Country

### **R.C. Mehrotra**

On invitation from Professor Cheng-Sen Li, visited Institute of Botany, Chinese Academy of Sciences, Beijing for one month during April-May, 2004 for strengthening the scientific collaboration with Chinese scientists.

### **Jayasri Banerji, G.P. Srivastava, Archana Tripathi & B.D. Singh**

On invitation from the Secretary (Science and Technology), visited Ranchi during May 25-29, 2004 and presented the Institute's proposal for developing the Birbal Sahni Memorial Science Centre (at Sahibganj) and Fossil Park (at Mandro) in Rajmahal Hills before Honourable Chief Minister of Jharkhand State.

### **Akhil Antal**

Attended Computer Karyashala organized by ITRC, Lucknow from June 7-11, 2004.

### **Asha Gupta**

Visited Sierra Nevada and National Park during associated field excursions of *XI International Palynological Congress*, Granada (Spain) held in July 2004. Also visited Alhambra's Museum, Museum of Fine Arts and Generalife palace.

### **Y.P. Singh**

Attended the Tech-ed Event of Microsoft held at New Delhi from August 25-27, 2004.

### **Dhirendra Sharma & Avanish Kumar**

Attended Short Term Training in Libsys Software organized by Libsys Corporation and held at Gurgaon from September 13-23, 2004.

### **Rakesh Saxena**

Attended Workshop on *Academia-Industry Interface Seminar* organized by Petrotech Society and held at INSA, New Delhi during September 17-19, 2004.

### **B.K. Misra, Rakesh Saxena, O.S. Sarate, B.D. Singh & Anupam Sharma**

Participated in the Seminar on *Advances in FTIR Instrumentation and its Applications* organized by Micro Device Metrohm Limited at Hotel Taj Residency, Lucknow on September 22, 2004.

### **A.K. Ghosh**

Attended 2<sup>nd</sup> *Foundation Training Programme* for Scientists and Technologists held at Indian Institute of Public Administration, New Delhi, sponsored by DST during July 5-September 24, 2004. Also participated in *Review/Brain Storming*

*Session-DST Training* organised by IIPA New Delhi and held at Heritage Village, Manesar, New Gurgaon during October 23-24, 2004.

### **A. Bhattacharyya, Anupam Sharma & Vandana Prasad**

Participated in DST sponsored *Training Programme on Fluvial Systems* held at Department of Geology, MS University, Baroda from November 16-25, 2004. As a resource person, **Bhattacharyya** provided Field Training to the participants regarding sample collection of pollen and tree-ring.

### **Manoj Shukla & J.S. Guleria**

Attended 1<sup>st</sup> NIAS-DST Course for Senior Scientists-Administrators on Multidisciplinary Perspective in Science and Technology held at National Institute of Advanced Studies, Bangalore during November 15-27, 2004.

### **P.S. Katiyar & Y.P. Singh**

Attended Open Source Technology and Linux Seminar organized by UPTEC Lucknow on November 19, 2004.

### **D.C. Saini**

Deputed to accompany Dr. Tomasz Zielonka, Visiting Scientist (under INSA/Polish Academy of Science Bilateral Exchange Programme) on a field trip to Dudhwa National Park, Lakhimpur-Khiri (UP) during November 25-26, 2004.

### **C.M. Nautiyal**

Attended 52<sup>nd</sup> and 53<sup>rd</sup> Meetings of NARAKAS held at CDRI, Lucknow in August 2004 and in February 2005, respectively. Also attended National Seminar on *Scientific Attitude: Role of Media* organised by Rajasthan University, Jaipur and NCSTC/DST during November 29-30, 2004.

### **A. Rajanikanth**

Attended the *European Plant Taphonomy Meeting*- November, 2004 held in The Netherlands and presented a research paper. Also visited different Museums and Botanical Gardens, viz. -Rijksmuseum van Oudheden, Hortus Botanicus, National Museum of Ethnology (Leiden), National Museum, Central Museum, Palaeobotanisch Museum Budapestlaan, Universite Museum (Utrecht), Museum of Natural Sciences, City Museum (Brussels), NEMO Science Centre, and Rijks Museum (Amsterdam).

### **Rajni Tewari**

After attending the *European Plant Taphonomy Meeting*- November, 2004 held in The Netherlands visited different Museums and Botanical Gardens, viz. -Rijksmuseum van Oudheden, Hortus Botanicus, National Museum of Ethnology (Leiden), National Museum, Central Museum, Palaeobotanisch Museum Budapestlaan, Universite Museum



(Utrecht), Museum of Natural Sciences, City Museum (Brussels), NEMO Science Centre, and Rijks Museum (Amsterdam).

Attended Hindi Workshop organised by Nagar Rajbhasha Karyanvayan Samiti at CDRI, Lucknow during September 1-2, 2004.

#### **Manoj Shukla**

Participated in National Working Group Meeting IGCP-493 'Rise and Fall of Vendian Biota' held at GSI, Kolkata on December 6, 2004.

#### **Anupam Sharma**

Participated and presented a project proposal "Quaternary sedimentary records of Mahi River Basin, Mainland Gujarat: A multidisciplinary approach" in the DST sponsored *Shallow Sub Surface Meeting* held at JNU, New Delhi during December 17-18, 2004. Also carried out geochemical investigations in the National Facility for Geochemical Research at School of Environmental Sciences, JNU.

#### **Ram Avatar & D.C. Saini**

Deputed to accompany Prof. Cheng-Sen Li and Prof. Yu-Fie Wang, Visiting Scientists (under INSA/Chinese Academy of Science Bilateral Exchange Programme) on a field trip to

Tropical forest of South India for 22 days during December 2004-January 2005. In the process also attended National Seminar on *Sedimentary Resources and Environments* held at Annamalai University, Annamalainagar on December 20-22, and *XIV Annual Conference of Indian Association for Angiosperm Taxonomy* held at Thiruvananthapuram on December 29-31, 2004.

#### **A. Bhattacharyya**

Attended the Group Monitoring Meeting held at the University of Madras, Chennai from December 22-23, 2004 in connection with the review of progress of the sponsored project *Analysis of climatic changes in North-East India during last several thousand years using pollen and tree-ring data*.

#### **Mukund Sharma**

Participated in DST sponsored SERC Winter School on Geological Mapping of Sedimentary Terrain in Cuddapah Basin, Kurnool area (AP) organised by GSI, Training Institute, Hyderabad during January 3-29, 2005.

#### **Supriya Chakraborty**

Deputed to give courses on *Stable Isotope Systematics and Radiocarbon Geochronology* at the SERC School on "Concepts in Quaternary Geology" held at IIT, Kanpur during March 27- April 16, 2005.



## Deputation to Conferences/Symposia/ Seminars/Workshops

### A. Bhattacharyya, S. Chakraborty & B. Sekar

- *International Workshop on Indian Monsoon and Climate Variability during Holocene* held at Bangalore from May 17-18, 2004.

### Asha Gupta

- *XI International Palynological Congress* held at Granada, Spain from July 4-9, 2004.

### A. Bhattacharyya & B. Sekar

- *Joint Asia Oceania Geosciences Society 1<sup>st</sup> Meeting and Asia Pacific Hydrology & Water Resources 2<sup>nd</sup> Conference* held at Singapore from July 5-9, 2004.

### S.K. Bera

- *National Workshop on Indian Antarctic Research Programme: Achievements of 23<sup>rd</sup> and Planning for 24<sup>th</sup> Antarctic Expedition* held at NCAOR, Goa from July 19-20, 2004.

### Vijaya

- *32<sup>nd</sup> International Geological Congress* held at Florence, Italy from August 20-28, 2004.

### S. Chakraborty & B. Sekar

- *Workshop User Interaction Meeting on Accelerator Mass Spectrometry of Radiocarbon* held at Bhubaneshwar from August 26-27, 2004.

### R.R. Yadav & Bhasha Dubey

- *Indo-EU Workshop on Climate Change and Natural Disasters* held Hyderabad from September 6-10, 2004.

### Asha Khandelwal & A. Rajanikanth

- *National Conference on Environmental Ethics for Sustainable Development* held at Mumbai from September 1-2, 2004.
- *Workshop on Environmental Management and Pollution Control Awareness* held at IEM, Lucknow on September 18, 2004.

### M.R. Rao

- *National Workshop on Sequence Stratigraphy* held Bangalore from November 4-6, 2004.

### A. Rajanikanth & Rajni Tewari

- *European Plant Taphonomy Meeting-2004* held at National Museum of Natural History, Naturalis, Leiden, The Netherlands from November 12-13, 2004.

### Mukund Sharma

- *IGCP-440 National Workshop on Rodinia Assembly and Break-up* held at Thiruvananthapuram on November 19, 2004.

### A.K. Srivastava, O.S. Sarate & B.D. Mandaokar

- *National Conference on Recent Trends in Botany* held at Chandrapur, Maharashtra from December 19-20, 2004.

### Chanchala Srivastava, M.S. Chauhan, Vandana Prasad, A.K. Pokharia & B. Sekar

- *Joint Annual Conference: Indian Archaeological Society XXXVIII, Indian Society for Prehistoric and Quaternary Studies XXXII and Indian History and Culture Society XXVIII and National Seminar on the Archaeology of the Ganga Plain* held at Lucknow from December 28-31, 2004.

### Rakesh Saxena

- *National Seminar on Geoscience and Environment (NASGEN)* held at Chennai from January 27-28, 2005.

### Asha Khandelwal

- *13<sup>th</sup> National Conference on Aerobiology* held at Nagpur Mumbai from January 31-February 2, 2005.

### A. Rajanikanth

- *1<sup>st</sup> J&K State Science Congress* held at Jammu from February 7-9, 2005.

### J.S. Guleria, Mahesh Prasad, Rajni Tewari, Madhabi Chakraborty & E.G. Khare

- *International Conference on Modern Trends in Plant Sciences with Special Reference to the Role of Biodiversity in Conservation (ICPSBC-05)* held at Amravati (Maharashtra) from February 17-20, 2005.

### C.M. Nautiyal, Ram Avatar & D.C. Saini

- *Paryavaran, Swasthyay, Jaiv evam Suchna Prodogiki: Nutan Sopan- HIMVAS-2005*, 1<sup>st</sup> International Scientific Conference through Hindi medium held at ITRC, Lucknow from February 28-March 2, 2005.

### Anjum Farooqui

- *European Geosciences Union 1<sup>st</sup> General Assembly and Symposium* held at Nice France from April 2004.
- *IGCP 464 Workshop* held at Marine Wing GSI, Visakhapatnam from March 30-31, 2005.



## Papers presented at Conferences/ Symposia/Meetings

**Bera SK** – Late Quaternary climatic history of Schirmacher Oasis and origin of polar lakes, East Antarctica as deduced from lake sediments and glacial organodebris using sedimentological, palynological and chronological parameters. *National Workshop Indian Antarctic Research Programme.: Achievements of 23<sup>rd</sup> & Planning for 24<sup>th</sup> Antarctic Expedition*, Goa, July 2004.

**Bhattacharyya A** – Climatic changes in the western Himalayan region during Holocene. *Joint AOGS 1<sup>st</sup> Annual Meeting & 2<sup>nd</sup> APHW Conf.*, Singapore, July 2004.

**Bhattacharyya A & Ranhotra PS** – Temporal and spatial aspects of western Himalayan climate and their implications to monsoon dynamics. *Workshop Indian Monsoon and Climate Variability during Holocene*, Bangalore, May 2004.

**Chakraborty S** – Investigating the Arabian Sea corals as a proxy record for the Indian monsoon. *Workshop Indian Monsoon and Climate Variability during Holocene*, Bangalore, May 2004.

**Chakraborty S** – Use of AMS in studying Ocean-Atmospheric variabilities. *Workshop User Interaction Meeting on AMS of Radiocarbon Dating*, Bhubaneswar, August 2004.

**Chauhan MS, Pokharia AK & Singh IB** – Pollen records of Holocene vegetation and climatic changes from Lahuradewa Lake, Sant Kabir Nagar District, U.P. *Joint Annual Conf. IAS, ISPQS & IHCS and National Seminar Archaeology of Ganga Plain*, Lucknow, December 2004.

**Dwivedi HD & Prasad M** – Siwalik (Middle Miocene) leaf impressions from Koilabas area in the Himalayan foot hills of western Nepal and their significance. *International Conference Modern Trends in Plant Sciences with Special Reference to the Role of Biodiversity in Conservation*, Amravati, February 2005.

**Farooqui A** – Biodiversity of mangroves during Holocene from south-east coast of India. *Symposium. 1<sup>st</sup> European Geoscience Union, France*, April 2004.

**Farooqui A** – The Evolution of Pichavaram mangrove and environment since Middle Holocene: A Palynological record. *IGCP 464 Workshop*, Visakhapatnam, March 2005.

**Guleria JS, Srivastava R & Misra KS** – A rare occurrence of plant and animal fossils in the Deccan basalts of Khandwa, Madhya Pradesh, India. *International Conference Modern Trends in Plant Sciences with Special Reference to the Role of Biodiversity in Conservation*, Amravati, February 2005.

**Gupta A** – Late Quaternary vegetation in temperate zone of Kumaun Himalaya– Palynological assay. *XI International Palynological Congress*, Granada, Spain, July 2004.

**Jha N & Tewari R** – Occurrence of Late Permian palynomorphs and equisetalean axes in Sattupalli Area, Chintalpudi Subbasin, Andhra Pradesh. *International Conference Modern Trends in Plant Sciences with Special Reference to the Role of Biodiversity in Conservation*, Amravati, February 2005.

**Khare EG, Rao MR & Prasad M** – Palynology of Lower Siwalik sediments (Middle Miocene) from Koilabas area, western Nepal. *International Conference Modern Trends in Plant Sciences with Special Reference to the Role of Biodiversity in Conservation*, Amravati, February 2005.

**Khendelwal A** – Management of mangroves around Chilka Lake, Orissa, India. *National Conference Environmental Ethics and Sustainable Development.*, Mumbai, September 2004.

**Khendelwal A** – Pollen in air and surface sediments of Lucknow, India: a critical assessment. *13<sup>th</sup> National Conference Aerobiology.*, Nagpur, January-February 2005.

**Mandaokar BD** – Depositional environment and age of the sediments (Early Miocene) in Chowngte Mizoram, India. *National Conference Recent Trends in Botany*, Chandrapur, December 2004.

**Pokharia AK & Saraswat KS** – Ancient crop economy from Ojiyana, Bhilwara District, Rajasthan. *Joint Annual Conference IAS, ISPQS & IHCS and National Seminar Archaeology of Ganga Plain*, Lucknow, December 2004.

**Prasad M** – Fossil remains of the genus *Dipterocarpus* Gaertn. in the Churia (Siwalik) sequence of western Nepal and its phytogeographical significance. *International Conference on Modern Trends in Plant Sciences with Special Reference to the Role of Biodiversity in Conservation*, Amravati, February 2005.



**Prasad V, Sharma M, Saxena A & Singh IB** – Fossil diatom assemblages from Lahuradewa Lacustrine sediments as clues for Human activity. *Joint Annual Conf. IAS, ISPQS & IHCS and National Seminar Archaeology of Ganga Plain*, Lucknow, December 2004.

**Rajanikanth A** – Vestiges of vanquished plants: A reminder to modern man. *National Conference Environmental Ethics and Sustainable Development*, Mumbai, September 2004.

**Rajanikanth A** – Role of print media in environmental awareness. *National Workshop Environmental Management and Pollution Control Awareness*, Lucknow, September 2004.

**Rajanikanth A** – Mesozoic terrestrial plant life of Pranhita-Godavari Basin, India. *European Plant Taphonomy Meeting*, Leiden, The Netherlands, November 2004.

**Rajanikanth A** – Indian Gondwana: A traverse. *I<sup>st</sup> J&K State Science Congress*, Jammu, February 2005.

**Ram Avatar** – Paryavaran evam Swasthya Sanrakshan men Lavanodvidh (mangrove) Paudhon ki upyogita tatha yogdan (in Hindi). *HIMVAS-2005, 1<sup>st</sup> International Scientific Conference through Hindi medium*, ITRC, Lucknow, February-March 2005.

**Rao MR** – Role of palynology in biostratigraphic zonation and correlation of the Tertiary sediments in Kerala Basin. *National Workshop Sequence Stratigraphy*, Bangalore, November 2004.

**Sahni A, Rana RS, Loyal RS, Saraswati PK, Mathur SK, Rose KD, Tripathi SKM & Garg R** – Western margin Palaeocene-Lower Eocene lignites: Biostratigraphic and palaeoecological constraints. *2<sup>nd</sup> APG Conference*, Khajuraho, September 2004.

**Saini DC** – Amarkantak chhetra ki Rog Niwarak avam Swasthyvardhak Van-aushadhian (in Hindi). *HIMVAS-2005, 1<sup>st</sup> International Scientific Conf. through Hindi medium*, ITRC, Lucknow, February-March 2005.

**Saraswat KS & Pokharia AK** – Plant resources in the Neolithic economy at Kanishpur, Kashmir. *Joint Annual Conference IAS, ISPQS & IHCS and National Seminar Archaeol. Ganga Plain*, Lucknow, December 2004.

*Archaeol of Ganga Plain*, Lucknow, December 2004.

**Sarate OS** – The coal of Junad Open Cast Mine and its biopetrographic constitution, Wardha Valley Coalfield, Maharashtra. *National Conference Recent Trends in Botany*, Chandrapur, December 2004.

**Saxena R** – Recent trends in petrological characterization of Indian coal and lignite. *National Seminar Geoscience and Environment*, Chennai, January 2005.

**Sekar B** – BSIP contributions on Palynology and  $^{14}\text{C}$  data for reconstruction of Quaternary vegetation of India. *Workshop User Interaction Meeting on AMS of Radiocarbon Dating*, Bhubaneswar, August 2004.

**Sekar B** – Emerging evidences of antiquity of human settlements in some areas of western coast of India transgressed by sea. *Joint AOGS 1<sup>st</sup> Annual Meeting & 2<sup>nd</sup> APHW Conference*, Singapore, July 2004.

**Srivastava C** – Emerging trends of palaeoethnobotanical investigations at ancient Ahirua Rajarampur and Siyapur, Kannauj district, U.P. *Joint Annual Conference IAS, ISPQS & IHCS and National Seminar Archaeology of Ganga Plain*, Lucknow, December 2004.

**Tewari R** – Significance of fossil plant cuticles in palaeoecology. *European Plant Taphonomy Meeting*, Leiden, The Netherlands, November 2004.

**Tewari R** – Permian megafloristics of Wardha Basin, Maharashtra. *International Conference Modern Trends in Plant Sciences with Special Reference to the Role of Biodiversity in Conservation*, Amravati, February 2005.

**Tewari R, Srivastava RK, Singh KK, Saraswat KS, Singh IB, Chauhan MS, Shekar B, Pokharia AK, Saxena A, Prasad V, Sharma M & Joglekar PP** – Epilogue: Implications for the archaeological studies in Ganga Plain. *Joint Annual Conference IAS, ISPQS & IHCS and National Seminar Archaeol. Ganga Plain*, Lucknow, December 2004.

**Vijaya** – An Early Cretaceous record of volcanism in the Panagarh area, West Bengal, India: Palynological evidence. *32<sup>nd</sup> Internatioanl Geological Congress*, Florence, August 2004.



## Consultancy/Technical Assistance rendered

**T**he consultancy services were provided to the following Institutes/Organisations for **Radiocarbon Dating** of a variety of samples: (Institute earned a total amount of Rs. 4,38,000/-)

Geological Survey of India, Kolkata (28 samples)  
 Mahatma Gandhi University, Gandhinagar (1 sample)  
 National Institute of Oceanography, Goa (14 samples)  
 Institute of Rajasthan Studies, Udaipur (2 samples)  
 Center for Earth Science Studies, Trivandrum (16 samples)  
 Archaeological Survey of India, Nagpur (8 samples)  
 Cochin University of Science and Technology (21 samples)  
 Rohilkhand University (6 samples)  
 Vakkom M Foundation (20 samples)  
 Deccan College, Pune (2 samples)  
 Geological Survey of India (Northern Region), Lucknow (6 samples)

**SEM Unit** has provided consultancy services in sample processing for ultrastructure, scanning electron microscopy and EDX analysis to the scientists/scholars of following Institutes and University Departments: (generated revenue of Rs. 40,100/-)

National Botanical Research Institute, Lucknow  
 Department of Metallurgical Engineering, BHU, Varanasi  
 Department of Botany, Institute of Science, Nagpur  
 GB Pant University of Agriculture, Pant Nagar  
 Central Mining Research Institute, Dhanbad  
 K.G. Medical University, Lucknow  
 Botany Department, Lucknow University  
 Zoology Department, Lucknow University  
 Physics Department, Lucknow University

Provided consultancy services to Methane Emission

Division of the Central Mining Research Institute, Dhanbad for the **Coal Petrographic** (mainly maceral characterization and associated mineral matter), reflectance range and microcleat study (including photographs) on 72 bore-core coal samples. (generated revenue of Rs.1,44,000/-).

**Archana Tripathi** provided scientific and technical assistance to a M. Phil., student of School of Studies in Geology, Vikram University, Ujjain (MP) in palynological techniques and identification of spore-pollen. Also supervised the work of Mrs. Babita Singh, Junior Research Fellow, CSIR, New Delhi, on "Palynological dating and correlation of coal bearing rocks from Talcher Coalfield, Orissa, India".

**J.S. Guleria** provided scientific assistance in identification of wood samples to Dr. R. Satheesh, School of Environmental Sciences, Mahatma Gandhi University Kottayam, Kerala; in investigation and identification of leaf impressions to Ms T.N. Priya, Asst. Geologist, GSI, Nagpur; and in his M.Sc. Dissertation Project on Palaeobotany-Tertiary megaflora of India to Mr. Arun Kumar of Geology Department, BHU.

**B.K. Misra & B.D. Singh** provided scientific assistance in Coal and Coke Petrology (both under normal and fluorescence modes) to Sri Prakash Singh, Research Fellow of Central Mining Research Institute, Dhanbad. Also assisted in observation of coal under SEM for nature of mineral association in organic microconstituents.

**S.K.M. Tripathi** imparted scientific training to Miss Priya, Assistant Geologist, Geological Survey of India, Nagpur to carry out palynological studies.

**Rakesh Saxena** updated the Training Manual for coal/lignite petrological study. Also prepared the present state of art in methods, principals and application in coal and lignite characterization for M. Sc. (Hons.) students of School in Geology, Punjab University, Chandigarh.

**S.K. Bera** provided training on various maceration techniques and other scientific assistance to Sri S.K. Basumatary, Lecturer in Goalpara College (Assam) and registered in Lucknow University for Ph.D. degree under supervision.



## Units

### Publication

#### Journal— *The Palaeobotanist*

The journal Volume 53(1-3) consisting of 21 Refereed papers, Conference reports, Award write up, Obituary and Archives was published with state of the art printing technology. Papers for the Volume 54(1) are being processed.

#### BSIP Newsletter

Newsletter 2004 was published (in June) with information on important activities of the Institute including participation in exhibitions, conferences, new additions to library, Memorial Lectures, National Science Day and Technology Day celebrations, important research finds, science meet reports and related information along with relevant visuals. Hindi activities including Hindi Pakhwara celebration, reports, articles in Hindi, *kavitain*, Hindi Essay, etc, were also incorporated in this Newsletter.

#### Annual Report

Bilingual (English/Hindi) Annual Report—2003-2004 was published with a new page design incorporating Institute's activities like Research, Conference participation, Awards,

Research papers published/accepted, Foundation/Founders' Day celebrations, reports of different units, Annual Accounts and related aspects with relevant graphics and photographs.

#### Hand-outs

Brief biographical profiles and themes of lecture of eminent speakers— Professor P. Ramachandra Rao, Vice Chancellor (BHU, Varanasi), Professor S.K. Tandon (Univ. of Delhi) and Professor A.K. Singhvi (PRL, Ahmedabad) delivered on the occasion of Foundation Day and Founders' Day were published.

#### Profile

A profile of Lifetime achievements in the field of Palaeobotany by Professor K.R. Surange, Ex-Director of this Institute was designed and published for distribution.

#### Sale of Institute Publication

This year the publication of the Institute netted an income of Rs. 1,07,240/-



Professor P. Ramachandra Rao, Vice Chancellor, Banaras Hindu University, Varanasi, releasing the BSIP Newsletter - 7 on the Foundation Day.



## Library

**L**ibrary is committed to serve to its users efficiently. To enhance the library facilities, work is carrying out Current Awareness Service, which is also available on the Institute's web site (<http://www.bsip.res.in>). A new bibliographic service Georef has been acquired to assist the scientists to referencing work.

The current holdings of library are as under:

Particulars	Additions during 2002-03	Total
Books	58	5,536
Journals	123	12,374
Reprints	341	37,090
Reference Books	04	325
Hindi Books	15	285
Ph.D. Thesis	-	91
Reports	-	46
Maps & Atlases	-	61
Microfilm/ Fisches	-	294
CD	15	72

Currently the library is receiving 141 journals (80 through subscription and 67 in exchange). There are 151 registered card holders using the library facilities.

### Exchange Unit

Journals received on exchange basis	67
Reprints of research papers purchased	18
Reprints sent out in exchange	626
Institutions on exchange list	66
Individuals on exchange list	146

**Computer Aided Library**— The library has a fully integrated multi-user LIBSYS 4 Software package with Web OPAC. The computerization of the literature is in progress. Most of the journals are also available on line to users.

**Current Awareness Service**— Current Awareness Service has completed 5 years. Library is regularly sending this bimonthly bulletin to different institutions and scientists throughout the country who are interested in Palaeobotany, Earth sciences and related fields.

**Lamination and Xeroxing**— To preserve the old and rare literatures, the lamination and xeroxing of such publications is done. Xeroxing facility is also provided to Institute scientists as well as to out side scientists and organizations on payment basis.

The following Institutions/Organizations availed the library facilities:

- Botanical Survey of India, Allahabad.
- Agharkar Research Institute, Pune.
- Department of Botany, University of Burdwan, Burdwan.
- Department of Geology, SNSRKS College, Saharsa.
- Department of Geology, Banaras Hindu University, Varanasi.
- Department of Botany, Institute of Science, Nagpur.
- Department of Geology, University of Jammu, Jammu.
- Department of Earth Sciences, Kurukshetra University, Kurukshetra.
- Departments of Botany and Geology, Lucknow University, Lucknow



## Museum

A display panel exhibiting the photographs of fossils is added in the Museum hall. These photographs show excellent preservation of plant fossils and were presented to the Institute by Drs. Giraud Foster and Norman Barker of Baltimore, U.S.A. Museum is playing an important role in popularizing and dissemination of Palaeobotanical knowledge. It was kept open for the students and common public during the celebrations of National Technology Day (May 11, 2004) and National Science Day (February 28, 2005). Several students, guests and people from different walks of life visited the Institute's Museum round the year and watched the fossil specimens with great interests. Seven sets of plant fossil specimens were gifted to different institutions of the country.

The scientists of the Institute deposited specimens, slides and negatives of their research publications as detailed below:

### Holdings

Particulars	Additions during 2004-2005	Total
Type and figured specimens	78	6,465
Type and figured slides	56	12,513
Negatives of above	265	16,821

Samples/specimens were collected by the scientists from 193 localities of the country and deposited in the Museum for investigation as under:

Project	Specimens	Samples
Project- 1	8	223
Project- 2	207	317
Project- 3	-	324
Project- 5	1	186
Project- 6	981	199
Project- 7	-	123
Project- 11	-	439
Project- 12	31	38
Project- 14	98	40

Samples collected other than Institute Projects— DST sponsored Projects (17 specimens and 149 samples).

Samples received from other organization— 443 samples from ONGC (collaborative project), 267 samples from Department of Geological Sciences, University of Cape Town, South Africa, and 10 samples from Dr. Julia Shaw, University of Oxford, UK.

Fifty-two type specimens of fossil Charophytes have been presented to BSIP by Professor S.B. Bhatia, FNA, Emeritus Professor, Panjab University, Chandigarh.

Specimens gifted within the country to the following centers:

Sir Padampat Singhania, Educational Center, Kamla Nagar, Kanpur

Department of Botany, Karorimal College, University of Delhi, Delhi

Mahila Vidyalaya Degree College, Lucknow

Islamia College of Science and Commerce, Sri Nagar

Lal Bahadur Shastri Post Graduate College, Gonda

Department of Botany, Annamalai University, Chidambaram

Govt. Maharaja P.G. College, Chatterpur, Madhya Pradesh

### Institutional Visitors

Department of Geology, Nagaland University, Kohima (Nagaland)

Department of Botany, Vinova Bhave University, Hazaribagh (Jharkhand)

Department of Botany, Andhra University, Visakhapatnam (AP)

P.G. Department of Botany, V.K.S. University, Ara (Bihar)

Presidency College, Kolkata (WB)

Govt. Model Science College, Jabalpur (MP)

K.N.I. PG College, Sultanpur (UP)

Department of Botany, L.B.S. P.G. College, Gonda (UP)

Department of Botany, D.B.S. College, Kanpur (UP)

Forestry Training Institute, Kanpur (UP)

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

Alternative Energy Research Development and Training Center, Lucknow

Exon Inter College, Campbell Road, Lucknow



## Herbarium

**A**dded about 1,100 plant specimens, 196 samples of polleniferous materials, 8 samples of wood blocks and 130 samples of fruit and seeds from Dudhwa National Park, Lakhimpur-Kheri (UP), and Tropical forests of Tamil Nadu and Kerala to enhance the reference materials of Herbarium. All

plants materials were processed. About 16 samples of food and medicine value were also collected from above mentioned localities for Institute's Museum. Data feeding in computer for Herbarium digitization is in progress.

### Holdings

Particulars	Additions during 2004-2005	Total
Herbarium		
Plant specimens	1,100	22,371
Leaf specimens	200	973
Laminated mounts of venation pattern	6	66
Xylarium		
Wood blocks	8	4,148
Wood discs	2	68
Wood cores	1,203	5,832
Wood slides	-	4,180
Palm slides (stem, leaf, petiole, root.)	-	3,195
Sporothek		
Polleniferous materials	196	3,016
Pollen slides	-	12,237
Carpothek		
Fruits & seeds	130	4,331
Museum Samples		
Medicinal & food plant	16	91

### Herbarium facilities provided

Sri V.K. Singh, Department of Botany, Vinoba Bhave University, Hazaribagh, Jharkhand.

Dr. R.C. Srivastava, Botanical Survey of India, Central Circle U.P., Allahabad.

Sri Bharu Goyal, Department of Botany, M.S. University, Baroda.

Miss Mamta Singh Yaduvanshi, Department of Botany, M.L.S. University, Udaipur.

### Visitors:

Dr. Willian E.Wight, Columbia University, New York (USA).

Dr. Han Mi Gyeong, Government Museum, South Korea.

Prof. Cheng-Sen Li, Institute of Botany, Chinese Academy of Science, Beijing.

Prof. Yu-Fei Wang, Institute of Botany, Chinese Academy of Science, Beijing.

Dr. Tomaz. Zelonka, Polish Academy of Science, Poland.

Students of G.B. Pant University, Pantnagar, Nainital (Uttranchal).

Students of Christian Medical College and Hospital Ludhiana (Punjab).

Students of Kamla Nehru Institute, Sultanpur (UP). Forest Guards (Trainees) of State Forest Research Institute, Kanpur (UP).

Teachers Attending Refresher Course, Academic Staff College, Lucknow University, Lucknow (UP).



## Electronic Data Processing

256 KBPS Internet Connection with Radio link facility from Software Technology Park of India (Lucknow) has been commissioned in the Institute. Proxy, Mail and DNS Servers are successfully configured on Redhat Linux ES 3.0 Operating System. This provides 24 hours Internet facility to the staff. At present, 68 computers are connected with the LAN. E-mail accounts for scientists and various units/sections of the Institute have been opened through Mail Server on Institute's Domain Name (BSIP.RES.IN). The inter-connectivity of windows with Linux Server has also been configured, so that the Windows users can use Linux security and services.

This year, Institute has procured ten USB Pen Drives, one Iomega external CD Writer and three 800 VA APC UPS.

Corel Draw Graphics suite 12 and Sigma Plot 9.0 softwares are also procured. Work for Institute's web site (<http://www.bsip.res.in>) is almost complete and is being tested on the Institute's Server. List of palaeobotanical words for spelling check has been compiled. The work of English to Hindi translation of palaeobotanical words is in progress.

Payroll, Form16 and Pension packages are modified as per the requirements and also the Institute's Annual Accounts, Budget and Revised Estimates are prepared. The section is regularly providing help to the scientists in preparing the multimedia presentations, charts, graphs, lithologs and other research related diagrams for their publications and documentation.

## Section Cutting Workshop

The unit is one of the important units of the Institute where fossil and rock samples are cut and their thin sections are prepared. During the year above 435 samples were cut and about 1,250 slides were prepared. In addition, 250 slices were

made and polished for detailed examination by the scientists.

A number of scientists, students and teachers visited the Unit. The visitors were given live demonstration of cutting, polishing and preparation of thin slides of the fossil materials.



## Foundation Day

The Institute celebrated its 58<sup>th</sup> Foundation Day on September 10, 2004. On this occasion Professor P. Ramachandra Rao, Vice Chancellor, Banaras Hindu University, Varanasi, delivered '8<sup>th</sup> Jubilee Commemoration Lecture on the topic "Trees: An Engineer's Delight". Professor S.B. Singh, Vice Chancellor, Lucknow University, Lucknow presided over the function. Many guests and scientists from various organisations of Lucknow attended the function.

## Founder's Day

The Founder's Day was celebrated on November 14, 2004. Institute staff and distinguished guests offered *floral tributes (Pushpanjali)* on the *Samadhi* of the Founder Professor Birbal Sahni, in the precincts of BSIP. Same afternoon two memorial lectures were organized to commemorate Prof A.C. Seward and his pupil Prof Birbal..



Professor S.K. Tandon, Research and International Relations and Dean, Department of Geology, University of Delhi, New Delhi offering tributes to Sahnis.

Professor A.K. Singhvi, Planetary and Geosciences Division, Physical Research Laboratory, Ahmedabad delivered the '34<sup>th</sup> Birbal Sahni Memorial Lecture' on the topic "The Human Dimension of Geosciences".

Professor S.K. Tandon, Research and International Relations and Dean, Department of Geology, University of Delhi, New Delhi delivered the '50<sup>th</sup> Sir Albert Charles Seward Memorial Lecture entitled "Stratigraphic Records of Late Quaternary Climate Shifts in the Thar and its Margins".

Professor J.S. Singh, Chairman, Governing Body of the Institute presided over the function. Several guests, well-wishers and scientists from outside institutions graced the occasion.



Professor A.K. Singhvi, Planetary and Geosciences Division, Physical Research Laboratory, Ahmedabad offering tributes to Sahnis.



## National Science Day

In accordance with directions from the DST, the National Science Day-2005 was celebrated for a fortnight (February 15-28) this year with the theme being "Celebration of Physics" to commemorate the centenary of Einstein's great discoveries in 1905. Four lectures were organized at the Institute, including two by outside speakers. On February 15, Institute scientist S. Chakraborty delivered a lecture on *Harmonic Oscillations and their Applications to Palaeoclimate*. The Officiating Director Dr Jayasri Banerji spoke on the significance of the year and highlighted the achievements of Einstein. A debate competition for school students was organized on February 22. Thirty-one students spoke for and against the topic "Space Science is a Luxury for India". On February 24, a lecture on *Einstein and Theory of Relativity* by Prof. G.P. Gupta, Head, Department of Physics (Lucknow University), portrayed Einstein as a great intellectual. Prof Gupta explained relativity in a simple manner with illustrations. On February 26, a collage competition for school students was organized on 'Tsunami: Causes and Effects' at Institute campus. About 70 students from 9 institutions participated. A 'Face-to-Face' programme for school students on 'Tsunami' was joined in by Institute scientists- R.K. Saxena, C.M. Nautiyal, S.K.M.

Tripathi and Mukund Sharma during which a large number of students asked questions on various aspects of tsunami.

The Valedictory function was held on the National Science Day (February 28) with Prof. Devendra Sharma, Ex Vice-Chancellor (Indore and Gorakhpur Universities) as the Chief Guest who, with illustrations, explained how Einstein's theory helped in understanding stellar behaviour. Institute scientist C.M. Nautiyal in his talk on *Planets, Plants and Physics* outlined the geological, geographical and climatic conditions on various planets; discussed how they were greatly governed by physical laws and illustrated how it would influence life forms, if any. A speech-competition for degree-students was also held on this day on the topic "Space Science is a Luxury for India". The officiating Director chaired the session and paid tributes to Professors Raman and Einstein. The Chief Guest gave away prizes to winners of various competitions. In all, 24 prizes were awarded in the form of science books, etc. All participants of collage competition were given small booklets of Prof C.V. Raman's lecture titled 'Why the Sky is Blue'. The Day was observed as an Open House.



Prof. Devendra Sharma along with winners of National Science Day Competitions.



## Distinguished Visitors

Dr. Giraud Foster, 917 Poplar Hill Road, Baltimore, Maryland, U.S.A.

Shri G.S. Srivastava, Ex-Dy. Director General, Geological Survey of India, Lucknow

Professor P. Ramachandra Rao, Vice-Chancellor, Banaras Hindu University, Varanasi

Professor S.B. Singh, Vice Chancellor, Lucknow University, Lucknow.

Professor S.K. Tandon, University of Delhi, New Delhi.

Professor A.K. Singhvi, Physical Research Laboratory, Ahmedabad.

Dr. William E. Wright, Columbia University, New York, U.S.A.

Dr. Benjamin I. Cook, University of Virginia, U.S.A.

Dr. A.K. Singh, Central Mining Research Institute, Dhanbad.

Professor Devendra Sharma, Ex Vice-Chancellor (Indore and Gorakhpur Universities), Lucknow

Dr. Cheng-Sen Li, Institute of Botany, Beijing, China

Dr. Yu-Fei Wang, Institute of Botany, Beijing, China.

Professor Jagdish C. Kapur, Indian Institute of Public Administration, New Delhi.

Dr. Nikki Grainger, Department of Health, London, U.K.

Dr. Arsenio B. Ella, Forest Products Research and Development Institute, DST College, Laguna, Philippines

## Reservations and Concessions

The Institute is following Government of India norms, as applicable to Autonomous Bodies and as amended from time to time, for the reservations and concessions of Scheduled

Castes (SC), Scheduled Tribes (ST), Other Backward Classes (OBC) and Physically Handicapped Persons for the posts meant for direct recruitment



Acting Director Dr. Jayasri Banerji welcoming Dr. R.N. Lakhanpal during the Hindi Pakhwara celebrations



## Status of Official Language

The efforts to promote use of Hindi in official work continued in earnest throughout the year. The staff was encouraged to increase use of Hindi in official and scientific work. The institute has been an active member of the Nagar Rajbhasha Karyanvayan Samiti, Lucknow (Unit 6) and was represented in its 52<sup>nd</sup> and 53<sup>rd</sup> half-yearly meetings. The Quarterly and Half yearly reports to DST and NARAKAS were sent regularly.

Hindi abstracts of research papers published in the Journal '*The Palaeobotanist*' continue to be prepared and published. The Annual Report is published in Hindi also. The Newsletter of the Institute is bi-lingual. This year, 3 scientists submitted abstracts to the International Conference on Hindi Madhyam mein Antarrashtriya Vaigyanik Sangoshti held at ITRC, Lucknow. In addition, a number of Institute scientists delivered science lectures, published popular science articles and broadcast radio/TV science programmes in Hindi. Some scientists were invited to deliver lectures in science writing seminars also.

### Hindi Workshop

To promote the use of Hindi, a one day Hindi Workshop was organised on May 20, 2004 at the Institute. Dr V.N. Tiwari from CDRI, Lucknow delivered 2 lectures dealing with various aspects of using Hindi in official work. He also answered queries from the audience

on appropriate use of Hindi, while Institute scientist CM Nautiyal delivered a lecture on communicating science in Hindi.

### Hindi Fortnight

The event was celebrated during September 14-29, 2004 with enthusiasm and witnessed participation from all sections of the staff. A 'Kavi Sammelan' on 15<sup>th</sup> September had renowned poet Dr Kunwar Bechain as the Chief Guest. Several other invited poets as well as six institute poets regaled the audience with their poetry till late evening. Over the fortnight, a number of competitions were organized for the institute staff. The winners included Dr Rashmi Srivastava and Dr Rajni Tewari (I), Mrs Renu Srivastava and Mrs SS Rathore (II), and Mr TK Mandal and Mr DK Pal (III) for *Antakshari*; Mr Ram Ujagar (I), Mr Deepak Pandey (II), and Mr Ajay K. Srivastava (III) for *typing*; Mr TK Mandal (I), Mr DK Pal (II), and Mr Subodh Kumar (III) for *Essay Writing*; and Mr Avinesh Srivastava and Mr Pushpendra Misra (I), Mr TK Mandal (II), and Dr Neerja Jha, Mr DK Pal and Mr Avinash Srivastava (III) for *Spot the Error*. In the *Quiz*, the teams comprising of Dr A Rajanikanth, Dr Rajni Tewari and Ms Anupam Jain (I), Dr Rakesh Saxena, Mr EG Khare and Shri Deepak Pandeya (II); Dr RR Yadav, Dr SK



Participants of 'Kavi Sammelan' held on 15<sup>th</sup> September, 2004.



Bera and Mr Avinash Srivastava (III) bagged the prizes. On the concluding Day, a *debate competition* was held and the winners were Dr Neerja Jha (I), Dr RK Saxena (II) and Mr KC Chandola (III). A special prize as the best non-Hindi speaking participant was announced for Dr A Rajanikanth. The Chief Guest on the occasion was Dr RN Lakhpal, a former Distinguished Scientist of BSIP. Dr MB Bande, another former BSIP scientist, also spoke on the occasion. Dr Jayasri Banerji chaired the concluding session.

### Hindi Protsahan Puraskar

On the Founders' Day, Prof. JS Singh, Chairman GB, gave away cash prizes to encourage the use of Hindi. Dr CM Nautiyal and Mr RB Kukreti received first prizes. The second prizes went to Dr DC Saini, Mr RL Mehra and Mr RK Kapoor. The third prizes were given to Dr Jyotsana Rai, Mr SK Singh, Mrs SS Rathore, Mr MM Misra and Mr Ram Ujagar.

### Miscellaneous

Several office-forms and letters were translated/made bi-lingual leading to increased use of Hindi in official correspondence. A noticeable improvement has also been seen in internal correspondence in Hindi. The process to procure Hindi software for Institute's computers was initiated so that computers become bi-lingual in accordance with official directive. Equivalent terms for administrative terms were displayed on the notice board.

Rita Banerji (III). In the 'Hindi Essay competition' held on September 22nd and judged by Dr. Archana Tripathi and Dr. S.K.M. Tripathi, winners were Mr. T.K. Mandal (I), Dr. (Mrs) Navita Budhraja (II) and Mrs. Anjali Trivedi (III). On 23rd September, 'Hindi

typing competition', judged by Dr. Mukund Sharma and Mrs. Nirmala, and judged Mr. Umesh Kumar, Mr. Hari Lal and Ms. Chitra Chatterji as I, II and III prize winners respectively. In the 'Spot the Error competition' held on September 24th, Dr. (Mrs) Navita Budhraja, Mr. T.K. Mandal and Dr. Mukund Sharma won I, II and III prizes respectively. In various competitions, participation and performance of even those belonging to non-Hindi speaking regions was a highlight.

Prof. H.L. Nigam, former Vice-Chancellor, APS University, Reewan delivered his speech as a Chief Guest during the Valedictory function on 30th September. His thoughts on 'Scope of Science Writing in Hindi' were very well received by the audience. The programme was chaired by Dr. Jayasri Banerji. This was followed by release of the bi-lingual Telephone Directory of the Institute. Registrar Mr. S.C. Bajpai proposed the Vote of Thanks.



## The Staff

### Director

Dr. Naresh C. Mehrotra (w.e.f. 01.03.2005)

### Scientists

(The names are in alphabetical order according to 'surnames')

#### Scientist 'F'

Dr (Ms) Jayasri Banerji (Officiating Director,  
up to 28.02.2005)  
Dr Anil Chandra (retired w.e.f. 31.12.2004)  
Dr Rahul Garg  
Dr Ramesh K. Saxena  
Dr Manoj Shukla  
Dr Ashwini K. Srivastava  
Dr Gajendra P. Srivastava (retired w.e.f.  
30.09.2004)  
Dr (Mrs) Archana Tripathi

#### Scientist 'E'

Dr Anil Agarwal  
Dr (Mrs) Usha Bajpai  
Dr Jaswant S. Guleria  
Dr (Mrs) Neerja Jha  
Dr (Mrs) Asha Khandelwal  
Dr Jagannath P. Mandal  
Dr Basant K. Misra  
Dr Mulagalapalli R. Rao  
Dr Samir Sarkar  
Dr Rama S. Singh  
Dr S.K.M. Tripathi  
Dr Ram R. Yadav  
Dr (Ms) Vijaya

#### Scientist 'D'

Dr Rupendra Babu  
Dr Samir K. Bera  
Dr Amalava Bhattacharyya  
Dr Anant P. Bhattacharyya (expired on  
21.06.2004)  
Dr Mohan S. Chauhan  
Dr (Ms) Asha Gupta  
Dr Brajendra N. Jana  
Dr Khowaja Ateequzzaman  
Dr Madhav Kumar  
Dr Bhagwan D. Mandaokar  
Dr Kindu L. Meena

Dr Rakesh C. Mehrotra  
Dr Chandra M. Nautiyal  
Dr (Mrs) Neeru Prakash

Dr Mahesh Prasad  
Dr (Mrs) Jyotsana Rai  
Dr Annamraju Rajanikanth  
Dr Ram Avatar  
Dr Dinesh C. Saini  
Dr Omprakash S. Sarate  
Dr Rakesh Saxena  
Dr Mukund Sharma  
Dr (Mrs) Alpana Singh  
Dr Bhagwan D. Singh  
Dr Kamal J. Singh  
Dr (Mrs) Chanchala Srivastava  
Dr (Mrs) Rashmi Srivastava  
Dr Shyam C. Srivastava (dismissed w.e.f.  
23.03.2005 F.N.)

Dr (Mrs) Rajni Tewari  
Dr Gyanendra K. Trivedi

#### Scientist 'C'

Dr Supriya Chakraborty  
Dr (Mrs) Anjum Farooqui  
Dr Amit K. Ghosh  
Dr (Mrs) Vandana Prasad  
Dr Anupam Sharma  
Dr Rajeev Upadhyay (resigned w.e.f.  
19.07.2004)

#### Scientist 'A'

Dr (Mrs) Binita Phartiyal  
Dr Anil K. Pokharia

#### Emeritus Scientist

Dr (Mrs) Chhaya Sharma

#### Birbal Sahni Research Scholar

Sri Himanshu D. Dwivedi  
Ms Ruby Ghosh  
Sri Bikash Gogoi  
Ms Shruti Mishra  
Sri Om Prakash  
Ms Aradhana Singh



## Technical Personnel

### Technical Officer 'D'

Dr B. Sekar

### Technical Officer 'C'

Sri P.K. Bajpai

Dr (Mrs) Madhabi Chakraborty

Mrs Indra Goel

Mrs Asha Guleria

Sri P.S. Katiyar

Dr E.G. Khare

Sri T.K. Mandal

Sri V.K. Singh

### Technical Officer 'B'

Mrs Reeta Banerjee

Mrs Sunita Khanna

Mrs Kavita Kumar

Sri Chandra Pal

Sri Prem Prakash

Sri V.P. Singh

Sri Y.P. Singh

Sri Avinesh K. Srivastava

### Technical Officer 'A'

Sri Madhukar Arvind

Sri Subodh Kumar

Sri R.L. Mehra

Sri R.C. Mishra

Sri Pradeep Mohan

Sri V.K. Nigam

Sri Keshav Ram

### Technical Assistant 'E'

Sri Chandra Bali

Sri A.K. Ghosh

Sri V.S. Panwar

Sri S.R. Yadav

### Technical Assistant 'D'

Sri Syed R. Ali

Sri D.S. Bisht

Dr Shreerup Goswami (resigned w.e.f. 25.06.2004)

Sri D.K. Pal

Sri S. Suresh K. Pillai

Sri Dhirendra Sharma

Sri Madhavendra Singh

Sri S.K. Singh

Sri Raj K. Tantua (on lien w.e.f. 04.03.2005 for 2 years)

Sri S.M. Vethanayagam

### Technical Assistant 'C'

Sri C.L. Verma

### Technical Assistant 'B'

Sri Avanish Kumar

Sri M.S. Rana

Sri S.C. Singh

Sri Ajay K. Srivastava

### Technical Assistant 'A'

Sri Pawan Kumar

Sri Saurabh Pradhan (resigned w.e.f. 16.09.2004)

Sri Om Prakash

## Sponsored Project Personnel

Dr Ratan Kar, Project Investigator

Dr (Mrs) Navita Budhraja, Research Associate (tenure ended w.e.f. 31.07.2004)

Sri Jayendra Singh, Research Associate (resigned w.e.f. 25.08.2004)

Sri Santosh K. Shah, SRF

Ms Debi Dutta, SRF (tenure ended w.e.f. 28.02.2005)

Sri Rajesh Chaturvedi, JRF (resigned w.e.f. 25.06.2004)

Mrs Babita Singh, JRF (resigned w.e.f. 30.09.2004)

Mrs Mani Sharma, JRF (resigned w.e.f. 17.01.2005)

Ms Bhasha Dubey, JRF (tenure ended w.e.f. 30.09.2004)

Ms Nisha Chandra, Research Assistant (tenure ended w.e.f. 23.09.2004)

## Administrative Personnel

**Registrar:** Sri Suresh C. Bajpai

**Accounts Officer:** Sri R.K. Takru

**Maintenance Officer:** Sri R.B. Kukreti (retired w.e.f. 31.03.2005)

### Section Officer

Sri I.J.S. Bedi

Sri R.K. Kapoor (Officiating)

Sri I.J. Mehra



Mrs V. Nirmala

**Private Secretary:** Mrs M. Jagath Janani

**Accountant:** Sri Dhoom Singh (Officiating)

**Assistant**

Mrs Ruchita Bose

Mrs Usha Chandra

Sri Hari Lal

Mrs Swapna Mazumdar (Officiating)

Sri K.P. Singh (Officiating)

Sri Koshy Thomas (Officiating)

Mrs P. Thomas

**Stenographer:** Sri M. Pillai

**Upper Division Clerk**

Ms Chitra Chatterjee (Officiating)

Sri Mishri Lal

Sri S.S. Panwar

Sri Rameshwar Prasad (Officiating)

Mrs Shail S. Rathore

Sri Gopal Singh

Sri Avinash K. Srivastava

Mrs Renu Srivastava

Sri N. Unnikannan

**Lower Division Clerk**

Sri Akhil Antal

**Driver**

Sri Nafees Ahmed ('III')

Sri D.K. Mishra ('II')

Sri M.M. Mishra ('II')

Sri V.P. Singh ('II')

Sri P.K. Mishra ('I')

**Class 'D' Personnel**

**Attendant 'IV' (Technical)**

Sri K.C. Chandola

**Attendant 'III'**

Sri Haradhan Mohanti

Sri Kesho Ram

Sri Prem Chandra

Sri Ram Deen

Sri Ram Kishan

Sri Ram Singh

**Attendant 'II'**

Mrs Maya Devi

Mrs Munni

Sri Kailash Nath

Sri Mani Lal Pal

Sri Mohammad Shakil

Sri Shri Ram

Sri Bam Singh

Sri Kedar Nath Yadav

**Attendant 'I'**

Sri R.K. Awasthi

Sri K.K. Bajpai

Mrs Beena

Sri Deepak Kumar

Sri Vishwanath S. Gaikwad

Sri Hari Kishan

Sri Inder Kumar

Sri Dhan B. Kunwar

Sri Subhash C. Mishra

Ms Nandani

Sri Ram Dheeraj

Mrs Ram Kali

Sri Ram Ujagar

Sri Ramesh Kumar

**Mali**

Sri Rameshwar Prasad Pal ('III')

Sri Ram Chander ('I')

Sri Ram Kewal ('I')

Sri Mathura Prasad ('I')



## Appointments and Promotions

### Appointments

Dr Naresh Chandra Mehrotra, Director w.e.f. 01.03.2005.

Dr Shantanu Chatterjee, Research Associate (under Emeritus Scientist) w.e.f. 11.06.2004.

Mrs Mani Sharma, Junior Research Fellow w.e.f. 11.06.2004.

Sri Krishna Gopal Mishra, Junior Research Fellow w.e.f. 01.11.2004.

Miss Divya Srivastava, Junior Research Fellow w.e.f. 12.01.2005.

Miss Vartika Singh, Junior Research Fellow w.e.f. 14.02.2005.

Miss Jyoti Sharma, Junior Research Fellow w.e.f. 23.02.2005.

Sri Jagdish Prasad, Field Assistant w.e.f. 29.10.2004

### Promotions

Dr Ashwini K. Srivastava, Scientist 'F' w.e.f. 01.04.2002.

Dr (Mrs) Usha Bajpai, Scientist 'E' w.e.f. 01.04.2002.

Dr (Mrs) Neerja Jha, Scientist 'E' w.e.f. 01.04.2002.

Dr (Mrs) Asha Khandelwal, Scientist 'E' w.e.f. 01.04.2002.

Dr Basant K. Misra, Scientist 'E' w.e.f. 01.04.2002.

Dr Mulagalapalli R. Rao, Scientist 'E' w.e.f. 01.04.2002.

Dr Samir Sarkar, Scientist 'E' w.e.f. 01.04.2002.

Dr Ram R. Yadav, Scientist 'E' w.e.f. 01.04.2002.

Dr Rupendra Babu, Scientist 'D' w.e.f. 01.04.2002.

Dr Anant P. Bhattacharyya, Scientist 'D' w.e.f. 01.04.2002.

Dr Mohan S. Chauhan, Scientist 'D' w.e.f. 01.04.2002.

Dr (Ms) Asha Gupta, Scientist 'D' w.e.f. 01.04.2002.

Dr Khowaja Ateequzzaman, Scientist 'D' w.e.f. 01.04.2002.

Dr (Mrs) Jyotsana Rai, Scientist 'D' w.e.f. 01.04.2002.

Dr (Mrs) Alpana Singh, Scientist 'D' w.e.f. 01.04.2002.

Dr Bhagwan D. Singh, Scientist 'D' w.e.f. 01.04.2002.

Dr (Mrs) Rashmi Srivastava, Scientist 'D' w.e.f. 01.04.2002.

Dr (Mrs) Rajni Tewari, Scientist 'D' w.e.f. 01.04.2002.

Dr (Mrs) Anjum Farooqui, Scientist 'C' w.e.f. 01.04.2002.

Dr Amit K. Ghosh, Scientist 'C' w.e.f. 01.04.2002.

Dr Gajendra P. Srivastava, Scientist 'F' w.e.f. 01.04.2003.

Dr Rama S. Singh, Scientist 'E' w.e.f. 01.04.2003.

Dr S.K.M. Tripathi, Scientist 'E' w.e.f. 01.04.2003.

Dr Bhagwan D. Mandaokar, Scientist 'D' w.e.f. 01.04.2003.

Dr (Mrs) Neeru Prakash, Scientist 'D' w.e.f. 01.04.2003.

Dr Rahul Garg, Scientist 'F' w.e.f. 01.04.2004.

Dr Ramesh K. Saxena, Scientist 'F' w.e.f. 01.04.2004.

Dr Manoj Shukla, Scientist 'F' w.e.f. 01.04.2004.

Dr (Mrs) Archana Tripathi, Scientist 'F' w.e.f. 01.04.2004.

Dr Anil Agarwal, Scientist 'E' w.e.f. 01.04.2004.

Dr Kindu L. Meena, Scientist 'D' w.e.f. 01.04.2004.

Dr Gyanendra K. Trivedi, Scientist 'D' w.e.f. 01.04.2004.

Dr (Mrs) Madhabi Chakraborty, Technical Officer 'C' w.e.f. 01.04.2002.

Mrs Asha Guleria, Technical Officer 'C' w.e.f. 01.04.2002.

Sri T.K. Mandal, Technical Officer 'C' w.e.f. 01.04.2002.

Mrs Sunita Khanna, Technical Officer 'B' w.e.f. 01.04.2002.

Sri R.L. Mehra, Technical Officer 'A' w.e.f. 01.04.2002.

Sri V.K. Singh, Technical Officer 'C' w.e.f. 01.04.2003.

Sri V.K. Nigam, Technical Officer 'A' w.e.f. 01.04.2003.

Sri Keshav Ram, Technical Officer 'A' w.e.f. 01.04.2003.

Dr E.G. Khare, Technical Officer 'C' w.e.f. 01.04.2004.

Sri P.S. Katiyar, Technical Officer 'C' w.e.f. 01.04.2004.

Mrs Reeta Banerjee, Technical Officer 'B' w.e.f. 01.04.2004.

Mrs Kavita Kumar, Technical Officer 'B' w.e.f. 01.04.2004.

Sri Chandra Pal, Technical Officer 'B' w.e.f. 01.04.2004.

Sri V.P. Singh, Technical Officer 'B' w.e.f. 01.04.2004.

Sri Avinesh K. Srivastava, Technical Officer 'B' w.e.f. 01.04.2004.

Sri S.R. Yadav, Technical Assistant 'E' w.e.f. 01.04.2003.

Sri Chandra Bali, Technical Assistant 'E' w.e.f. 01.04.2004.



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Institute staff rendering *Saraswati Vandana* during Founder's Day Function



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## AUDIT REPORT

### to the Governing Body of the Birbal Sahni Institute of Palaeobotany 53 University Road, Lucknow

We have audited the attached Balance Sheet of Birbal Sahni Institute of Palaeobotany, Lucknow, as at 31st March 2005 and also the Income & Expenditure account and Receipt & Payment account for the year ended on that date annexed thereto. These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with auditing standards generally accepted in India. Those Standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statement. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

Further to our comments in the Annexure "A" attached, we report that:

- (i) We have obtained all the information and explanation, which to the best of our knowledge and belief were necessary for the purpose of our audit;
- (ii) In our opinion, proper books of account as required by law have been kept by the Institute so far as appears from our examination of those books;
- (iii) The Balance Sheet and Income & Expenditure account and Receipt & Payment account dealt with by this report are in agreement with the books of account;
- (iv) In our opinion and to the best of our information and according to the explanations given to us, the said accounts give the information required, in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India;
  
- a) In case of the Balance Sheet, of the state of affairs of the Institute as at 31st March, 2005;
- b) In the case of the Income & Expenditure account, of the surplus/deficit for the year ended on the date, and
- c) In the case of Receipt & Payment account, of the receipts & payments of the Institute for the year ended on that date.

Date : 25.08.2005

Place : Lucknow

*For Singh Agarwal & Associates  
Chartered Accountants*

Sd/-  
Mukesh K. Agarwal  
FCA, DISA(ICA)  
(Partner)

**ANNEXURE - 'A'**

(Annexed to and forming part of the Audit Report for the year ended 31st March, 2005)

**Comments/Audit observations on accounts of Birbal Sahni Institute of Palaeobotany- Lucknow for the year ended 31<sup>st</sup> March, 2005**

Comments/Observations by the Chartered Accountants	Action taken by the Institute	
<b>ACCOUNTS</b>		
1. The Institute is getting separate grants for Plan and Non-Plan expenses based on the budgets approved by the DST. During the year under report, the Governing Body has approved on 21.03.2005 in its meeting to use Plan head for Salary instead of Non-Plan Budget.	As per the approval of GB, the Salary and Allowances component of those Scientific and Technical staff members who are working under the X Five Year Plan Projects were charged from Plan Head instead of Non-Plan during the year 2004-05.	
2. Advances (capital head) unsettled and pending for recovery/adjustment as on 31.03.2005 under different heads, since long, are to be properly taken care of at the Institute level for early adjustment. Details of which are as under:	The advance has already been settled on 27.06.2005. The efforts are being undertaken to settle the advances as soon as possible.	
<b>Date</b>	<b>Particulars</b>	
	<b>Amount</b>	
<b>a) Research Apparatus &amp; Equipment</b>		
2003-04	Olympus Singapore	272200.00
<b>b) Books &amp; Journal</b>		
1983-84	Handbook of Calcareous Algae (Vol-7)	878.00
2000-01		1681.44
2001-02		8238.23
2002-03		18307.91
<b>c) CNR</b>		
2003-04	Exe.Engineer Lucknow (for shifting of transformer)	562789.00
1999-00	Air conditioning	17799.00

3. Institute Authorities are advised to be more cautious

At present, most of the Pensioners are within the zero



### Comments/Observations by the Chartered Accountants

in calculating and deducting tax at source on Pension payments:

4. The Institute should adopt double entry system of accounting for more effective and meaningful maintenance of accounting records. It will also help proper accounting records comparable with standards applicable in India.

### LIBRARY

5. As per the Bye Laws/Rules of the Institute the Physical Verification of the Library is to be carried out at an interval of 2 years. Verification for the year 2004-05 has become due but discrepancies mentioned in the year 2002-03 are yet to be taken up for eventual rectification.

### PUBLICATION

6. On scrutiny of records of the priced publication of the Institute, it has been observed that during last several years, the Institute had brought out publications on different subjects with an objective to sell out the same, in the market. The stock position of these priced publications as on 31.03.05 was Rs.43.25 Lacs apart from the reserved stock of Rs.6.68 Lacs. Thus, the total stock of the publications stood at Rs.49.93 Lacs at the close of the year, which seems to be on higher side. A practical assessment has to be made for the quantity to be got printed together with its economics etc. so that wastage and blockage of funds can be avoided.

The Institute authorities are expected to make it certain that wasteful avoidable expenses on any account is avoided by effective assessment.

### Action taken by the Institute

income tax limit. The Pensioners above income tax limit have submitted documentary proofs of various income tax saving schemes to save income tax and hence tax deducted at source has been regulated accordingly.

Efforts are under way for the Institute to adopt double entry system of accounting.

Physical verification of Library for 2002-03 has been completed and report has been submitted. 33 publications/books are still missing and efforts are being made to trace them.

Physical verification of Library for 2004-05 is in process.

The F&B Committee during its meeting held on October 26, 2004 has recommended that the prized publications published before 2000 be given to Institutions/Universities for Institutional/ Library use free of cost on request. Accordingly, advertisement has been hosted in our Institute's Website and advertisement has been given in the Current Science. Some requests from different Universities have already been received. The GB during its meeting held on September 09, 2005 has decided to introduce a special five years subscription offer of the Journal 'The Palaeobotanist' and has advised that letters be written to Heads of Departments of Botany and Geology of different Universities informing them of various Schemes available to individual and institutional subscribers.

Identification of marketing agency willing to purchase the unsold publications on the Institute's terms and conditions is also being looked into.



<b>Comments/Observations by the Chartered Accountants</b>	<b>Action taken by the Institute</b>
<b>STORES</b>	
<p>7. The Fixed Assets Register and Stores Register are being maintained properly. Physical verification was to be carried out during the year under audit. As per Office Memorandum dated 05.09.2003 a Committee was constituted for the purpose but no progress in this regard has been noticed. It has been informed to us that the job of physical verification is still continuing and will be completed soon. Effective and timely conduct of physical verification should be the prime concern of the said Committee to make exercise fruitful.</p>	<p>As per Memorandum No.316 dated 11.07.2003, 9 Officers were deputed for physical verification of different stores/ sections. 6 Officers who could not submit the reports were again issued a reminder on 05.09.2003 for completion of the physical verification of different stores. Out of above, 5 Officers have submitted their reports. Only one report of Workshop is still awaited.</p>
<b>RESERVE FUND AND PENSION FUND</b>	
<p>8. Reserve Fund &amp; Pension Fund amounting to Rs. 76.61 Lacs and Rs.156.42 Lacs do not represent investments of matching amounts. Shortfall of Rs. 32.94 Lacs and Rs.69.40 Lacs respectively have not been invested as on 31.03.2005.</p>	<p>Physical verification of different stores/ sections for the year 2004-05 is under process.</p>
<b>EMPLOYEES PROVIDENT FUND</b>	
<p>9. As against the total reserves of Rs.387.52 Lacs against the Employees Provident Fund as on 31.03.2005, nothing was invested during the year. Interest on investment in bonds of M P Electricity Board amounting to Rs.20.00 Lacs has neither been received nor accounted for on accrual basis. Only Rs.69814/- received in the year 2000-01 has been accounted for. As reported, Rs.7,30,398/- has been received in the year 2005-06 and balance will be received on instalment basis. Incomes accrued on investments made with other bodies are also not accounted for on accrual basis.</p>	<p>Rs.69.39 Lacs have already been invested from Pension Fund and Rs. 66.6 Lacs have been invested from Reserve Fund.</p> <p>Rs.75.00 Lacs have already been invested in the current financial year 2005-06.</p> <p>Now, we have received Rs.775658/- from M P Electricity Board as interest on our investment of Rs.20 Lacs during the current financial year 2005-06. We maintain our GPF account on actual cash basis.</p>
<b>OTHERS</b>	
<p>10. The Institute had given a portion of their building to Indian Overseas Bank for opening one extension counter over there during June 1997 but till date no agreement has been entered into with them and no rent is being recovered. The Institute informed us</p>	<p>We are realising the electricity bill w.e.f. 01.09.2003 from the IOB Extension Counter as per approval of the GB.</p>



### Comments/Observations by the Chartered Accountants

that an understanding regarding agreement has been made except on some issues. Institute authorities are advised to take effective steps for early realisation of rent.

Date : 25.08.2004

Place : Lucknow

### For Singh Agarwal & Associates

*Chartered Accountants*

Sd/-

Mukesh K. Agarwal  
(Partner)

  
R.K. Takru  
(Accounts Officer)

### Action taken by the Institute

All the conditions of the agreement have been finalised and the agreement is to be signed soon and the realisation of rent is to be started with the recovery of rent from 01.09.2003. as per approval of the GB. the mutual consent basis after expiry the initial agreement.

  
S.C. Bajpai  
(Registrar)

  
Naresh C. Mehrotra  
(Director)



## Birbal Sahni Institute of Palaeobotany, Lucknow

### Balance Sheet as at March 31, 2005

Fig. in Rupees

CORPUS/CAPITAL FUND AND LIABILITIES	Schedule	Current Year	Previous Year
Corpus/Capital Fund	1	136281941.00	133345867.00
Reserves and Surplus	2	7262615.00	5883705.00
Earmarked/Endowment Funds	3	55284209.00	48273674.00
Secured Loans and Borrowings	4	0.00	0.00
Unsecured Loans and Borrowings	5	0.00	0.00
Deferred Credit Liabilities	6	0.00	0.00
Current Liabilities and Provisions	7	89584.00	106352.00
<b>TOTAL</b>		<b>198918349.00</b>	<b>187609598.00</b>
<b>ASSETS</b>			
Fixed Assets	8	116476138.00	105865179.00
Investments-from Earmarked/ Endowment Funds	9	54638987.00	47628452.00
Investments-others	10	7660785.00	6066910.00
Current Assets, Loans, Advances, etc.	11	20142439.00	28049057.00
Miscellaneous Expenditure (to the extent not written off or adjusted)		0.00	0.00
<b>TOTAL</b>		<b>198918349.00</b>	<b>187609598.00</b>
Significant Accounting Policies	24		
Contingent Liabilities and Notes	25		
On Accounts			

**CERTIFICATE**

Certified that the figures of Assets as shown in the Balance Sheet have been reconciled with the total figure of Assets shown in the relevant Registers of the Institute.

For Singh Agarwal & Associates  
Chartered Accountants  
Sd/-  
Mukesh K. Agarwal  
(Partner)

  
R.K. Takru  
(Accounts Officer)

  
S.C. Bajpai  
(Registrar)

  
Naresh C. Mehrotra  
(Director)

**Birbal Sahni Institute of Palaeobotany, Lucknow**  
**Income and Expenditure Account for the year ending March 31, 2005**

Fig. in Rupees

Annual Report 2004-2005

INCOME	Schedule	Current Year	Previous Year
Income from Sales/Services	12	689180.00	345292.00
Grants/subsidies (OB, Deposit A/C and Transfer from Cap. Fund)	13	6080000.00	61595000.00
Fees/Subscriptions	14	0.00	0.00
Income from Investments (Income on Invest. from Earmarked/Endow. Funds transferred to Funds)	15	241965.00	183205.00
Income from Royalty, Publication, etc.	16	107240.00	210001.00
Interest Earned	17	736617.00	352972.00
Other Income	18	329346.00	122957.00
Increase/(decrease) in stock of Finished goods and works-in-progress	19	0.00	0.00
<b>TOTAL(A)</b>		<b>62877348.00</b>	<b>62809427.00</b>
<b>EXPENDITURE</b>			
Establishment Expenses	20	44210479.00	39917868.00
Other Administrative Expenses, etc.	21	12241885.00	12259680.00
Expenditure on Grants, Subsidies, etc.	22	0.00	0.00
Interest	23	0.00	0.00
Depreciation (Net Total at the year-end-corresponding to Schedule 8)		0.00	0.00
<b>TOTAL (B)</b>		<b>56452364.00</b>	<b>52177548.00</b>
Balance being excess of Income over Expenditure (A-B)		6424984.00	10631879.00
Transfer to Special Reserve (specify each)		1378910.00	1700000.00
Transfer to/from General Reserve to Pension Fund		2110000.00	4660000.00
<b>BALANCE BEING SURPLUS/DEFICIT CARRIED TO CORRUS/CAPITAL FUND</b>		<b>2936074.00</b>	<b>4271879.00</b>
Significant Accounting Policies	24	0.00	0.00
Contingent Liabilities and Notes On Accounts	25	0.00	0.00

N.C. Mukherjee



Naresh C. Mehrotra  
*(Director)*



R.K. Takru  
*(Accounts Officer)*

For Singh Agarwal & Associates  
*Chartered Accountants*  
 Sd/-  
 Mukesh K. Agarwal, (Partner)





Birbal Sahni Institute of Palaeobotany

## Receipts and Payments Account for the year ended March 31, 2005

Fig. in Rupees

RECEIPT Current Year	Previous Year	PAYMENTS	
		Current Year	Previous Year
I. Opening Balances			
a) Cash in hand	2.58	3.2	
b) Bank Balances			
i) In current accounts			44210479
ii) In deposit accounts			12241885
iii) Endowment deposits	0	0	
II. Grants Received			
a) From Government of India			
b) From State Government			
c) From other sources(details)			
(Grant for capital & revenue exp. To be shown separately)			
d) Deposit Account	0	0	
III. Income on Investment from			
a) Earmarked/Endow. Funds	2032	0	
b) Own Funds (Utilized)		0	
IV. Interest Received			
a) On Bank deposits	434390	8733	
b) Loans, Advances etc.	302227	36986	
		307253	
V. Other Income (Specify)			
i) Sale proceeds of Publications	107240	210001	
ii) Miscellaneous Income	255849	108378	
iii) Sale of Services (Consultancy)	689180	345292	
VI. Amount Borrowed		0	
VII. Any other receipts (give details)			
(Pension Contribution)	69425	14579	
VIII. Closing Balances			
i) Earnest Money Deposit	1684311	1411718	
ii) FDR Matured	0	31948	
iii) FDR Maturity	0	0	
IX. Other Payments (Specify)			
i) Advances to Staff			
ii) Earnest Money Refunded			
iii) Advances to Parties			
iv) Advances to Parties			
v) Excess Expenditure			
TOTAL	74107071	79211567	TOTAL
			79211565
For: Singh Agarwal & Associates Chartered Accountants Sd/- Mukesh K. Agarwal (Partner)			
N.C. Bajpai R.K. Taku (Accounts Officer)			
S.C. Bajpai (Registrar)			
Naresh C. Mehrotra (Director)			