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Varanasi 221 005

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Technology Bhavan  
New Mehrauli Road  
New Delhi 110 016

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Dept. Ocean Development (Gov. of India)  
N – 1/A, 'Manjusha',  
Kakatiya Nagar  
Habsiguda  
Hyderabad 500 007

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Department of Botany  
University of Allahabad  
Allahabad 211 002

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Punjab University  
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Panchkula 134 109

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Lucknow University  
Lucknow 226 007

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27, Jawaharlal Nehru Road  
Kolkata 700 016

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Botanical Survey of India  
5<sup>th</sup> Floor, MS Building  
'F' Block, CGO Complex  
DF Block, Sector 1  
Kolkata 700 064

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Lucknow 226 007

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Lucknow 226 007

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Former Professor of Botany  
Department of Botany,  
University of Allahabad,  
Allahabad 211 002

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Lucknow 226 007

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H – 44B, Saket  
New Delhi 110 017

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Kathmandi  
Narnaul 123 001

#### **Professor A.K. Singhvi**

Planetary and Geosciences Division  
Physical Research Laboratory  
Navrangpura  
Ahmedabad 380 009

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49 D, Townshend Road  
Bhawanipur  
Kolkata 700 025

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Emeritus Professor  
Dept. of Botany, P.G. College of Science  
Osmania University, Saifabad,  
Hyderabad 500 004

#### **Professor P.K. Khare**

Department of Botany  
Allahabad University  
Allahabad 211 002

#### **Dr. R.R. Rao**

Director Grade Scientist  
CIMAP Research Station  
Allalassandra, GKVK Post Office  
Bangalore 560 065

#### **Dr. Debabrata Ray** (up to 27.6.2005)

#### **Dr. D.M. Kale**

Group General Manager - Head  
KDM Institute of Petroleum Exploration  
9, Kaulagarh Road  
Dehradun 248 195

#### **Professor D.M. Banerji**

Department of Geology  
Delhi University  
Delhi 110 007

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Geological Survey of India  
Northern Region, Sector- E, Aliganj  
Lucknow 226 020

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Birbal Sahni Institute of Palaeobotany  
Lucknow 226 007

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or his Nominee,  
Department of Science and Technology,  
New Delhi 110 016

#### **Professor M.P. Singh**

Member, Governing Body  
Birbal Sahni Institute of Palaeobotany  
Lucknow 226 007

#### **Shri V.P. Garg**

71, Mall Avenue  
Avas Vikas Colony  
Lucknow 226 001

### *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

## Foundation Day

The Institute celebrated its 59<sup>th</sup> Foundation Day on September 10, 2005. On this occasion Shri V.K. Sibal, Director General, Directorate General of Hydrocarbons, New Delhi, delivered '9<sup>th</sup> Jubilee Commemoration Lecture' on the topic "Knowledge Sharing: An opportunity for brighter Future".

On the same evening, Guest of Honour Sri Ravi Shanker, Retired Director General, Geological Survey of India delivered

a popular lecture in Hindi on *Paryavaran Pradooshan Prabandhan- ek Bhuvaigyanic Pariprekshya (Environment Management-A Geological Perspective)* to mark the beginning of **Hindi Pakhwara**.

Professor M.P. Singh, Member Governing Body presided over the function. Many guests and scientists from outside the Institute attended the function.



## Founders' Day

The Founder's Day was celebrated on November 14, 2005. The Institute's staff and distinguished guests from other organizations offered *Pushpanjali* on the *Samadhi* of the Founder Professor Birbal Sahni. Same day in the evening two memorial lectures were organized.

Dr. P.S. Goel, Secretary, Department of Ocean Development, Govt. of India, New Delhi delivered the '**51<sup>st</sup> Sir Albert Charles Seward Memorial Lecture**' entitled "*Excitement of Oceans*".

Dr. S.R. Shetye, Director, National Institute of Oceanography, Goa delivered the '**35<sup>th</sup> Birbal Sahni Memorial Lecture**' on the topic "*Role of Ocean Processes in defining the Indian Summer Monsoon*".

Professor M.P. Singh, Member, Governing Body of the Institute presided over the function. Several guests and scientists from outside the Institute attended the occasion.



## Diamond Jubilee National Conference

The Diamond Jubilee National Conference on *Challenges in Indian Palaeobiology— Current Status, Recent Developments and Future Directions* was organized at the Institute during November 15-16, 2005 in continuum of Founders' Day programme. This conference is a result of the concern expressed by several Palaeobotanists and Paleontologists on the future of our discipline in the light of diminishing perception of the relevance and usefulness of this science and also the consequent drastic reduction in the scope of the discipline as taught at graduate and undergraduate levels.

The Conference was inaugurated by Dr. Harsh K. Gupta, Former Secretary, DOD, Govt. of India. More than 100 Palaeobiologists representing 34 organizations of Research Institutions (WIHG, Dehradun; NIO, Goa; Agarkar Research Institute, Pune; French Institute, Pondicherry; ISI, Kolkata, etc.), Universities (BHU; Delhi University; Allahabad University; Punjab University; Osmania University, Hyderabad; Lucknow University; IIT Roorkee and Kanpur, etc.), Industry (ONGC, OIL, etc), and Professional organizations and Societies (BSI; GSI; Geological Society of India, Bangalore; Petrotech Society; Palaeontological Society of India, Lucknow; Palaeobotanical Society of India, Lucknow; etc.) took part in intense discussions under 15 sessions on 7 different themes on strength, gaps and weaknesses of the subject.

The different sessions were chaired by. Prof. C. Manoharachary (Hyderabad), Dr. K.R. Gupta (New Delhi), Prof. G.V. Patil (Nagpur), Prof. D.R. Misra (Allahabad), Dr. K. Ayyasami (Hyderabad), Prof. G.K. Srivastava (Allahabad), Prof. Ashok Sahni (Chandigarh), Prof. Asru Chowdhry (Kolkata), Dr. Rajeev Nigam (Goa), Prof. S.K. Tandon (Delhi), Sri Ravi Sanker (Lucknow), Dr. R.R. Rao (Bangalore), Sri Kuldeep Chandra (Dehradun), Dr. V.N. Singh (Chandigarh) and Prof. C.L. Verma (Lucknow). Institute's scientists— Drs. CM Nautiyal, Usha Bajpai, SKM Tripathi, RC Mehrotra, A Rajanikanth, DC Saini, Mukund Sharma, KJ Singh, Alpna Singh, Rajni Tewari, Anjum Farooqui, AK Gosh and Binita Phartiyal acted as Reporters for different technical sessions. Various deliberations charted out new dimensions for studies, involving multidisciplinary and multi-institutional approach with co-operation from within and outside the country to make it more relevant to societal needs.

Following are the salient recommendations emerged from various technical sessions:

### **Theme-I: Emerging trends in Palaeobiology**

- 1 India should participate in the frontier area of research in the field of early signature of chemical evolution of origins of life and traces of early life on earth. Studies on the Astropalaeobiology should be provided the required instrumental support. Precambrian palaeobiological studies hold great promise in the front ranking sciences.
- 1 Fossil fungi are an area of study, which is still untapped and need to be pursued. Their discovery and reports will attract attention at global level and help understand their role in evolution. BSIP can take lead in this area.

- 1 There is an urgent need for climate modeling based on physiognomic characters of leaves and woods of Tertiary fossils. Character-state mapping for understanding the evolution of angiosperms need to be done.
- 1 The emerging trends in Palaeobiology were best reflected in the presentations on palaeoclimate. They emphasized on multi-proxy, multi-parametric approaches should be emphasized with special focus on integration of biological, physical, and geo-chemical parameters and spatial synthesis of proxy data on continent wide scale and its relation to oceanic domain for the most significant Cenozoic climatic events (assessment of the biological and non-biological response system to LPTM events; C3/C4 vegetational dynamics events ~between 6-8 million years; initiation of the cooling trends after permanent Antarctic Ice sheet formation in Middle Miocene *i.e.* 14 Ma onwards).
- 1 Reassessment of the chronological data of the last glacial cycle and selection of record with secure chronological data, and using the latter to assess the inter-regional variability, lag time and exploring the role of feed-backs.
- 1 To generate new data using high resolution records for making a quantitative assessment of millennial scale and century scale variability for the post LGM period.
- 1 To intensify research on mangroves as response systems to linked climate and sea level shifts in the last 20,000 years.
- 1 Modern man has made considerable changes both constructive and destructive in the plant world. The presentation on the history of human impact on plant world emphasized the need to use new aspects of studies including phytoliths, coprolites, AMS dating and palynological studies.

### **Theme-II: Interface of Palaeobiology with other disciplines.**

- 1 Palaeontological studies need a fresh approach involving the tools of other disciplines was clear and loud message of this theme. Newer techniques, viz. computer modeling using latest software to understand the taphonomic problems, need to be used.

### **Theme-III: Integrated approaches to Palaeobiology and Sedimentology**

- 1 Efforts to improve public perception are important for better appreciation of the discipline and its use in finding solutions to societal problems.
- 1 Geology incorporating Palaeobiology should not only be taught at University level but also at the School level be introduced.
- 1 It should be taken up at a larger level and brought to the notice of policy makers. A white paper should be prepared with all the important points and be circulated in Institutions and Universities and State and Central Governments for action. Group of people from different

## Diamond Jubilee National Conference



concerned institutions and universities should be assigned this task.

- 1 New and small States like Uttranchal should be made the first target for these changes and the Chief Minister should be contacted and briefed for the same.
- 1 All the high dignitaries in the field of Geology should extend their help for its implementation.

### **Theme-IV: Traditional Palaeobiology– Current status, recent development and future directions**

- 1 Call for major changes in the style of study. Traditional Palaeobiology should be strengthened along with its

blending with modern computer modeling for determining the plant structure and cladistics. The structural details of fossils plants should be utilized for reconstructing the scenario, vegetation and climates of the different periods.

### **Theme-V: Applied Palaeobiology in Fuel Research**

- 1 The theme highlighted the use of Palynology, Dispersed Organic Matter and Coal Petrology in fossil fuel exploration and emphasized that the existing courses need to be updated and made more relevant to Industrial and Societal needs. There are avenues for collaboration between academic Institution and Industry. Academic expertise available with the institutions can help solve

some of the industrial problems and in turn can become more relevant to the society.

- 1 Postgraduate curriculum should incorporate those aspects of subjects that are needed by the industry. Exchange of experts between Academia and Industry will benefit both and should be encouraged.

**Theme-VI: Outreach and Teaching in Palaeobiology**

- 1 Palaeontology be taught invariably at Undergraduate and Post-Graduate levels and UGC must be approached to revise and restore the syllabi of Palaeontology and Palaeobotany. Early exposure to this subject will help in making it a more popular choice at higher level.
- 1 Museums play important role in dissemination of knowledge to public. The Different Natural History Museums can be requested to incorporate the Palaeobiological inputs in their museums by introducing separate gallery. At the initial stage BSIP, other similar Institutions and individuals pursuing Palaeontological

studies can provide exhibits. Modern approach and Gadgetry can be used for display. In addition virtual museums should be created and put on the web sites. These virtual museums can also be disseminated through CDs. Digitization of the museum's documents and exhibits will be helpful in proper record keeping and dissemination.

- 1 Academic Societies can incorporate a small component of popularization of our discipline in their activities and publication schedule. Popular books on Earth Sciences can engage the young minds towards the science. Recognition for those involved in popularization of Palaeobiology will go a long way in promoting the cause.

**Theme-VII: Biodiversity: Past and Present**

- 1 The inventory of Lower Plants be made with the help of Taxonomists.
- 1 Classical botanical expeditions need to be mounted for recording the diversity rich ecosystem of Himalayas and Western Ghats.

**Dr. B.R. Arora, Director WIHG, Dehradun presided over the valedictory function of the conference.**

**Diamond Jubilee Lecture**

Dr. Harsh K. Gupta, Former Secretary, Department of Ocean Development (Govt. of India) and Member of our Governing Body delivered the **1<sup>st</sup> Diamond Jubilee Lecture** on the topic *The Great December 26, 2004 Tsunami and Indian initiative for early Warning* at the inaugural function of the Diamond Jubilee National Conference on Challenges in Indian Palaeobiology on November 15, 2005.





## National Science Day

Institute celebrated the Science Day function for a week during February 22-28, 2006 with great zeal involving many schools of the city. Three competitions for schools, colleges and degree students were organized, besides participated in 2 exhibitions at Lucknow and Bahadurpur-Jais (Rae Bareli district, UP). The Day (February 28<sup>th</sup>) was declared as open house to the public.

Institute put up a pavilion in a National Exhibition at Bahadurpur-Jais during February 18-22, 2006 following selection and invitation by DST (New Delhi). The exhibition was inaugurated by Honourable Union Minister of State for Science and Technology Sri Kapil Sibbal and Honourable Member of Parliament Sri Rahul Gandhi. The Institute also organized an exhibition of fossils at the premises of the UP Council of Science and Technology, Lucknow during February 27-28, 2006. The exhibition was visited by the Vice-Chairman of the Council Sri Rajendra Chowdhary (Minister of State), Sri PL Loi (Principal Secretary, S&T-UP), Sri Maurya (Secretary, S&T-UP), Sri RN Tripathi (DM, Lucknow), Dr. MJK Siddiqui (Director, UP Council of S&T), and many other dignitaries and a large number of other people.



Sh. Sanjiv Nair, Joint Secretary (DST) and Sh. Navneet Verma, Director (Finance) also at DST being explained the exhibits at the exhibition at Jais (Rae Bareli) on 18th Feb., 2006.

For the students of class IX to XII, an 'essay competition' was organized on the topic *To Nature, Vegetation is more important than Human Beings*. The choice of topic was governed by the present concern for biodiversity and environment. There were 64 entries from 10 schools for the competition. The best 4 essays were selected for prizes. The next event to be held was 'collage competition' on 25<sup>th</sup> February on the topic *Physics in everyday Life* for students of class VI to VIII. The topic was chosen in line with the theme for the

concluding celebrations of Year of Physics. A total of 47 students made collage on the topic displaying their skills, some of which were displayed outside the auditorium on the concluding day. The idea behind choosing such themes was to stimulate them to think and learn science rather than creating just a work of art. A total of 7 students' entries were selected.

On the Science Day, Institute organized a 'speech competition' for degree students on *Nurture Nature for our Future*, the theme for the Day announced by DST. Prizes were declared for 2 entrants. Science-based cartoons by a free-lance cartoonist Sri Sandeep Bisariya were also displayed. This programme was the conclusion of Institute's Science Day



Chief Guest Sh. Y.N. Saxena releasing a book by Dr. S.K.M. Tripathi in presence of the Director, BSIP Dr. N.C. Mehrotra

festivities for the public. The Chief Guest- Sri YN Saxena, Former DGP, who had worked at the Institute in mid 50s, felicitated the prize winners of various competitions held during the past week. In his address, Sri Saxena lauded the Institute's efforts to focus on multifarious approaches in Palaeobotany. He was of the view that in addition to pure research, scientists must find ways to find applications for the societal benefit. He said that doing work was very important but it's also equally important that the masses are appraised of what is being done in the laboratories. This, he said, is the debt scientists owe to the society.

Showering praise on Institute's contributions, he expressed hope that the new initiatives being taken will prove immensely beneficial to the Institute as well as the society. On this occasion, he also released a book "*Gatik Prithvi aur Jaivik Itihaas*" written by Dr SKM Tripathi, a scientist of the institute.

## Distinguished Visitors

- Dr. B.R. Arora, Director, Wadia Institute of Himalayan Geology, Dehradun.
- Sri D.N. Awasthi, Petrotech Society, New Delhi.
- Professor S.N. Bhalla, Retired Chairman, Geology Department, AMU, Aligarh.
- Mr. Ming-Yi Ge, Dy. Director General, Bureau of International Cooperation, CAS, Beijing, China.
- Padmashri Dr. P.C. Goel, Secretary, Department of Ocean Development, New Delhi.
- Padmashri Dr. Harsh K. Gupta, Former Secretary, Department of Ocean Development, New Delhi.
- Dr. Cheng-Sen Li, Institute of Botany, Beijing, China.
- Sri Y.N. Saxena, Former Director General of Police, Lucknow.
- Sri Ravi Shanker, Former Director General, Geological Survey of India, Kolkata.
- Dr. S.R. Shetye, Director, National Institute of Oceanography, Goa.
- Sri V.K. Sibal, Director General, Directorate General of Hydrocarbons, New Delhi.
- Dr. A.K. Singh, Central Mining Research Institute, Dhanbad.
- Dr. V.N. Singh, Director, Government Museum, Chandigarh.
- Professor S.K. Tandon, University of Delhi (New Delhi).
- Dr. Yu-Fei Wang, Institute of Botany, Beijing, China.



## Research Report

### 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*

Studied carbonaceous mega-remains and organic-walled microfossils from Sirbu Shale and Nagod Limestone formations of Bhandar Group, exposed in different localities of Satna district, MP. The compressions/impressions of carbonaceous mega-remains belonging to *Chuarid*, *Tawuid*, *Longfengshanid* and *Vendotaenid* groups have been found. Filamentous form like *Tyrasotaenia* and some algal remains like *Enteromorphites* and *Konglingiophyton* are also present. The OWMs present in the shale and intercalated chert belong to both acritarchs and cyanobacteria. The acritarchs are dominated by sphaeromorphs, viz. *Leiosphaeridia*, *Nucellosphaeridium*, *Satka colonialica*, *Nevifusa robusta*, *Leiofusa* and *Cymatiosphaeroides* sp., and acanthomorphs, viz. *Pterospermopsimorpha*, *Micrhystridium* and *Synsphaeridium* are also present. The cyanobacterial remains are represented by *Obruchevella* sp., *Myxococcoides* sp., *Cunicularious hellarie*, *Symplassosphaeridium*, *Oscillatoriopsis*, *Arctacellularia*, *Palaeolyngbya* and algal thallii comparable to modern chlorophytes are also present.

The total assemblage of mega-remains compares well with the Upper Sinian Miaohoe biota of China. The dominance of large sized leiosphaerids (mega-spheromorphs) and helically coiled forms (*Obruchevella*) in the microfossil assemblage indicates its closeness to the known assemblage from the Ediacaran sequence in other parts of the world.

**Manoj Shukla & V.K. Singh**

(w.e.f. 15.06.2005)

Mesoproterozoic (~1600 Ma old) Salkhan Limestone (Semri Group) exposed in Rohtas district of Bihar, preserves an abundant and varied ancient microbial assemblage. The assemblage includes characteristic mat-forming Scytonematacean and Entophysalidacean cyanobacteria. *Eoentophysalis* is the dominant organism in the assemblage. Ellipsoidal akinetes of Nostocalean cyanobacteria (*Archaeoellipsoides*) and spherical unicells also occur; both are distinct from mat-forming assemblage. Small-sized akinetes of heterocystous cyanobacteria display rod shaped, ellipsoidal to spindle shaped morphologies, with prominent intracellular mass in 2 species out of 3. Their distribution indicates allochthonous, presumably planktic and possibly dormant resting nature. The recognition and record of akinetes are important to trace the antiquity of Nostocales and understanding the concentration of oxygen in the atmosphere in the geological past, corroborating the geochemical evidence of atmospheric oxygen level above 1% of present day level by Early Mesoproterozoic.

The Olive Shale (Koldaha Shale) belonging to the Semri Group exposed in the Newari area of the Sonbhadra district (UP) has yielded a variety of macroscopic, millimetric and carbonaceous films. These films can be attributed to multicellular/ thalloid macroalgae that are divided into 4 morphogenera and 5 morphospecies, viz. *Changchengia stipitata* Yan 1997, *Tuanshanzia lanceolata* Yan 1995, *Tuanshanzia platyphylla* Yan 1997, *Leiosphaeridia* sp. and *Eopalmaria pristina* Yan 1995. These may represent the oldest megascopic carbonaceous remains from India.

**Mukund Sharma**

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

Examined the shale and intercalated cherts in Rehatikhoh Formation (oldest), Singhora Group exposed in the Singhbahal village of Juba-Banjhapali area in Mahasamund district for microfossils. Both acritarchs and cyanobacterial remains are being recorded for the first time. The acritarchs comprise of 3 dominant genera of sphaeromorphs, viz. *Leiosphaeridia minutissima*, *L. kulinguca*, *Satka squamifera* and *Cymatiosphaeroides kulingii* and acanthomorphs of the subgroup Sphaerohystrichomorphida viz. *Pterospermo-psimorpha*,

*Micrhystridium* and *Tappania*. The cyanobacterial remains are represented by *Glenobotrydion aenigmatis*, *Archeonema longicellularis* and *Siphonophucus septatum*. These forms resemble with the members of Chroococcales and Nostocales. The assemblage compares well with the Late Palaeoproterozoic / Early Mesoproterozoic assemblage from other parts of the world.

**Rupendra Babu & Manoj Shukla**

**THRUST AREA: GONDWANA FLORISTICS, PALAEOCLIMATE AND PALAEOECOLOGY: RELEVANCE TO BREAK-UP 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**

Finalized spore-pollen study recovered from Ca 1000 m thick Late Palaeozoic- Mesozoic Succession of bore-hole DPD-3, Deocha-Pachami area (Birbhum Coalfield). The study brings out presence of Talchir (899.70-898.35 m depth) and Karharbari (888.35-869.60 m depth) palynoflora for the first time in this field. The Barakar Formation is dated to represent the time span from Early Permian to Earliest Triassic, as derived from the palynoassemblages identified in between 856.80 and 317.00 m depth. Permian-Triassic transition seems to lie within 342.00 to 322.15 m. The pebbly bed at the base of Dubrajpur Formation (311.60-270.00 m) might represent the hiatus from

Early Triassic to earliest Middle Jurassic. The uppermost reaches in Dubrajpur Formation (229.60-28.15 m) is suggested to mark the Jurassic-Cretaceous (Tithonian-Berriasian) transition. Palynological dating of the Dubrajpur Formation intersected in the Mesozoic succession (core samples DPD-3, 6, 7, 15, 16 & 17) evidenced that the major part of the Triassic and Lower to Middle Jurassic sediments are missing in this area. Occurrence of pebbly bed (maximum 311.60-270.00 m) at the base of Dubrajpur Formation may be encountered for such hiatus.

Vijaya

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

Carried out palynological analysis of samples (100) from bore-hole SNB-1 and demarcated Late Permian Raniganj palynoassemblage at 1013.10 to 907.05 m depth showing dominance of striate bisaccate pollen. At depth 889.60 to 722.20 m, an Early to Middle Triassic palynomorphs have been encountered, which show dominance of *Lundbladispora*,

*Falcisporites*, *Alisporites*, *Densoisporites* and Taeniate pollen along with striated bisaccates and a few taeniate pollen. Compiled the palynoassemblages recovered from another bore-holes (SJ-1, SMP-1 & 3). Also collected fresh bore cores and outcrop samples from the field. Finalized a paper on fossil wood collected from the Tiki Formation (with A.Rajanikanth).

Ram Awatar

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

Carried out chemical processing of the samples collected from the Chharchharia Nala section (near Rajpur village) in Ib-River Coalfield, but could not yield any pollen and spores. Surface samples collected from Lakhanpur area also proved to be barren. Documented a paper on Talchir palynoflora recovered from the section (in tributary of Hasdo River) near

Baikunthpur village of Mahendragarh area (Chhattisgarh). Besides occurrence of marine forms in the Ib-River Coalfield is recorded. Visited Ib-Himgir Basin coalfields (Jharsuguda and Sundargarh districts, Orissa) and collected fresh surface and subsurface samples for palynological study.

K.L. Meena

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

Collected well-diversified and preserved plant fossils from blackish-gray shales exposed in mine cut section at Belkher (Amrawati district, Maharashtra). The plant fossils consist of *Matonidium indicum*, *Cladophlebis indica*, *Sphenopteris*, *Ptilophyllum cutchense*, *P. acutifolium*, *Taeniopteris spatulata*, *Brachyphyllum sehoraensis*, *Elatocladus plana* and *Araucarites cutchensis*. This assemblage shows dominance of

pteridophytes and conifers. Occurrence of genus *Matonidium indicum* is significant feature as this is an age marker of Early Cretaceous beds of Himmatnagar, Tarnetar and Than. The palaeofloristics are compared and correlated with various Early Cretaceous flora of India and has been observed that the flora is coeval to Dhrangdhara, Gardeshwar and Himmatnagar floral assemblages of western India.

Analysed palynoflora and dispersed organic matter recovered from the section (12 m) exposed along Sher River near village Sehora (Satpura Basin) to assess palyno-diversity and preservation potential in relation to lithofacies and environment of deposition. On the basis of palynoassemblage / palynofacies the section is divided into lower, middle and upper units. The lower unit is characterized by pollen *Araucarites ghuneriensis*, *Callialasporites dampieri*, *C. monoalaspuris*, *C. trilobatus*, *Cycadopites grandis*, *Contignisporites cooksonii*, *Cyathidites australis*, *Biretisporites spectabilis*, *Dictyophyllidites hardensis*, *Alsophilidites bellus*, etc. Biodegraded terrestrial matter followed by amorphous, black debris, structured terrestrial and spore-pollen dominates the OM. The middle unit is represented by the dominance of *Cycadopites grandis*, *Callialasporites dampieri*, *Densoisporites velotus* and other fern spores. No major change in diversity of DOM has been noticed except comparatively low frequency (5-10%) of spore-pollen. The

upper unit shows dominance of *Araucarites ghuneriensis* followed by *Callialasporites dampieri*, *Cycadopites grandis* and some recycled Permian grains. The OM dominated here by biodegraded terrestrial matter followed by amorphous and black debris. The frequency analyses of palynoassemblage and DOM indicate prevalence of rain-forest vegetation in studied area. The sediments were deposited at various phases of fluvio-lacustrine conditions under subtropical condition during Early Cretaceous.

Macerated about 50 samples collected from Jhala, Tekan and Machrar River section for palynofacies study. Slides of productive samples have been prepared and scanned. Also undertook fieldwork to collect plant fossils from various localities of South Rewa Basin (MP). River cutting and nala sections (near Umrar River) are also traversed and collected megafloal impressions and palynological samples.

**Madhav Kumar & Neeru Prakash**

### **Component 5: Morphotaxonomy, floristics, biostratigraphy and palaeoecological studies in Korba Coalfield**

Processed, identified, photographed (27 specimens) and studied around 130 megafossil specimens collected from southern part of the coalfield in Chhattisgarh State. Five species of *Glossopteris*, viz. *Glossopteris nimishea*, *G. communis*, *G. barakarensis*, *G. spatulata* and *G. indica*, along with the taxa

*Vertebraria indica* and *Cordaites* sp. have been identified. Also collected about 290 fresh megafossil specimens of *Glossopteris* flora from the Dipika and Gevra collieries, extension sites of the Korba Coalfield.

**K.J. Singh**

## **Project 3: Vegetational patterns, Palaeogeography and Palaeo-environmental analysis of Satpura–Wardha-Godavari and Gujarat–Rajasthan basins**

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

Systematically described and finalized study on *Glossopteris* species from the Kamthi Formation of Camp IV area, Tohegaon Village (Chandrapur district, Maharashtra), Wardha Valley Coalfield. The genus is represented by 21 species, viz. *G. angusta*, *G. angustifolia*, *G. barakarensis*, *G. brongniartii*, *G. communis*, *G. indica*, *G. intermedia*, *G. hinjridaensis*, *G. kamthiensis*, *G. leptoneura*, *G. longicaulis*, *G. maheshwarii*, *G. mohudaensis*, *G. musaefolia*, *G. retifera*, *G. rhabdotaenioides*, *G. stenoneura*, *G. subtilis*, *G. syaldiensis*, *G. tenuifolia*, and *G. vulgaris*. Besides, a number of specimens with impressions of equisetalean axes are also recorded. The *Glossopteris* species are comparable with those of Raniganj and Kamthi formations of Damodar and Handappa (Mahanadi) basins, respectively indicating an Upper Permian age.

Finalized study on megaspores recovered from Kachinapalli and Gundala areas of Godavari Graben (with **Neerja Jha**). The diversity in exosporium ornamentations from laevigate to verrucate, baculate to connate/spinate and nature

of spines, viz. simple, bifurcate and multifurcate indicates structural diversity and complexity reflecting variety and richness of the megaspore assemblage.

Collected plant megafossils from Barakar Formation of Umrer Coalfield area (Nagpur district, Wardha Basin) and rock samples for recovery of megaspores, seeds etc. Rock samples were also collected from Ramagundam area (Karimnagar district, Godavari Graben). Megafossils from Barakar Formation of Srirampur OCP, Bellampalli area (Adilabad district) including specimens of *Glossopteris*, *Noeggerathiopsis*, and equisetalean axes were also collected. Additionally, Somagudem, Motilal Khani, and Ramakrishnapuram collieries of Mandhmari area and Khairugora, Goleti and Bellampalli OCP of Bellampalli areas were also visited from where ill preserved equisetalean axes and palynological samples were collected.

**Rajni Tewari**



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

Compiled and finalized spore-pollen studies recorded in samples from bore-hole SSP-133 drilled in Sattupalli area. Late Permian and Early Triassic palynoassemblages have been demarcated in 352.00 m deep sedimentary sequence of this bore-hole. Finalized palynological study of Equisetalean axes bearing sediments from bore core MSP-21 of the area.

Systematically described and finalized study on megaspores from the Barakar Formation of Gundala area and Barakar and Raniganj formations of Kachinapalli area (with **Rajni Tewari**). The assemblage from Kachinapalli area is represented by 7 genera and 15 species, viz. *Bokarosporites rotundus*, *Bokarosporites* sp.\*, *Banksisporites utkalensis*, *Jhariatrilletes baculosus*\*, *J. srivastavae*\*, *J. damudicus*\*, *J.*

*filiformis*\*, *Biharisporites sparsus*\*, *Biharisporites* sp.\* *Singhisporites surangei*\*, *S. radialis*, *S. godavariensis* sp. nov.\*, *Ramispinatispora indica*\*, *R. nautiyalii*, and *Penchiella* sp\*. The taxa marked with asterisks are new addition to the megaspore assemblage of Godavari Graben, while the genera *Jhariatrilletes* and *Penchiella* are recorded for the first time. Relatively fewer taxa comprising 4 genera and 4 species, viz. *Bokarosporites rotundus*, *Banksisporites utkalensis*, *Talchirella trivedii* and a new genus have been recorded in Gundala area. The taxa *Jhariatrilletes*, *Penchiella* and *Talchirella* are reported for the first time in Godavari Valley Coalfields indicating diversity in megaspore assemblage.

**Neerja Jha**

**Component 3: Biostratigraphic and palaeoenvironmental studies in Wardha and northern part of Godavari Valley Coalfield**

Discontinued (w.e.f. 21.06.2004) due to sudden demise of **A.P. Bhattacharyya**

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

Systematic description of plant fossil assemblages from Pench Valley Coalfield was finalized. The assemblages are characterized by the species of *Buriadia*, *Euryphyllum*, *Gangamopteris*, *Glossopteris*, *Noeggerathiopsis*, *Botrychiopsis*, *Rubidgea*, *Phyllothea*, *Samaropsis*, *Cordaicarpus*, *Vertebraria*-axes, different types of megaspores and spore-pollen. The flora is comparable with transitional flora of Karharbari/Lower Barakar formations. In having the dominance of *Gangamopteris*, *Noeggerathiopsis* leaves and radial monosaccate pollen.

A new pinnate frond represented by more than 25 specimens has been discovered from New Sethia open cast mine. The pinnules are often attached at irregular distances and at irregular angles, elongate narrow-lanceolate pinnules possess strong midvein, where lateral veins are one to three times forked. Well-preserved cuticles are obtained from all parts of the frond. The adaxial and abaxial surfaces show similar types of cell structures and stomatal apparatuses are distributed on both the surfaces. The external morphological features and cuticular structures of the frond are comparable with the pteridospermic pinnules, known from the northern flora of

Europe. Complete and incomplete small leaves comparable with *Taeniopteris/Rhabdotaenia* have also been recovered. The leaves are distinct in having acute apex, obtuse-acute base and small in size (2-3 cm long & 1-2 cm wide). The fertile axes of lycopods have been recovered for the first time in the Lower Gondwana flora along with the sterile axes. The study is under progress.

Undertook a field visit to various localities of Pench, Kanhan and Pathakhera coalfields and collected plant fossils from different open cast and underground mines of Datla, Damua, Nandan, Ghorawari and Tandsi subareas of Kanhan; Chattarpur, Satpura, Shobhapur and Tawa subareas of Pathakhera and Thisgora, Mathani, Naheria, Shivpuri, Vishnupuri and Eklehara sub-areas of Pench coalfields. A number of fossil wood specimens have also been collected from Terhi Imli hillock situated near Dungaria village of Kanhan area. The morphotaxonomic study of the fossils and chemical processing of the samples are under progress.

**A.K. Srivastava**

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

Morphotaxonomic and palaeoecological studies on East Coast floras have been carried out. Synthesis of palyno- and mega-fossils of Early Cretaceous sequences has been accomplished and palaeoecological significance of fossil distribution has been analysed. Important floral components include- *Cladophlebis*, *Sphenopteris*, *Pachypteris*,

*Ptilophyllum*, *Pterophyllum*, *Dictyozamites*, *Taeniopteris*, *Elatocladus*, *Pagiophyllum*, *Brachyphyllum* and associated forms.

Biodiversity studies of plant fossils embodied in Indian Mesozoic sequences (Triassic, Jurassic and Cretaceous) are attempted. Systematically categorized into various taxonomic

groups depending on the plant part preservation- leaf, stem, root, wood, pollen, spore, fruit, seed, etc. and their character assessment, taxonomic affinities have been determined. Indian Mesozoic terrestrial phytodiversity has been elucidated as

evidenced by plant fossil records. Growth of luxuriant vegetation with rich diversity characterize Mesozoic terrestrial ecosystem.

A. Rajanikanth

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

Studied megafloral assemblage collected from the Pariwar Formation exposed near Habur in Jaisalmer district, Rajasthan. The recovered plant fossils reveal the presence of *Pachypteris haburensis*, *Pachypteris* sp., *Taeniopteris spatulata*, *T. densinervis*, *Pterophyllum* sp., *Ginkgo* sp., *Elatocladus tenerima*, *Elatocladus* sp., *Pagiophyllum* sp., *Conifero-caulon*

sp. etc. Common occurrence of the genera *Pachypteris* and *Pagiophyllum* are noticed in this assemblage. Collected fresh megafossils and palynological samples from 10 different Jurassic and Cretaceous sequences of Gujarat. Well-preserved specimens of the genus *Sphenopteris* collected from Kuar Bet in Kachchh district need special mention.

B.N. Jana

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

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

Studied a large number of silicified ovules/seeds recovered from the Early Cretaceous intertrappean rocks of Sonajori locality. Morphological and anatomical features of ovules/seeds exhibit similarity with the extant taxon *Acmopyle* of the family Podocarpaceae. These studies ovules/seeds have been

categorized under a new genus—*Podospermum*. Post-pollination and post-fertilization stages have also been observed in these ovules/seeds. The record of these podocarpaceous remains further confirms the palaeoposition of Indian sub-continent during the Early Cretaceous Period.

Jayasri Banerji & A.K. Ghosh

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

Assessed the palynological data so far generated from the subsurface intertrappean beds encountered in bore-holes RJR-2, RJNE-32, 35, RCH-151, RJKS-2, RJSJ-5 and RJMC-4, representing Rajmahal Formation to see the pattern of species distribution. On the basis of overall composition and occurrence and first appearance of age marker taxa, four palynozones have

been identified. These are *Ruffordiaspora australiensis*, *Foraminisporis wonthaggiensis*, *Foraminisporis asymmetricus* and *Coptospora verrucosa* in chronological order. The last palynozone is characterized by the presence of angiospermous pollen.

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**

Studied 30 lignite samples from Neyveli area under normal and fluorescence modes, which show richness in huminite and liptinite group of macerals. Typical suberinite has also been recorded under UV mode. Selective charts on biaxial and ternary diagrams are prepared depicting maceral behaviour. Low reflectance pattern ranging from 0.208-0.246 in oil and high huminite contents render their suitability for briquetting

purpose and also for the extraction of humic acids. Varied lithological sections of lignite have also been plotted to depict their time and space relationship. Further, 4 working lignite seam sections are plotted to show typical resin bandings along with the associated lithology for their time and space relationship.

Rakesh Saxena

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

A manuscript concerning the petrological study of coals from Junad Open Cast Mine, Wardha Valley Coalfield (Maharashtra) has been finalized. Investigations on biopetrology of the coals from Makardhokada area and Kayar

Block of the coalfield are being finalized. Undertook a field trip and collected a number of samples from Shekapur area of Wardha district, Maharashtra for study.

O.S. Sarate

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

Compiled microconstituents (macerals/micro-lithotypes), associated mineral matters and vitrinite reflectance (for rank) data of the coals encountered in bore-hole HRC-107, representing seams II top, II bottom and III in Hura Coalfield. The sub-bituminous A to high-volatile bituminous C rank ( $R_{o\ max.}$  0.40-0.57%) coals contains variable proportions of macerals of vitrinite and inertinite groups. The study under normal incident mode revealed that these coals are of inferior quality for selective utilization, because of the predominance of mixed (vitrinite-rich: fusovitrinite + inertinite-rich: vitrofusite) coal types associated with poor contents of liptinite macerals (up to 10%) and dispersed inorganic (mineral) matters. Observations under fluorescence mode have shown appreciably high amount of liptinite macerals, chiefly constituted by sporinite and liptodetrinite, cutinite, fluorinite, resinite, alginite (*Botryococcus* and lamalginite) and exsudatinitite are in

subordinate amount. Sporinite showed wide range of preservational stages from well preserved to highly degraded and fragmented.

Various compositional models utilizing the macerals and microlithotype data have also been prepared for assessing the coal types and related conditions of deposition of seams. Evidently, it appears that the seams have formed dominantly from hypautochthonous to autochthonous woody vegetation. Study also indicates rapid seasonal fluctuations with wet-reducing (anaerobic: vitrinite-rich) to dry-oxidative (aerobic: inertinite-rich) conditions. Occurrence of alginite indicates that the source (vegetal) material has been deposited under brackish water conditions. High amount of hydrogen-rich microconstituents (liptinite + perhydrous vitrinite: 24-70%) in the coals render them suitable for liquefaction.

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**

Discontinued (in 2004), due to collaborative-consultancy programme with CMRI (Dhanbad) on Sohagpur coals.

B.K. Misra (till June 2005), B.D. Singh & Alpana Singh

**Component 5: Petrographic Atlas of Indian coals and lignites**

Computer scanned certain selected photographs (exposed under normal and fluorescent lights) of macerals and associated minerals of Indian Tertiary lignites and coals. Varieties of semifusinite and fusinite macerals of the inertinite group recorded from Indian Permian Gondwana coals (of low rank)

have been categorized based on degree of oxidation, cell structure, cell wall thickness, reflectance, etc. Compiled bibliography on petrology of Indian coals and lignites.

B.K. Misra (till June 2005),  
B.D. Singh & Alpana 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, sections of a large number of petrified woods collected from the Plio-Pleistocene sediments of Kachchh and Bhavnagar districts of Gujarat and from Jaisalmer area of Rajasthan. Anatomy of these woods revealed existence of extant genera— *Barringtonia*, *Cynometra*, *Dipterocarpus*, *Milletia-*

*Pongamia*, *Pterocarpus* and *Sterculia*. These genera indicate that the climate in the area was conducive for the growth of semi-evergreen to deciduous vegetation until Plio-Pleistocene time and the drier conditions prevailed in the area afterwards.

J.S. Guleria



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

An Early Palaeogene palynological assemblage from Marh Formation, Nagaur district, Rajasthan has been reported for the first time. Analysed samples from lignite and associated sediments (carbonaceous shale and clay) near Kashnou and Matasukh for the recovery of palynofossils. The studied sequence is situated about 30 km SE of Nagaur city in western Rajasthan and could be observed in the open cast mine currently explored for lignite. Base of the sequence is represented by ferruginous sandstone of Nagaur Group, which is underlain by Marh Formation. The oldest rock of this formation is represented by carbonaceous shale intercalated with siltstone. Overlying this bed is the lignite seam (average 3-4 m thick), which is intercalated with bands of carbonaceous shale and clay. The yellowish clay constitutes the youngest sequence of the Marh Formation.

Lignite samples yielded a rich and diversified palynological assemblage, which is dominated by angiosperm pollen. The assemblage is characterized by high frequency of pollen belonging to the family Meliaceae. Significant palynotaxa in the assemblage include *Dandotiaspora* spp., *Lygodiumsporites* spp., *Arecipites* spp., *Palmidites* spp., *Meliapollis* spp., *Matanomadhiasulcites* spp. and *Grevilloideaepites* spp. The 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. Most of the modern counterparts of the palynofossils are tropical to subtropical in present-day distribution. Based on qualitative and quantitative analyses of the assemblage the studied sequence is dated as Late Palaeocene in age.

S.K.M. Tripathi

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

Prepared thin sections of 44 carbonised woods from Ratnagiri beds (Maharashtra), Neyveli Lignite (Tamil Nadu), Varkala and Payangadi mines (Kerala) and studied under microscope. Identified fossil fruits and leaves from Ratnagiri, Payangadi and Neyveli and compared some fossil leaves with the modern counterparts, viz. *Mangifera* spp., *Alstonia scholaris* Br., *Holorrhina antidysenterica* Linn., *Avicennia officinalis* Linn., *Phyllanthus* sp., *P. collumnaris* Muell., *Maniltoa polyandra* Roxb., *Cassia* sp., *Parinarium polyneurum*, *Hydnocarpus pentendra*, *Litsea nitida* Roxb., *Aphanamixis polystachya*, *Embelia ribes*, *Embelia parviflora* Wall., *Eugenia bracteata* Roxb. (= *Syzygium bracteatum*), *Bassia braceana*, *Mimusops hexandra* Roxb., *Brucea mollis*, *Ficus* sp., *Anacardium occidentale*, *Rhus cotinis*, *R. punjabensis*, *R. insignis*, *Wightiana tomentosa*, *Cassia marginata*; *Fissistigma bicolor* and *Trychodesma zeylanicum*. Fossil axes are compared with the genera *Pandanus* and *Borassus/Phoenix*.

Compared fossil fruits/seeds with the modern fruits—*Caesalpinia nuga*, *Elaeocarpus lacunosa*, *E. serratus*, *E. spp. E. aristatus*, *E. tinctorius*, *Hydnocarpus alpine*, *Kurzii* sp., *Wightiana* sp., *Venenata*, *Madhuca indica*, *Hopea odorata*, *Theohroma*, *Barringtonia asiatica*, *Gardenia gummifera*, *G. turgida*, *G. obtusifolia*, *G. corinata*, *G. coronaria*, *G.*

*complanulata* and *G. costata*, belonging to families Anacardiaceae, Apocynaceae, Avicenniaceae, Chrysobalanaceae, Euphorbiaceae, Rubiaceae, Fabaceae, Flacourtiaceae, Lauraceae, Meliaceae, Myrsinaceae, Myrtaceae, Sapotaceae, Pandanaceae, Sumaroubiaceae, Elaeocarpaceae and Arecaceae. Some of the fossil fruits are also tentatively identified as *Artocarpus chaplasi*, *A. lacoocha*, *A. hirsuta*, *Hydnocarpus alpine*, *Gardenia turgida* and *G. gummifera* belonging to families Moraceae, Flacourtiaceae and Rubiaceae.

Visited Indian Botanical Museum, Kolkata and studied modern fruits/seeds of *Myotica malabarica*, *Hydnocarpus alpine*, *Terminalia belerica*, *T. catappa*, *Limonia accoussina* and *Gardenia latifolia* respectively belonging to families Combretaceae, Flacourtiaceae, Myristicaceae, Rutaceae and Rubiaceae. Further study is in progress. Also undertook a field visit for the collection of plant megafossils from Ratnagiri, Deogard, Sindhudurg, Sawanthwadi and its adjoining areas and collected a few fruits, leaves, and carbonized woods. Sorting and documentation of the collected material has been done. SEM study of fossil leaves, seeds, and fruits are in process. Prepared two draft manuscripts on floristics and diversity of Neyveli Lignite deposits.

Anil Agarwal

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

Investigated angiospermous leaf impressions from Keria and Mohgaon Kalan of Chhindwara district (Madhya Pradesh). Some of the specimens were identified through comparing with modern genera, viz. *Alstonia* (Apocynaceae), *Ficus* (Moraceae), *Kayea* (Clusiaceae), *Miliusa* (Annonaceae).

Further work is being done. Studied some fossil woods from Ghughua National Fossil Park, Dindori district (Madhya Pradesh). Most of them are already reported from the area. A few palm leaves and rootlets have also been studied from Binori Reserve Forest, Seoni district (Madhya Pradesh).

An interesting fossil specimen collected from Ghughua Fossil Park has been studied (with **J.S. Guleria**). On the basis of xylotomy the fossil wood has been systemetised under the genus *Sterculia* with distinct growth rings, storied vessels,

vertical gum canals and bark anatomy. Such distinct features have not been reported so far. A paper has been prepared on detailed anatomy of this wood.

**Rashmi Srivastava**

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

Both quantitative and qualitative studies of the dispersed palynomorphs obtained from the Deccan Intertrappean beds of Anjar (Gujarat), Padwar and Mohgaon-Kalan (Madhya Pradesh), and Naskal (Andhra Pradesh) have been carried out. The assemblages recovered are rich and diverse with representation of all plant groups. Besides the known records from the intertrappean localities, 35 additional palynomorphs are recorded and their systematic morphology has been studied. *Hirsutispora*, *Acrolamellispora*, *Padwarispora*, *Manofoveosulcites*, *Padwaripollenites*, *Sparganiumpolles*, *Robustispinosus* and *Deccantetradites* are instituted after a detail taxonomical study. The new identifiable additions to the Deccan Intertrappean palynoflora recorded are— *Hirsutispora excellensa* gen. et sp. nov., *Acrolamellispora reticulata* gen. et sp. nov., *Padwariaspora baculata* gen. et sp. nov., *Botrycoccus braunii* Kutzing, *Nostoc linckia* (Roth.)Bornet & Flahaunt, *Brazilea parva* (Cook & Dett)Tiwari & Navale, *B. circularis* (He)Yi, *Lacaniella mutigonata* Yi, *L. triplidiscus* Yi, *Cordosphaeridium exilimurum* Davey&William, *Tetraanguladium excellensa* sp. nov., *T. triradiata* sp. nov., *Notothyrites setiferus* Cookson, *Todisporites kutchensis* Sah & Kar, *Intrapunctisporites intrapunctis* Krutzsch, *Osmundacidites cephalus* Saxena, *Acrostichumsporites*

*megalayaensis* Kar, *Lycopodiumsporites magnareti-culatus* sp. nov., *L. circulatus* sp. nov., *Contignisporites* sp., *Ariadnaesporites capitus* sp. nov., *Laevigatosporites kaliensis* Sah & Kar, *Polypodiaceasporites major* Saxena, *Costathea diskoensis* (Miner) Hall, *Spermatites ellipticus* Miner, *Manofoveosulcites interappius* gen. et sp. nov., *Padripollenites triangulus* gen. et sp. nov., *Barringtoniapollenites reptilatus* Kar & Sharma, *Sparganiumpolles mahabalea* gen. et sp. nov., *Robustispinosus tricolpatus* gen. et sp. nov., *Deccantetradites intertrappus* gen. et sp. nov., and *Tescissus grandis* Tschudy. The marker species associated in all of the assemblages indicate a Maastrichtian age.

The Naskal Intertrappean bed bearing the first eutherian mammal record was palynologically assigned a Maastrichtian age due to the presence of marker taxa: *Ariadnaesporites*, *Gabonisporites*, *Triporoletes*, *Mulleripollis*, *Azolla* and *Mineripollenites*, which has implication in understanding palaeogeographic distribution of the mammals. In general, spores of fresh-water ferns dominate the assemblages indicating a lacustrine environment of deposition and a warm and humid climate. Also undertook a field trip to the Intertrappean localities of Madhya Pradesh.

**R.S. Singh**

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

Sectioned about 20 fossil woods collected from the Tipam Sandstone Formation of Lumding, Assam and study is under progress. Out of them, one appears to be new. A few fossil impressions collected from the Disang sediments of Wokha

district, Nagaland have been sorted, selected and photographed and their detailed study is under progress. A review paper related with the antiquity and migratory paths of angiosperms in India is finalized.

**R.C. Mehrotra**

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

Studied some plant remains from Beragua Coal Mines of Eocene age situated in Rajauri district (Jammu & Kashmir). One of the samples is identified as a fruiting axis of the genus *Acorus* Linn. belonging to the family Acoraceae. The genus indicates existence of swampy conditions in the area at the

time of deposition of vegetal material, which ultimately led to the formation of coal in the Palaeogene sediments of Subathu Formation in studied area. Further work is in progress.

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

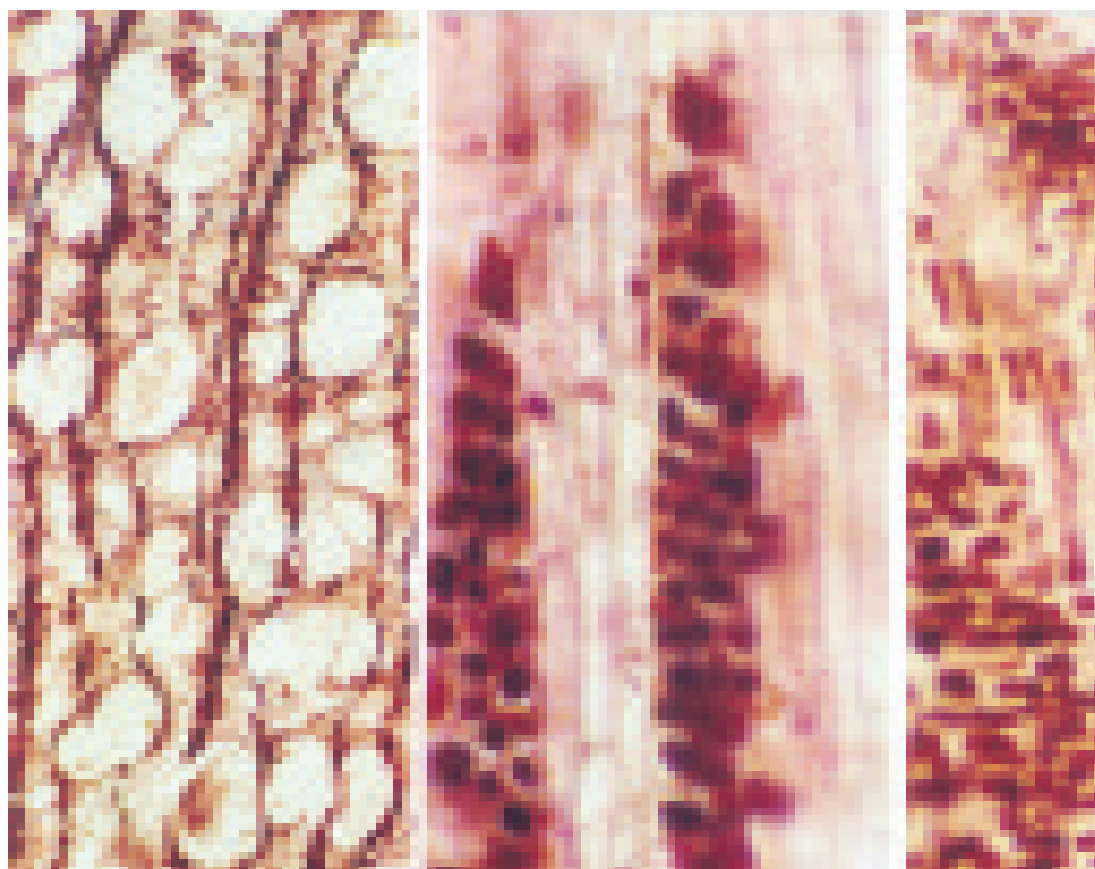
### **Component 8: Siwalik foreland Basin: Floristics, evolutionary pattern and climate**

Investigated plant megafossils comprising leaf impressions and a few carbonised woods from the Siwalik sediments of Oodlabari area, Darjeeling district (West Bengal). A comparative study of morphological features between the

fossils and extant taxa reveals that they belong to 20 species of 13 angiospermous families. On the basis of recorded assemblage as well as known floral data, the palaeoclimatic conditions of the studied area near the Himalayan foothill during



A well exposed Middle Siwalik section containing well preserved leaf impressions along the banks of Ghish River, Darjeeling District West Bengal



Wood section of *Shorea robusta* from 5600 years BP Holocene sediments of Uttaranchal, India



Mio-Pliocene have been deduced. The dominance of entire margined fossil leaves indicates the presence of tropical climate. Other features, like drip tips, leaf size, leaf texture, nature of petiole and venation density collectively suggest tropical climate with heavy rainfall during deposition of fossil-bearing sediments. Analysis of present day distribution of floral assemblage indicates the dominance of evergreen elements in the area during Mio-Pliocene times in contrast to mixed deciduous elements at present. This change in the vegetation pattern reflects the change in climatic conditions during the Siwalik times.

Morphotaxonomic study on the leaf and fruit impressions from Siwalik sediments of Tanakpur area (Uttaranchal) reveals the presence of some more new form species showing their close resemblance with extant taxa— *Meiogyne pannosa*, *Fissistigma fulgans* and *Popowia ramosissima* (of Anonaceae), *Paramignia monophylla*, *Todalia asiatica*, *Zanthoxylum alatum* and *Evodia fraxinifolia* (Rutaceae), *Garcinia spicata* and *G. cambogia* (Clusiaceae), *Drimycarpus racemosus* (Anacardiaceae), *Bauhinia* sp., *Derris indica*, *Dalbergia indiana* and *Wagatia spicata*, *Sapothalmus parviflora* (Fabaceae), *Berchemia floribunda* and *Ventilago calyculata* (Rhamnaceae), *Terminalia arjuna* and *T. argrophylla* (Combretaceae), *Lagerstroemia speciosa* and *L. parviflora* (Lythraceae), *Ficus microcarpa* (Urticaceae) etc. Two fossil fruits showing close

similarity with the extant taxa *Dalbergia indiana* and *Wagatia spicata* have been reported for the first time from this area. The floral assemblage so far recorded from the area is indicative of warm humid climate during the sedimentation.

Anatomical study of a fossil wood collected from Holocene sediments of Tanakpur area has been carried out. This fossil wood has been dated ( $C^{14}$  dating 5600 yrs BP) and identified with the extant taxa *Shorea robusta* Roob. (Dipterocarpaceae). This occurrence of fossil wood of Sal in these sediments is phytogeographically important, because the wood of *Shorea robusta* has not yet been recorded from Siwalik sediments of Himalayan fore land basins, which is growing luxuriantly at present in the entire Himalayan foothills. The study indicates that this taxon might have come into existence in Himalayan foothills before 5600 yrs, when suitable conditions favoured its growth.

Collected fresh plant megafossils (wood, leaf, fruit) from Siwalik sediments of Darjeeling district, West Bengal. Palynological samples from well-exposed sections have also been collected. Also visited Central National Herbarium, Shibpur (Howrah) and identified the leaf and fruit impressions collected from Siwalik sediments of Uttaranchal.

**Mahesh Prasad**

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

48 surface rock samples of Subansiri Formation exposed on Pasighat-Rengging-Pangin Road, East Siang district have been chemically processed. The yield was poor and some Tertiary palynomorphs were recovered— *Schizaeoisporites*, *Inaperturopollenites*, *Striatriletes*, etc. In addition to these Permian palynomorphs like *Crescentipollenites*, *Lunatisporites*

and Lower Cretaceous palynomorphs like *Callialasporites* were also recorded. The source area of the reworked Permian palynomorphs could possibly be Lower Gondwana exposures in Singrimari, West Garo Hills (Meghalaya). Presence of Cretaceous forms indicate that these sediments also existed along with the Permian sediments.

**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**

Macerated 28 samples collected from the Rewak Formation of Silni River Section in West Garo Hills district, Meghalaya. Scanning of slides and photodocumentation and study of palynofossils have been initiated. The study of the Kopili Formation of North Cachar Hills, Assam has been completed. The important palynotaxa of this assemblage are— *Cyathidites australis*, *C. minor*, *Foveosporites triangulus*, *Intrapunctisporis intrapunctis*, *Lygodiumsporites eocenicus*, *L. lakiensis*, *Monolites mawkmaensis*, *Osmundacidites wellmanii*, *Polypodaceasporites indicus*, *P. levis*, *P. punctatus*, *P. strictus*, *P. tertiarus*, *Polypodisporites favus*, *P. formosus*, *P. speciosus*, *P. splendidus*, *P. tuberculensis*, *P. ornatus*, *P.*

*verrucosus*, *Poly-podiisporonites mawkmaensis*, *Striatriletes susannae*, *S. multicostatus*, *S. paucicostatus*, *Todisporites major*, *Araucariacites australis*, *Inaperturopollenites punctatus*, *Podocarpidites ellipticus*, *Pinuspollenites crestus*, *Densiverrupollenites eocenicus*, *Margocolporites sahnii*, *Palmaepollenites nadhamunii*, *Palmidites plicatus*, *Pellicieropollis langenheimii*, *Polyadopollenites levis*, *Psiloschizosporis psilata*, *Rhoipites nitidus*, *Tricolpites crassireticulatus*, *T. minutus*, *Tricolporopillites robustus*, *Tricolporopollis matanomadhensis*, *Verrucolporites verrucus*, etc. The assemblage also contains a variety of fungal spores and fruiting bodies. Dinoflagellate cysts and reworked Permian

and Early Cretaceous palynofossils have also been recorded. The palynoflora indicates a tropical to subtropical, warm-humid climate with heavy precipitation. The environment of deposition has been interpreted as coastal with ponding conditions nearby.

The present assemblage is identical to the Kopili assemblage recorded from the neighbouring Jaintia Hills and is Late Eocene in age.

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

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

Completed analysis of palynological assemblage from Wagopadar section (23° 32': 68° 57'). The assemblage consists of 11 genera and 18 species of spores and 32 genera and 45 species belonging to angiosperm pollen. Gymnosperm pollen and dinocysts are totally absent. Swamp vegetation represented by 41% followed by 22% of low land and 18% of coastal (palm)

pollen grains. The assemblage is characterized by comparatively high incidence of spores than the other Early Eocene assemblages of Kachchh Basin. The study suggests that deposition took place near shore in swamp. The study is continuing to build up palynostratigraphy of Palaeogene sequence of Kachchh Basin.

**J.P. Mandal**

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

Chemical processing of samples from Niniyur Formation (Periakurichi and Adnan Kurichi Limestone Mines) and Niniyur Section (Cauvery Basin) has been completed. Morphotaxonomy, identification and data interpretation of spore-pollen recovered from Periakurichi Limestone mine and Niniyur Section have been completed. The palynoassemblage represented by algal remains (dinoflagellate cysts), pteridophytic spores, gymnosperm and angiosperm pollen. The angiosperm pollen registers dominance over pteridophytic spores. Some of the genera recorded are— *Lygodiumsporites*, *Cyathidites*, *Podocarpidites*, *Palmidites*, *Liliacidites*, *Tricolpites*, *Retitricolporites* and *Graminidites*. Data interpretation of spore-pollen have been taken up and continued.

water edge (*Azolla*, *Botryococcus*, *Liliacidites* and *Meliapollis*) and sandy beach elements (*Palmidites* and *Iridacidites*). The high incidence of algal and fungal remains and the presence of grass pollen indicate that the prevailing flora was mainly of wet green, open and mixed nature. The good representation of colonies of *Botryococcus* indicates that a fresh water environment of deposition (most probably lacustrine) prevailed. It is quite possible that these colonies got deposited in quiet, open ponds/ lakes or lakes of freshwater. The absence of dominant coastal elements and mangrove and back-mangrove elements indicates that the deposition of sediments took place away from the sea-coast. The presence of *Polyadosporites*, *Iridacidites*, *Cuddaloripollis*, *Tamilipollenites* and *Meliapollis* in the assemblage suggests a Miocene age.

Completed palynological investigation on the MECL's Sellur borehole, Tiruvarur district (Tamil Nadu). The palynoassemblage consists of algal/fungal remains and angiosperm pollen. Pteridophytic spores and gymnosperm pollen are not recorded. The palynoflora suggests a tropical (warm-humid) climate with plenty of rainfall during the time of deposition. The palynotaxa recorded are referable to the floral elements of diverse ecology, viz. lowland (*Lakiapollis*, *Graminidites* and *Retitrescolpites*), freshwater swamp and

Undertook a field visit to East-Coast of India to study and collect various rock samples from Lower to Upper Cretaceous-Tertiary sediments exposed at Ariyalur and adjoining areas (Tamil Nadu) and Rajahmundry and adjoining areas (Andhra Pradesh). Collected 80 samples from 8 sections in Cauvery (5 sections) and KG basins (3 sections) for palynological investigation. Thickness, lithology and fossil contents of different sections are recorded.

**M.R. Rao**

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

Carried out analysis of spore-pollen and dispersed organic matter from outcrop sections of Disboi, Maja and Saraijan Nala of Golaghat district, Tirap Colliery of Margherita district, Dilli-Jeypore Colliery of Dibrugarh district, and Lumding-Haflong Road and Bara Langpher River sections of Naogaon district. The recovered palynoassemblages exhibit Late Palaeocene age, comprising of the taxa—*Dandotiaspora telonata*, *Dictyophyllidites kyrtomatus*, *Matanomadhiasulcites maximus*,

*Palmaepollenites kutchensis*, *Spinizonocolpites echinatus*, *S. wodehousei*, *Neocouperipollis kutchensis*, *Proxapertites* spp., *Tricolpites crassireticulatus*, *Lakiapollis ovatus*, etc. The Early Eocene sequence of Saraijan Nala contains *Lanagiopollis* spp., *Longapertites retipilatus*, *Podocarpidites khasiensis*, etc. and dinoflagellate cysts of *Homotryblium* sp. and *Apectodinium* sp. The coaliferous deposits of Late Oligocene sequences (Tirap and Dilli River sections) contain *Striatriletes* complex,



*Polypodiisporites* spp, *Pelliceroipollis langenheimii*, *Meyeripollis nahorkatensis*, *Polyadopollenites granulatus* and some Permian saccate pollen grains. Spore-pollen grains of *Crassoretitriletes vanraadshoovenii*, *Varisculptinaaperturites sphericus*, *Graminidites media*, *Clavaperiporites jacobii* and rich Permian saccate grains represent the Mio-Pliocene sequences of Bara Langphor and Lumding-Haflong Road sections. The aim of analysis of the palynoflora in these sequences is to reconstruct succession in palaeovegetation in various stratigraphic units. It is observed that coaliferous deposits of Palaeogene age were deposited under marginal marine condition, while Mio-Pliocene sequences (Late Surma

and Tipams) under continental fluvial condition.

The diversity of different kinds of organic matter are analyzed to assess preservation potential in various lithotypes, ratio of continental vs marine constituents, influence of various depositional factors in distribution towards proximal and distal trends and palynofacies modeling in marine shelf to continental depositional set up. Also macerated about 300 samples collected from Dilli River Section, Tirap colliery and other out crops of Upper Assam Basin. Slides of productive samples have been prepared and scanned.

**Madhav Kumar**

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

Studied disperse plant microfossil assemblage from Upper Bhuban Formation (Early Miocene) of Tlabung section, Mizoram. Terrestrial forms including pollen-spores, tubular structures and cuticle-like sheets dominate the palyno-assemblage. The palynoflora consists of *Malvacearumpollis*, *Hibisceapollenites*, *Compositoipollenites*, *Todisporites*, *Pteridacidites*, *Trisyncolpites* etc. and fungal remains. Presence of *Spinizonocolpites echinatus* referable to *Nypa* suggests a coastal environment. The occurrence of salt loving taxon (*Polyporina*) which belongs to a coastal marsh vegetational

community, support the presence of tidal swamps near the area of deposition. The diversity based on the presence of *Serpulid* worm tube, an internal mould of *Turritellid* gastropod, in faunal bivalve and other known animal remains from Tlabung could be suggested that an estuarine and low intertidal to shallow marine conditions existed during the period of deposition. This assemblage is comparable to coeval assemblages from other parts of India.

**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**

Recorded Late Callovian age nannofossils from non-gypsiferous shales (=middle part of Chari Formation) overlying the gypsiferous shales and micro-ammonite bearing horizon from an exposed prominent cliff section (GPS location: 23°43'38" N: 68°59'42" E, altitude 22 m). The section is capped by 3 hard fossiliferous marker Dhosa oolite bands. The nannofossil assemblage indicates presence of *Ansulasphaera helvetica*, *Biscutum intermedium*, *B. dubium*, *Cyclagelosphaera margerelii*, *Crepidolithus perforata*, *C. granulatus*, *C. pliensbachiansis*, *Discorhabdus corollatus*, *D. criotus*, *D. striatus*, *Ethmorhabdus gallicus*, *Hexapodorhabdus cuvillieri*, *Lotharingius crucicentralis*, *Crepidolithus* sp., *Polypodorhabdus escaigii*, *Schizosphaerella punctulata*, *Stephanolithion bigotii* ssp. *bigotii*, *S. bigotii* ssp. *maximum*, *S. hexum*, *Stradnerlithus clatriatus*, *Watznaueria barnesae*, *W. britannica*, *W. ovata* and *Zeugrhabdotus erectus*. The assemblage belongs to NJ 13 *Stephanolithion bigotii bigotii* Zone corresponding with late early Callovian *Calloviense*

ammonite Zone. Presence of cosmopolitan nannofossil markers, viz. *A. helvetica*, *S. hexum*, *S. bigotii* has helped to assign and confirm Late early Callovian age. The assemblage indicates reworked Aalenian-Pliensbachian age nannotaxa. Callovian was an event of eustatic rise and the imprints of this event are evidenced by nannofossils' presence in the western coastal margins of India.

Conducted a detailed fieldwork in Mesozoic localities representing Kaladongar and Goradongar formations of Patcham Island and collected representative samples (96 in all) of various members of Kaladongar, Goradongar and Chaper Bet area. Samples of Chari and Katrol formations from Jara Dome and Chari Formation of Jhura Dome are also collected for nannofossil studies. Besides, samples of Umia Formation overlying the Katrol Formation are also collected. GPS locations of all the samples have been noted.

**Jyotsana Rai**

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

Microscopic studies of thin sections from the Karasur Formation of Pondicherry area, Patti Formation of Vriddhachalam area and Ninniyur Formation of Ariyalur area of Tamil Nadu have been carried out. Taxonomic analyses of calcareous algae have been done. Interpretations have been made on the palaeoecological significance of Palaeocene

calcareous algae from the Karasur and Ninniyur formations. The global event of gradual cooling since post-Cretaceous and its impact on the community of benthic calcareous algae from India has been analyzed. Further taxonomic analyses of the algal forms from the study area are in progress.

**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***

Carried out detailed morphologic study of several new morphotypes in Late Palaeocene dinocyst-assemblage from the Khasi Hills (Meghalaya) representing the early wetzelielloids and described one new genus with two species. The new genus is characterized by cornucavate cyst with intercalary quadra archaeopyle, distinctive pentagonal outline and non-tabular ornamentation of low relief. It shows morphologic characters overlapping between *Apectodinium* and *Rhombodinium*. The new genus is recorded from the uppermost levels of Lakadong Sandstone (above CIE) and is considered to have immense biostratigraphic potential for identification of Sparnian and/or Palaeocene/Eocene boundary in this region. A key to identification of various wetzelielloid genera is proposed based on significant morphologic characters. Based on new findings, a model of possible phylogenetic relationship between genera of the subfamily Wetzelielloidae (Family Peridiniaceae) proposed earlier by Bajale & Davies (1983) is emended. New lineages are proposed indicating the new genus originating from *Apectodinium* and ancestral to the genera *Wilsonidium* and *Rhombodinium*. Draft manuscripts on the above aspects are finalized.

Photo-documentation and detailed morphologic study of dinoflagellate cysts from Dilni River section, Tura-Dalu Road, Garo Hills (upper part of the Tura Fm. and Siju Lst.) are carried out. 32 species belonging to 22 genera are identified and their frequency distribution is plotted. The dinocyst assemblage indicates Lutetian-Bartonian age. Studies on biostratigraphic and palaeoenvironmental significance of the assemblage are continuing.

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

Studied palynofacies analysis and microfossil content of Ranikor Barsora, Jathang and Cherrapunji sections exposed along the southern slopes of Khasi Hills. Palynofacies study supported by firm biostratigraphic control based on larger benthic foraminifera (SBZ Zone) and dinoflagellate cyst-study help to interpret in terms of Transgressive-Regressive cycles and facies architecture. The thicker coal seams and associated clastic units at Ranikor Barsora indicate point source deltaic setting with high rate of subsidence. This is in contrast to the relatively thin impersistent coal and carbonaceous bands with thin clastic units representing deposition in non-deltaic paralic setting with low rate of subsidence in Jathang and Cherrapunji sections in the northern part. Both these sections represent deposition in a marshy-estuarine setting. The large-scale cyclicity of the Late Palaeocene-Early Eocene succession may represent 3<sup>rd</sup> order sea level cycles. Four TST deposits have been identified interlayered with three HST deposits, each showing their own palynofacies characteristics. The coal containing siliciclastic sequence was deposited during the early TST phase under warm climate. Five parasequences have been identified during this phase. Each successive parasequence of this phase exhibits progressively increasing marine influence. Maximum Transgression with prominent negative carbon isotopic excursion at 55.5 Ma, SBZ6 and Aau biochrons, characterize the PETM event in this region. This transgression resulted in the drowning of coastal swamps and extensive development of low saline estuarine conditions.

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

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

Palynostratigraphic study of the Lower Tertiary sediments of Dharmsala (Himachal Pradesh) and its adjoining areas has been continued. Processed 17 samples of Dharmsala Formation from Naddi area and recorded an assemblage consisting of pteridophytic/fungal spores, and gymnospermous/angiospermous pollen. 25 species belonging to 16 genera have

been identified. Some of the important palynotaxa are—*Lycopodiumsporites speciosus*, *Foveosporites retiformis*, *Monolites major*, *Polypodiisporites* spp., *Leptolepidites* spp., *Pinuspollenites* spp., *Compositoipollenites* spp., etc. Preliminary data interpretation points towards an Early Miocene age of the sediments. Morphotaxonomic study of the

recovered palynofossils from the Dharmsala sediments of the Churon Khad, Manjhi Khad and Gaj Khad stratigraphic sections has been completed. A paper is finalized highlighting the age and environment of deposition of the Dharmsala Formation.

A rich palynofloral assemblage has been recovered from the Subathu Formation exposed along Manjhi Khad on Kuni-hara-Thothri road section, near Dharmsala. Dinoflagellate cysts and acritarchs dominate the assemblage. The important dinocyst taxa in the basal part of the studied sequence are—*Cleistosphaeridium diversispinosum*, *Homotryblium tenuispinosum*, *H. abbreviatum*, *Adnatosphaeridium vittatum*, *Cordosphaeridium* spp., whereas *Thalassiphora pelagica*, *Operculodinium centrocarpum* and *Spiniferites ramosus* occur in the upper part. Some samples from the upper part have also yielded palynofossils, which are very rich in terrestrial elements mainly represented by pteridophytic/fungal spores,

ascostromata and bisaccate pollen. A shallow marine environment of deposition has been deduced. Detailed data interpretation is being done. A field visit to the stratotype sections of the Subathu, Dagshai and Kasauli formations (Palaeocene-Miocene) in Himachal Pradesh was made during a national field workshop.

**Samir Sarkar**

Reassessment of significance of various palynofacies parameters for palaeoenvironmental reconstruction of early phase of Subathu sedimentation in Nilkanth and Kharak areas has been made in the light of available micropalaeontological and sedimentological data. Facies variants, sea level fluctuations and architecture have been compared in both the areas and prepared a manuscript on these aspects.

**Vandana Prasad & Samir Sarkar**

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

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

Discontinued (w.e.f. 31.12.2004) due to superannuation of **Anil Chandra**

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

Discontinued (in 2004) due to the completion of work on samples in hand.

**Asha Khandelwal**

## THRUST AREA: QUATERNARY VEGETATION, EUSTATIC SEA LEVEL CHANGES, GLOBAL CLIMATE CHANGE AND ANTHROPOGENIC IMPACT

## Project 10 : Quaternary vegetation, Palaeoclimate and Palaeoseismicity

### *Component 1: Pollen analytical studies in Rajasthan lake sediments to reconstruct Vegetational history and climatic changes during LGM*

Discontinued (w.e.f. 31.07.2002) due to superannuation of **Chhaya Sharma**.

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

Pollen analysis of a 2.5 m deep sediment core from Jogi-Chhapar, Shahdol district, Madhya Pradesh deciphering the vegetation succession and contemporary climatic changes in south-eastern Madhya Pradesh during last 3000 yrs has been completed. The pollen evidence has shown that around 3000 to 2500 yr BP open mixed deciduous forest comprising *Terminalia*, *Lagerstroemia*, *Emblica officinalis*, *Adina cordifolia*, *Holoptelea*, *Radermachera*, etc. occurred in the region under warm and moist climate. Between 2500 to 1000 yr BP, the mixed forest turned relatively more diversified and dense as manifested by the improved frequencies of most of

the tree taxa and first appearance of *Shorea robusta*. This change in the floristic composition might have occurred with the prevalence of more-moist climate, attributable to increased precipitation. Since 1000 yr BP, the expansion of *Shorea robusta* and better representation of other associates, viz. *Lagerstroemia*, *Madhuca indica*, *Syzygium* and shrubby element, *Grewia* and a simultaneous decline in grasses envisage further enhancement in rainfall.

Pollen analysed 8 samples from a 1.5 m deep trench profile from Amoleswar, Umaria district. The preliminary results



obtained have revealed the scanty presence of pollen of tree taxa, viz. *Madhuca indica*, *Terminalia*, *Lannea coromandelica*, *Radermachera*, *Boswellia*, *Mitragyna* etc. However, the herbaceous complex is marked by the better representation of grasses and sedges as compared to Asteraceae, Chen/Am, *Justicia*, Malvaceae etc. The overall vegetation assemblage

depicts the presence of open mixed tropical deciduous forest in the region during the course of sediment accumulation. The abundance of monolete and trilete spores denotes the profuse growth of ferns and their allies in the proximity of the investigated site.

M.S. Chauhan

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

Carried out pollen analysis of 3/4<sup>th</sup> part of sedimentary profile TT-II (BS-1966; 4880±180 yrs. BP) from Talli Tal (Naini Tal district), Kumaun Himalaya. Palynodebris recovered is poor though interesting palynomorphs of a large number of arboreal and non-arboreal taxa are recorded. Among arboreals *Quercus* and *Pinus* are chief elements. *Carpinus*, *Ulmus*, *Alnus*, *Engelhardtia*, *Celtis*, Myrtaceae and Alangiaceae are close associates of the former, while *Picea*, *Abies* and *Taxus* of the latter. Non-arboreals show dominance of Poaceae, Cyperaceae, Chen/Ams, Caryophyllaceae, Tubuliflorae, Liliaceae,

Polygonaceae, Urticaceae, Brassicaceae, Lamiaceae, Malvaceae, Liguliflorae and Portulacaceae are encountered in low values. Shrubs include *Strobilanthes*, members of Anacardiaceae, Berberidaceae, Rutaceae and Rubiaceae. Aquatic vegetation is represented by *Typha*, *Pediastrum* and *Nymphaea*. Spores are trilete, monolete, alete and cryptopolar types. Whole scenario reflects presence of temperate mixed oak forest vegetation, favouring warm and humid climate at the region.

Asha Gupta

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

Interpretation of palynodata from Antarctic ice sheet has been finalized and prepared a manuscript. Another three manuscripts as a part of different conference proceeding volumes on Antarctic science are finalized as a part of Institute's component. The evidence of plant fragments, pollen spores, diatoms, desmids in various terrestrial and polar lake sediments, ice edge debris even in polar air offers new insights into further

palaeoclimatic studies in polar environments, although relationship between trans-oceanic dispersal of palynomorph, wind patterns and origin of Antarctic flora found limited. More multiproxy studies including palaeolimnology, granulometry/sedimentology, mineral, magnetic and high-resolution palynostratigraphy (AMS Dating and stable isotopes) are proposed.

S.K. Bera

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

Pollen analysed 20 samples of sediment profile from Bhagwanpur, Orissa (BS-1152; ±30,625 yrs BP), which exhibited high values of core mangroves dominated by Rhizophoraceae pollen. The other core mangrove taxa—*Sonneratia*, *Heritiera*, *Avicennia*, *Aegialitis* and *Excoecaria* are also well documented albeit in relatively low values. *Xylocarpus*, *Brownlowia*, *Acanthus*, and *Acrostichum* are recorded in low and sporadic values. *Borassus*, *Cocos*, *Terminalia* and *Barringtonia* belonging to peripheral mangroves remained subdued. Most of the midland taxa

remained absent in these samples except for sporadic occurrence of Oleaceae, Fabaceae Rubiaceae, Malvaceae, Meliaceae, *Embllica*, *Holoptelea*, *Acacia*, *Casuarina*, *Anacardium*, *Holoptelca* and *Salvadora*. Poaceae, Amaranth/Chenopod, Cyperaceae, Urticaceae, Apiaceae, Asteraceae and Lamiaceae being ubiquitous are present in moderate values. Overall representation of ferns and fresh water taxa is negligible. The dinoflagellate cysts showed spurt in many samples. Drifted conifer pollen are recorded in a few samples.

Asha Khandelwal

### Component 6: Climate and vegetational succession in tropical forests of Mikir Plateau and Upper Assam Plain, North East India during Quaternary.

Palynological studies of 20 surface sediments procured from Nowgong forest division of lower Assam have portrayed an assemblage of both angiosperm and pteridophytes. The major taxa comprise *Dillenia*, *Syzygium*, *Schima*, *Terminalia*, *Dalbergia*, Oleaceae etc. as arboreals and *Oldenlandia*, Tubuliflorae, Acanthaceae, *Polygonum serrulatum*, Caryophyllaceae and grasses as non-arboreals. Fern spores include *Gleichenia*, *Davallia*, *Lycopodium*, *Cheilanthes*, *Pteris*, etc. However, *Pinus*, *Alnus* and *Abies* belong to the high altitude

taxa. The assemblage occurred, though in low value, has helped significantly in interpreting the fossil pollen data from sedimentary profiles. The soil profile belongs to Bhangar in nature by virtue of being compact, black and having moisture content, the age is estimated late Holocene (700 yrs BP at 80 cm level). The palynoassemblage reveals warm and moist-increased warm and moist climatic conditions as evidenced by the occurrence of tropical to subtropical moist forest elements comprising both phanerogams and pteridophytes. The

assemblage depicts that the general climate and vegetation had not changed much in the study area at significant level excepting a little alteration of vegetation change since late Quaternary period. It is interesting to note that the Teak (*Tectona grandis*) pollen is not recorded in assemblage in spite of its luxuriant growth around the study area, needs further studies. Occurrence of degraded pollen-spores indicates microbial activity during sedimentation.

**S.K. Bera**

A field visit to Margherita, Ledo and Lekhapani forest divisions in Upper Assam was undertaken and collected twenty surface samples, three sedimentary soil profiles for palynological study. Macerated ten surface sediments collected across Margherita-Ledo forest division and pollen analysis reflects the existence of tropical deciduous forest as evidenced by the occurrence of major arboreal taxa like *Syzygium*, *Terminalia*, *Dillenia*, *Salmalia*, *Melastoma*, etc. Grasses, herbs

and ferns are dominant in the studied assemblage over arboreals.

**S.K. Bera & S.K. Basumatary**

(w.e.f. 12.07.2005)

Carried out pollen morphological studies of 30 major tropical plant taxa belong to moist deciduous forest of Assam. The pollen grains show a wide range of variations in respect of number, nature of apertures and sexine patterns. Besides a concise account of the mode of pollination, habit and habitat of the species has also been incorporated. This pollen morphological information can greatly help in precise identification of sub-fossil pollen and their interpretation in tracing palaeofloristics of tropical regions in Assam and adjoining areas. This study would also facilitate the generic/specific identification of tropical taxa, which otherwise owing to stenopalyny are difficult to differentiate from each other.

**S.K. Basumatary** (w.e.f. 12.07.2005)

## 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

Analysed 225 samples at 2 cm interval from a 5.5 m deep gravity core (GC-7) from Karwar Coast (samples provided by Dr. Rajiv Nigam, NIO) to study distribution pattern of dinocyst and organic matter components. Dinocyst recovery throughout the core is very poor while amorphous organic matter is found to be dominant. Further study is in progress.

**Rahul Garg & Khowaja Ateequzzaman**

Studied dinocysts and palynofacies distribution pattern in a 40 cm. deep shallow core (SC-28, samples at 2 cm interval) at 200 m water depth, Karwar Coast (samples provided by Dr. Rajiv Nigam, NIO). The palynological assemblage shows

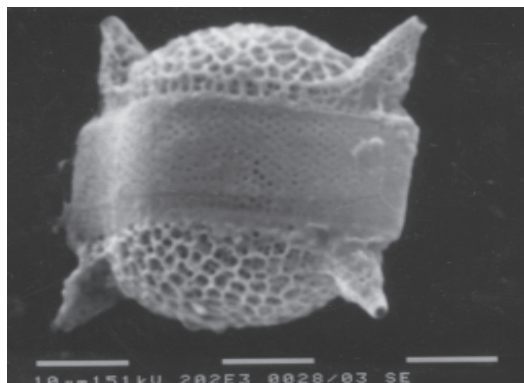
dominance of algal components and amorphous organic matter along with dinocysts and zooplanktic organic matter (copepods, scolecodonts, foram-linings). Dinocysts are represented by *Tuberculodinium vancampoae*, *Spiniferites* spp. and protoperidinioids. Comparison of vertical distribution of various organic matter components and rectilinear benthic foraminifera (RBF) is made. Direct correlation noted in peak abundance of RBFs (indicative of anoxic conditions) and selected organic matter components is very significant. Further studies are in progress.

**Vandana Prasad & Rahul Garg**

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

Continued analysis of surface sediments containing diatom assemblages collected from different environmental set up at Digha and its adjoining areas of East Midnapur district. A total of 58 diatom taxa representing 33 genera in the 63 samples have been identified. The majority of the taxa had fresh water-brackish or brackish water affinities. In general the relative abundance of fresh water-brackish species increased towards south-eastern side of the coast. Fresh water diatoms are found abundantly in some restricted areas. A paper has been finalized describing the relationship between species distribution and salinity and water depth of deposition in depth profiles along the Ramnagar Khal towards Mohana near Digha. A total of 49 species and varieties of diatoms have been recorded from the samples (3 short cores) from Kalyani Lake, Nadia district. Variation in the total diatom abundance in the sequence clearly indicates temperature fluctuations. Detailed study is now being done.

**Samir Sarkar**



*Biddulphia rhombus* (Ehrenb.) an ecological indicator diatom species recovered from surface sediments of Ramnagar Khal, East Midnapur District, West Bengal

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

*Godavari delta*— Pollen analysed 21 surface and subsurface soil samples from along the Nilaveru tributary of Godavari river. The pollen grains of terrestrial land plants are low to nil. Abundance of algal and fungal fruiting bodies that are usually saprobes or parasites on aquatic plants/ algae is recorded. Slender colourless vegetal tissues indicate either *in situ* seasonal production or short distant transport. Intrusion of saline water is supported by stray pollen grains of distant Rhizophoraceae, marine dinocysts, microforaminifers, marine annelid worms and eggshell of Copepods and other algal cysts. Fragments showing affinity to insect, annelids and animal skin are also observed in the sediments. The surface samples studied belong to subtidal (sublittoral) to least intertidal (littoral) coastal zone. This zone is periodically submerged and/or emergent. The environment is stressful for organisms, but food availability is abundant. 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.

*Off Godavari*— A 350 cm deep core (SK-127-GC- 23; 35 samples) under 200 m water depth is pollen analysed. The sediment at 340-350 cm dates back to 4400 yrs. BP (BS-2356) and from 90-100 cm dates back to 2500 ±200 (BS- 2434). The rate of sedimentation during middle Holocene is faster than the rate of sedimentation during the Late Holocene. At 1500-2000 yrs. four rhythmic cycles of Highstand System Tract and Lowstand System Tract were observed on the basis of

percentage of marine and terrestrial palynomorphs recorded in the sediment.

*Off Bengal*— A 210 cm deep sedimentary soil profile (SK-127-GC-30; 21 samples) under approx. 200 m water depth are analysed for palynological assemblage. The Radiocarbon date from 200-210 cm is 17930 ±580 yrs. BP (BS-2432). The samples studied at an interval of 10 cm throughout the core provide climatic, relative sea level and vegetation changes with the resolution of around 850 yrs when rate of sedimentation was uniform. To ascertain this, C<sup>14</sup> dates in between the core are under investigation. About seven cycles of Highstand System Tract were recorded with the variation in magnitude since 17930 yrs. BP. The magnitude was maximum between ~12000 and 13000 followed by around 8000-9000 yrs. BP.

*Off Nizamapatnam*— A 540 cm deep sedimentary soil profile (SK-127-GC-18; 54 samples) is pollen analysed. The Radiocarbon date from 530-540 cm dates back to 26430 ±740 (BS-2427). A 1000 to 1500 yrs. cyclicity of climate, sea stand system tract and vegetation are analysed. About 12 Highstand System Tract was recorded with maximum magnitude at 360 cm depth. Radiocarbon dates at different depths are being ascertained.

*Pichavaram Estuary*— Study of 6 surface and sub-surface samples from the estuary do not show significant palynological changes as markers of Tsunami event. More samples from adjoining areas are under investigation.

Anjum Farooqui

## **Project 12 : Palaeoethnobotanical investigations of Archaeological sites**

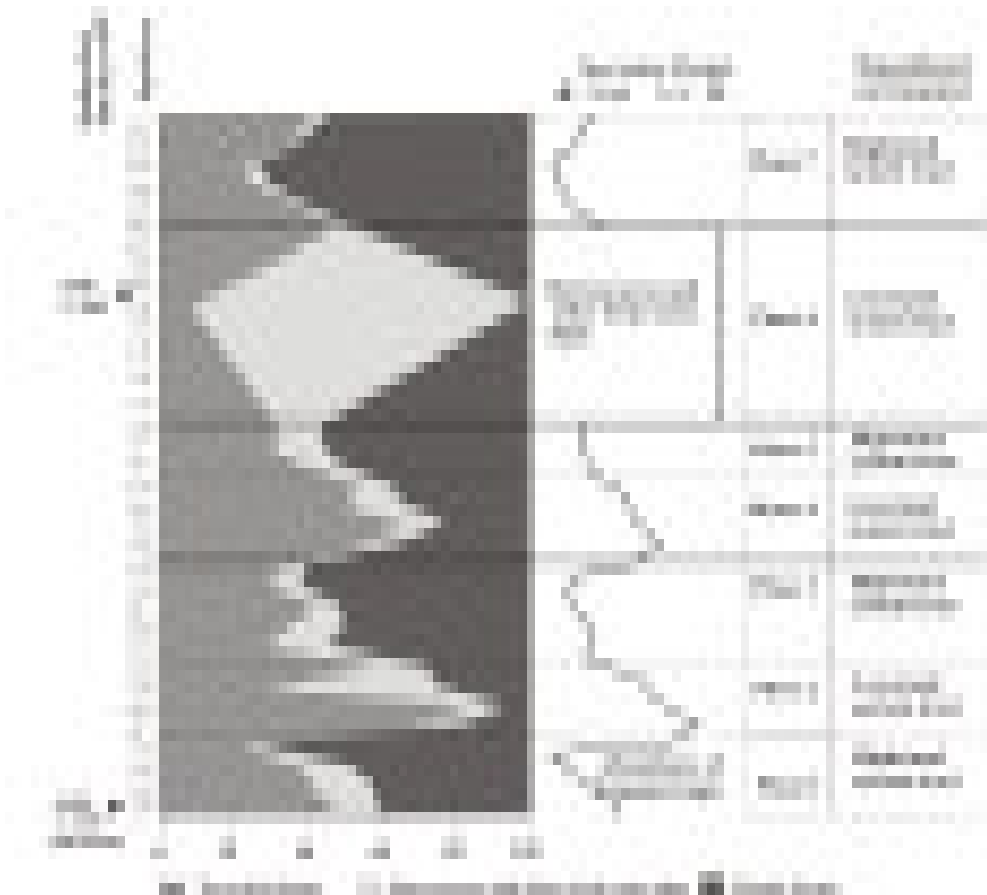
### **Component 1: Palaeoethnobotany: Ancient man, plants and environment in north and north-western India— Studies of botanical remains from the ancient sites at Jhusi in District Allahabad, UP**

Study of botanical remains recovered through the archaeological excavations at an ancient mound in Jhusi, situated on the confluence of Yamuna and Ganga rivers has been taken up. The remains of grains and seeds from a wide range of cultural deposits, datable to 2500-1000 BC reflect an advanced state of agricultural economy. The finds include the remains of field-crops belonging to rice (*Oryza sativa*), barley (*Hordeum vulgare*), bread-wheat (*Triticum aestivum*), dwarf-wheat (*Triticum sphaerococcum*), lentil (*Lens culinaris*), field-pea (*Pisum arvense*), grass-pea (*Lathyrus sativus*), green-gram (*Vigna radiata*), horse-gram (*Macrotyloma uniflorum*), sesame/til (*Sesamum indicum*) and linseed (*Linum usitatissimum*). A seed of grape (*Vitis vinifera*) recovered in the mixture suggests

its cultivation for its fruits. Associated with these crop plants, the remains of the seeds and fruits of weeds and other wild taxa have also been identified as *Vicia sativa*, *Vicia hirsuta*, *Setaria cf. glauca*, *Coix lachryma-jobi*, *Trianthema triquetra*, *Chenopodium album*, *Fimbristylis sp.*, *Acacia sp.*, *Embllica officinalis* and *Ziziphus nummularia*.

Undertook two field trips to a Neolithic site at Hetapatti, District Allahabad (UP) and a Harappan site Kanmer in District Kachchh (Gujarat) and collected rich carbonised remains from these sites during the course of archaeological excavations.

A.K. Pokharia



Percentage palynological record in marine sediment (SK/187/GC 23 Core) Off Godavari showing cyclicality of sea level fluctuation corresponding to climate changes



1&2-Botryococcus braunii infested by Nevskia ramosa bacterium; 3.Pediastrum; 4-Rhizophoraceae pollen; 5- Mangrove cuticle; 6- Budding bacteria of Planctomyces group (anaerobic oxidisers); 7- Ammonia Foraminifer lining; 8-Copepod egg shells (marine); 9-Scolecodont fragments (marine).

**Abundant fresh water forms & low % of marine forms between 3000 to 2000 yrs. BP in Off Godavari Marine sediments indicating Lowstand system tract (LST)**



### ***Component 2: Palaeobotany: Ancient man, plants and environment in north and north-western India— Studies on botanical remains from ancient sites in UP***

Continued morphologic investigation of seed and fruit remains from ancient sites at Ahirua Rajarampur (tehsil Chhibramau) and Siyapur (tehsil Tirwa), District Kannauj from cultural horizon of Kushana Period (approx. 1000 BC–300 AD) to build up plant economy practiced by the ancient settlers and to deduce regional ecological conditions in the past. Both the sites exhibit similar ancient plant economy. The field-crop finds belong to cereals, viz. barley, rice; sawan (*Echinochloa crusgallii*) and kodon-millet (*Paspalum scrobiculatum*); pulses-lentil (*Lens culinaris*), pigeon-pea (*Cajanus cajan*), khesari/grass-pea (*Lathyrus sativus*), field pea (*Pisum arvense*), green gram (*Vigna radiata*), black gram (*Vigna mungo*), horsegram/kulthi (*Macrotyloma uniflorum/Dolichos biflorus*), aconite/moth bean (*Vigna aconitifolia*); seeds of oil yielding plant-field brassica (*Brassica juncea*); jujube (*Ziziphus* sp.), Leguminous fruiting pod and seeds of silk-cotton (*Salmaal malbarica*) fibre.

A total of 32 types of weeds and wild taxa have been recovered, belonging to wild grasses, viz. *Andropogon* sp. (blue stem grass), *Avena* sp. (wild Oat), *Dactyloctenium aegyptium* (crow-foot grass), *Eleusine indica* (goose grass), *Panicum* sp. (panicum grass), *Poa* sp. (blue or meadow grass); and sedges— Flat sedge, Spikerush sedge, Fimbristylis sedge, Bulrush, *Scleria ciliata*. 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. Crow-foot grass (*Dactyloctenium aegyptium*) and all the sedges, Day-flower faint (*Commelina benghalensis*), Lalsabuni (*Trianthema portulacastrum*) may have been the weeds in summer group. Crops like rice, whereas Hairy Indigo (*Indigofera hirsute*), Sweet clover (*Melilotus alba*), common vetch (*Vicia sativa*), Pigweed (*Amaranthus* sp.), white Goose-foot (*Chenopodium album*) represent the weed components in winter crops like wheat and barley in the ancient agriculture at the site. Mullein (*Verbascum thapsus*) is occasional member along water channels where as Labbibi (*Polygonum barbatum*) and Khat-palak (*Rumex dentatus*) represent moist and swampy localities in the surroundings of habitational deposits.

Undertook field excursion to ancient site at Sanchankot (Ramkot), District Unnao to participate in the archaeological excavations and collected archaeobotanical materials in fairly good amount from cultural deposits of Painted Grey Ware (PGW), Northern Black Polished Ware (NBPW) and Shunga-Kushana Periods. The site (near Unnao-Hardoi border) is situated on the bank of river Sai, a tributary of river Gomti. Geologically the area is a part of Ganga Plain.

**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 crossdating, ring-width measurement and analyses of tree-ring series of *Juniperus macropoda* from Keylong in Lahul, Himachal Pradesh, and finalized a manuscript on *Juniperus* tree ring analyses. Summer temperature reconstruction using Juniper chronologies from the area has been finalized.

159 increment core samples from 97 trees from various forest sites in Kinnaur (Himachal Pradesh) were collected. The crossdating of tree ring sequences in 15 tree core samples of *Cedrus deodara* has been completed. The oldest age of dated tree core sample extends back to 500 years. More tree ring samples are being crossdated to prepare ring-width chronology with sufficient sample replication for climate studies.

**R.R. Yadav**

Pollen records from a 2 m deep sediment profile from the Parashar Lake in Mandi district (Himachal Pradesh) has

deduced the existence of conifer-oak forest in the vicinity of the lake since prior to 3000 yrs BP. The conifers, such as *Pinus*, *Cedrus*, *Abies* and *Picea* together with *Quercus* are the prominent forest constituents. However, based on expansion and reduction of conifers and oak and vice-versa, 3 cold and dry alternating with 2 warm and moist climatic oscillations have been inferred in the region. Pollen analysis of 10 samples from a 1.2 m deep sediment profile from Kullu district has brought out a rich pollen assemblage of both arboreals and non-arboreals. *Betula*, *Corylus*, *Carpinus*, *Quercus* together with conifers, viz. *Pinus*, *Cedrus*, *Abies* and *Picea* are the major constituents of arboreal vegetation. The ground vegetation is marked by the high frequency of grasses followed by sedges, Asteraceae, *Impatiens* and *Thalictrum*. Fern spores have been encountered very frequently. The investigation of the remaining samples is in progress.

**M.S. Chauhan**

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

Based on ring-width data of teak (*Tectona grandis* L.) from Hoshangabad (MP), mean monsoon precipitation of June-September has been reconstructed back to AD 1835. The reconstructed climate records show several alternating periods

of high and low monsoon episodes. Many of these low monsoon years have been recorded to coincide with most of the known principal drought years of India.

**Amalava Bhattacharyya**

**Project 14: Special Activities**

**Component 1: Palynological, geochemical and magnetic studies in Lahaul-Spiti and Ladakh regions: Implications to palaeoclimate and neotectonics**

Field visit to Ladakh and adjoining areas for collection of palaeobotanical and Quaternary samples (glacio-fluvial-lacustrine sediments, present lake sediments, aeolian sediments, etc.) for mega/micro plant fossils, geochemical, sedimentological and magnetic studies has been undertaken. Palm and pinnate palm have been identified from Tso-Kar locality. Finalized a paper entitled 'Miocene palynological assemblage from Nindam Formation, Ladakh Himalaya, India

and its implication on palaeoenvironment'. Another paper entitled 'Discovery of the Jurassic palynofossils from the Lamayuru Complex, Ladakh Himalaya' has also been finalized. Chemical processing of samples collected from Chameshan Nala, Nubra Valley has been completed and quantitative analysis is in progress. However, Quaternary samples collected from Nubra, Shyok and Indus Valleys have not yielded any spores-pollen. Late Jurassic/Early Cretaceous dinoflagellates



New fossil palm leaf *Palmacites tsokarensis* recorded from the Hemis Formation (Late Eocene-Oligocene), Tsokar area, Eastern Ladakh, Jammu & Kashmir

have been recovered from Karakoram region. Quantitative analysis and photo-documentation is in progress.

Water samples from various first order streams in Nubra-Shyok Valley and different places of Indus River were also collected and recorded several parameters (temperature, pH, mv, conductivity, TDS, salinity) in the field itself and further

analysis of these samples is underway at Wadia Institute of Himalayan Geology (Dehradun) to understand the surface geological processes. Geochemical data generation of Khalsar fluvio-lacustrine sediments has been done and magnetic and geochronological work is in progress. Aerobiological samples from Manali to Nubra Valley tract were collected

**Ram Awatar, Anupam Sharma & Binita Phartiyal**

***Component 2: Floral diversity, evolution, palaeoecological interpretation and relationship of Permian flora of Eastern Himalayas***

**Discontinued** (w.e.f. 2003)

Due to tectonic activity it has been found that the preservation of plant fossils is not good and their occurrence

and distribution are also limited.

**A.K. Srivastava & A.P. Bhattacharyya\***

(\*deceased)

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

Data compilation on the occurrence of growth rings in the Tertiary woods was carried out. The woods of *Araucarioxylon* and *Podocarpoxyton* among the gymnosperms together with a large number of angiosperms (dicot) woods have been studied.

**J.S. Guleria**

New additions to the wood flora of Jurassic sequences of Pranhita Godavari Graben have been made. Four new species, two each of *Araucarioxylon* and *Podocarpoxyton* have been

described. Investigation on a number of silicified woods from Kota Formation suggest occurrence of both growth ring free and woods with growth rings in the wood assemblage. Depending on the part from of which the wood was derived from the parent plant, growth ring distribution varied. Frequency of wide rings with very little late wood is high and suggestive of favourable growth period. Besides, preponderance of araucarian and podocarpean taxa indicate existence of Conifer forest near the depositional site.

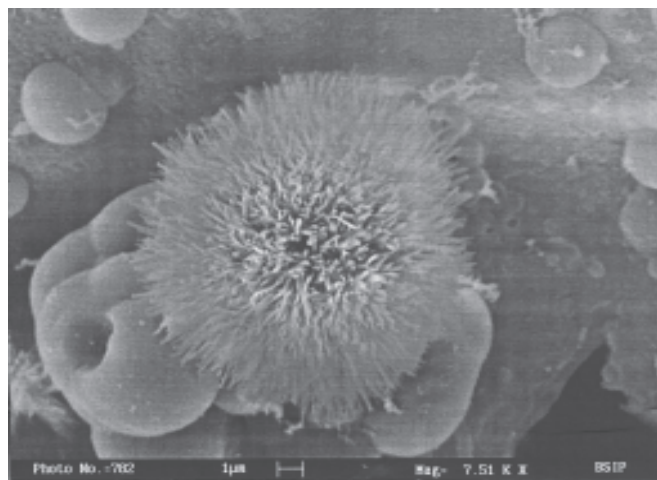
**A. Rajanikanth**

***Component 4: Floral diversity and ecology of Mahuadanr beds, Chachhari Valley, Palamau***

**Discontinued** (w.e.f. 30.09.2004) due to superannuation of G.P. Srivastava.

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

LM/SEM studies of fruits of some species of Verbenaceae and Sapotaceae families have been carried out. The fruits of Verbenaceae are species of the genus *Vitex*. Fruits are small to fairly large in size; pericarp is multiplicative, thin-walled or sometimes with reticulate thickening. Mesocarp is 2-3 layers thick whereas the endocarp is crushed. SEM study of fine thin sections shows that the mesocarp cells of the fruits are filled with a large number of oil droplets and crystals of various shapes and ornamentation. These forms of crystals are being reported in fruits of *Vitex* for the first time. All the three species investigated show variation in crystal structure. In *V. lecoxyton*, the crystals are 'puff'-like with numerous needle-like outgrowths coming out from a center point, the electron density of the needle shows that it is a homogeneous structure. In *V. pinnata* the crystals are also 'puff'-like but a crystal here is a heterogeneous structure with the central region being an electron dense area. In *V. pubescens* the central area forms a triangular structure. The free ends are flattened, ribbon-shaped



*Vitex pinnata* - Puff-like new type of crystal with numerous needles. Crystal heterogeneous in density showing electron dense area in the center

and the terminal tips are bifurcated.

Sapotaceous fruits studied are medium to large in size, and ellipsoid to compressed in shape. The surface is slimy and a variety of trichomes cover the pericarp; epicarp is leathery, mesocarp is thin-walled, aerenchymatous with vascular bundles, endocarp is very thin. Seeds are lignified, sclerotic. New forms of crystals are reported in one species of *Madhuca*, two species of *Mimosops* and a species of *Sapota*. In *Madhuca indica* the crystals are a bunch of raphides joined at one end and the other end shows dichotomy of raphides. In *Mimosops bourdillonii* the raphides are dumbbell-shaped and many dumb-

bells often join at the center; the other end is free. In *M. elengi* the crystals are rosette-shaped structures, the crystals form fringe-like structure at the periphery of the rosette. In *Sapota* sp. also the crystals are arranged in rosettes, are lanceolate in surface view. The marked differences in the crystal aggregates at the ultrastructural level suggest some differences at genetic constitution in different species. It seems likely that the morphologic and chemical nature of crystals present in different species of fruits will be useful in determining the phyletic position of the species.

Usha Bajpai

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

Writing of a manuscript entitled *An Illustrated guide of air-borne pollen grains of Lucknow in relation to their allergenic significance* has been accomplished. It has been divided into various chapters— Preface, Introduction, Aerobiological network in India, Aerobiology at BSIP (Air samplers, Sampling sites, Pollination periods, Pollen calendars of Lucknow, Details of those plants producing air-borne pollen grains in Lucknow- about 95 pollen taxa), Meteorological data and pollen incidence, Pollen allergy (Symptoms of allergy, Allergic reaction, Air borne pollen allergens, Allergy test, Desensitization and Drugs used for treating allergy), Suggestions for minimising the pollen loads, User agencies, Glossary (medical terms and morphological terms of pollen) and References.

The house dust samples of 25 asthmatic patients residing

in different parts of Lucknow city and adjoining areas are chosen for qualitative and quantitative estimates of fungi. The serial dilution plate technique revealed the presence of 19 genera. Out of which, species of *Aspergilli* belonging to *Aspergillus niger*, *A. flavus*, *A. nidulans*, *A. fumigatus*, *A. terreus*, *A. tamarii*, *A. sulphureus* are found in all investigated samples. Other reported significant fungi are *Penicillium citrinum*, *Alternaria alternata*, *Mucor hiemalis*, *M. racemosus*, *Geotrichum*, *Rhizopus stolonifer*, etc. The visual method exhibited the dominance of 'Small round spores' followed by *Alternaria*, *Cladosporium*, *Mucor*, *Fusarium*, *Penicillium*, *Microsporium*, *Trichoderma*, etc. On the basis of above findings a manuscript entitled 'Identification and prevalence of indoor mycoflora from homes of asthmatic patients of Lucknow' has been prepared.

Asha Khandelwal

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

Carried out floristic survey of North Anuppur Forest Division in Madhya Pradesh and collected 1008 plant specimens of angiosperms and 50 specimens of pteridophytes along with 5 specimens of wood and 90 specimens of fruits/seeds. Processed all plant materials and poisoned them by insecticide. Identification of the plant specimens is being done. Documented ethnobotanical information of about 30 plant species as medicine, 10 species as food and 6 species as fibre and cordage from tribal localities of the area. A research paper

on Medicinal plants of Pusprajgarh in Anuppur district has been finalized. Compilation of flora of Shahdol district (Madhya Pradesh) and medicinal plants of BSIP campus is being done. About 15 living samples of medicinal plants were brought from Amarkantak and planted in the garden.

Living and fossil data of about 6 plant species has been collected for updating Herbarium data-base of living and fossil plants. Photo-documentation of about 78 extant plant and 6 related specimens of fossils has 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**

A picture of the climate evolution in the studied region was deciphered. It was based on elemental carbon, nitrogen and pollen analyses on various aliquots from different depths of 70 cm deep sediment from Motiya Dol (Madhya Pradesh),

and complementing it with the radio carbon dates for 45-50 cms deep samples. The vegetation of the area emerged as being open, moist mixed deciduous forest before 8000 yrs. BP. It was followed by the sporadic immigration of *Shorea robusta*



along with *Terminalia*, *Embllica officinalis*, *Bombax*, *Schleichera* coupled with an increasing trend of *Madhua indica* about 6000 yrs. ago and the forest turned profuse as a result of onset of moist climate. A change took place about 3000 yrs. ago and active summer monsoon led to pre- dominantly modern sal (*Shorea robusta*) forest. The variation in the carbon-concentration in the samples analysed is within a factor of 1.5.

The carbon to nitrogen ratio also reflects a change from a value of about 12 (up to about 5000 yrs. ago) to 33 by about 3000 yrs. ago indicating greater domination of terrestrial vegetation as also indicated by the pollen record, which show domination of sal forest. The manuscript on Loktak lake work was also revised.

**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***

The number of samples dated has seen an upward swing this year and a total of 187 samples were processed, out of which 85 samples belonged to the Institute's projects, 90 samples under consultancy and 5 samples on collaboration basis. In addition to that one NBS oxalic acid standard, one internal lab standard and two background samples were processed. Work on a parallel system has been started by

selecting and initiating the procurement of necessary components. Radiocarbon assay was carried out on over 200 samples. Work relate to system maintenance was carried out with respect to the gas-preparation system as well as the counters. A new computer was attached to the counter and related validation done.

**C.M. Nautiyal, Supriya Chakraborty &  
A.K. Arya (w.e.f. 24.06.2005)**

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

The carbon determination system has been extensively used to measure the carbon content in the sediment aimed for radiocarbon dating. Aliquots of CO<sub>2</sub> of some of these samples

were collected in sealed glass ampoules. These were taken to Physical Research Laboratory, Ahmedabad and measured for C using the isotope ratio mass spectrometer.

**Supriya Chakraborty**

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

The RAC recommended (in 2004) that further action on the issue might not be taken for the time being. Geochemical investigations of Quaternary samples of Ladakh Himalaya at

the National Facility for Geochemical Research at School of Environmental Sciences, JNU (New Delhi) was taken up between September 30 and October 15, 2005.

**Anupam Sharma**

## Additional Research Contributions

A revised and updated version of the earlier catalogue, published in 1992, is being prepared containing information on palaeobiological remains (microfossils, macrofossils, stromatolites, trace fossils and problematic remains) from the Precambrian sediments of India.

**Manoj Shukla, Mukund Sharma,  
Rupendra Babu & V.K. Singh**

The studies on *Umkomasia indica*, the female fructification of *Dicroidium* reported from the Late Permian beds of Tatapani-Ramkola Coalfield have been finalized. *Ramkolia indica* gen. et sp. nov., a new equisetalean cone, has been instituted from the Tatapani-Ramkola Coalfield. Similarly the studies on the Carboniferous floras in siliciclastic rocks of Kashmir Himalaya have been finalized.

**K.J. Singh**

Samples collected along the Brahmani River Section, Talcher Coalfield, the type section of Talchir Formation have been analysed for pollen and spores. The yield of palynomorphs is poor. The palynodebris shows presence of distorted striate and non-striate bisaccates instead of monosaccate pollen. Certain pollen of Mesozoic affinity are also observed.

**Archana Tripathi**

A manuscript entitled 'Conifer wood from the Tiki Formation, South Rewa Basin (Madhya Pradesh), India' was finalized (with *Ram Awatar*). Completed another manuscript entitled 'Articulated and non-articulated Coralline algae from the Uttatur Group, South India' describing 9 species of coralline algae (with workers from Botany & Geology Departments, Lucknow University). Studied fossil woods belonging to Araucariaceae and Podocarpaceae collected from the Bellampalli area, Godavari Basin (with *O.S. Sarate*).

Importance of knowledge accrued on various palaeobiological aspects and new tools to disseminate have been brought out. Role of scientific meets, museums, electronic media, print media, exhibitions advertisement, governmental and non-governmental agencies, involvement of children/people through science popularization, building up databases and exchanging sub-data sets, etc. has been emphasized.

**A. Rajanikanth**

An update of recent trends in the petrological characterization of coal/lignite was made in the Training Manual. Coal samples (40) received under consultancy programme, from CMRI, Dhanbad were processed for petrological characterization and cleat studies (with *O.S. Sarate*).

**Rakesh Saxena**

Three posters depicting significance of fluorescence studies in characterizing of Indian coals and lignites, and utilization of fundamental petrological research in hydrocarbon (oil, gas and coal bed methane) exploration were prepared.

**Alpana Singh & B.D. Singh**

Updated and finalized a catalogue of Indian fossil plants (Tertiary Megafossils) from 1989-2005 and is ready for publication.

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

Described a fossil wood of Family Araucariaceae (*Araucarioxylon*) collected from the Kamthi Formation, near Tohegaon, Chandrapur district, Maharashtra (with *A. Rajanikanth & Rajni Tewari*). Further study is in progress. Prepared and finalized a manuscript entitled 'Encroachment of forest land in Garo Hills of Meghalaya by construction of roads: A threat to environment and biodiversity' (with *S.K. Bera & S.K. Basumatary*).

**Anil Agarwal**

A fossil fruit showing close resemblance with a coastal legume *Caesalpinia nuga* (Fabaceae) from Baragolai Formation (Upper Oligocene) of northeast India has been recorded for the first time.

**Anil Agarwal & Mahesh Prasad**

Investigation on fossil leaf impressions from Siwalik sediments of Koilabas area reveals the occurrence of 26 species belonging to 24 genera and 17 families of angiosperms. Out of these 20 species have been found new to the fossil flora of Siwalik. The presence of majority of evergreen taxa in the assemblage witnessed existence of warm and humid climate in the Himalayan foot hills during Siwalik sedimentation. Some of the taxa, like *Shorea wrightse*, *Lodes ovalis*, *Paranephellesia*, *Xestophyllum* and *Bouea macrophylla* in the assemblage are phytogeographically significant, having restricted distribution in the Malayan region. These taxa migrated from Malaya to India during Neogene times.

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

A catalogue, including all records of spores and pollen from the Indian Tertiary sediments published after 1988 up to 2004 has been prepared and finalized. This catalogue is an updation of earlier one on Indian Tertiary spores and pollen (Saxena 1991), which includes records published up to 1988.

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

Palynological study of un-differentiated Tertiary sediments from 120.40 to 80 m interval encountered in bore-hole BGG-

3 of Birbhum Coalfield (WB) drilled in Gopalnagar-Ganpur Block suggests an Early Eocene age. The assemblage records high frequency of *Proxapertites*, polycolpate taxa and fungal remains. Morphotaxonomic study of palynomorphs has been completed. Analysis of assemblage has been initiated.

**J.P. Mandal & Vijaya**

Prepared posters on the 'Application of Palynology in Hydrocarbon Exploration of Petroliferous Basins of India', 'Organic Matter Studies in Source Rock Analysis', 'Palynology and Palynofacies studies: some case histories— Gap areas where BSIP can play a role', and 'BSIP— Offerings to Industry in Hydrocarbon Exploration Research', besides a pamphlet "Birbal Sahni Institute of Palaeobotany, Lucknow: Offering Palynology as a tool to Industry in Hydrocarbon Exploration Research".

**Vandana Prasad, Madhav Kumar, Alpna Singh,  
Jyotsana Rai, S.K.M. Tripathi,  
B.D. Singh & Rahul Garg**

A catalogue of dinoflagellate cysts from India is updated, listing all the published records (since 1990) of organic walled dinoflagellate cyst taxa, described from Indian sedimentaries available as on December 2005. The nomenclatural validity and taxonomic status of all the species are assessed providing information on synonymies, orthographic changes as well as geographic and geological occurrences within India.

**Khowaja-Ateequzaman, N.C. Mehrotra &  
Rahul Garg**

The preliminary palynological study of 5 sediments from Deepor beel, an endangered wetland of Kamrup district (Assam) depicts low frequency deposition of pollen/spores, diatoms and other cryptogams as compared to the existing macro and microflora in and around the study area. Illicit encroachment of wetland area by local people and other agencies causes threat to the pristine environment. More detailed multiproxy studies are needed to understand the palaeoecological status as compared to present in important wetlands of northeast India for which beginning has been made.

**S.K. Bera**

Prepared and submitted a project proposal entitled 'Palaeoclimate during Quaternary period in Ladakh, Northwestern Himalaya: A multidisciplinary approach' under the Palaeoclimate programme of DST.

**Binita Phartiyal**

Carried out a TEM study on the cuticular membrane of various species of *Cycas* and it has been observed that in all the species the cuticular membrane exhibits a series of electron-dense bands alternating with electron lucent ones. It is suggested that the electron-lucent areas contain wax or wax precursors, where as electron dense areas are cutin rich.

**Usha Bajpai**

Finalized a paper entitled 'Identification and prevalence of indoor mycoflora from homes of asthmatic patients of Lucknow, India'. The paper compiles qualitative and quantitative analyses of house dust for the presence of fungal allergens collected from residence of 25 asthmatic patients residing in different parts of Lucknow and adjoining areas. The study revealed that the species of *Aspergillus niger*, *A. flavus*, *A. nidulans*, *A. fumigatus*, *A. terreus*, *A. tamarii*, *A. sulphureus*, *Penicillium citrinum*, *Alternaria alternata*, *Mucor himelii*, *M. racemosum*, *Geotrichum* sp. and *Rhizopus stolonifer* are potential allergens.

**Shantanu Chatterjee & Asha Khandelwal**

Consulted literature pertaining to the work carried out on Tertiary palaeoenvironment and prepared some reference cards of important papers on fossil records. Undertook a field trip (in February 2006) to Cambay Basin— Vastan Lignite Mine (Surat district) and Vagadkhol Formation (Ankleshwar district, Gujarat) with National Geographic team, comprising scientists from Belgium, India and USA. Collected a large number of animal and plant fossils from Cambay Shale (Vastan Lignite mine) and Vagadkhol formations. The plant fossils include around 200 seeds from Vastan and 12 leaf fossils of higher plants from Vagadkhol, whereas the bone fossils belong to vertebrate fossils of Mammals.

**Hukam Singh** (w.e.f. 25.01.2006)

Consulted literature pertaining to the Gondwana palynology. Learnt maceration techniques and carried out maceration of some samples from bore-holes RRK (15 samples), BKB (5 samples), and EBM (10 samples).

**Srikanta Murthy** (w.e.f. 01.02.2006)

Consulted literature related with palynology and palynofacies. Learnt sample processing, maceration and slide preparation techniques. Maceration of about 45 sediment samples was done in order to recover Quaternary dinoflagellates and also for palynofacies studies. Statistical techniques have been explored using various computer software programmes for application in palynological counts of Quaternary sediments.

**Biswajeet Thakur** (w.e.f. 01.02.2006)

## Collaborative Work

Investigated 9 samples of silicified carbonaceous/black shales associated with chert nodules belonging Wak Mamley section of Sikkim for palynological remains. The organic walled microfossils comprising of acritarchs, viz. *Leiosphaeridia*, *Lophosphaeridium*, *Cymatio-sphaeroides* and *Paracymatio-sphaeroides* and low quantity of cyanobacterial remains of extant forms of Chroococcales, Nostocales and Stigonematales orders have been recorded from 3 samples. The study is under progress.

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

Studied petrographic thin sections and isolated macerated residues of the black-bedded chert belonging to Deo ka Tibba Formation, Tal Group of Nigalidhar Syncline, Sirmaur district, Himachal Lesser Himalaya for the presence of microfossils. Organic-walled microfossils comprising cyanobacterial remains and acritarchs have been recorded. The cyanobacterial remains are in the form of solitary cells and group of the sphaeroidal cells with or without mucilaginous sheath including unbranched trichomes belonging to Chroococcales, Oscillatoriales and Pleurocapsales orders. The acritarchs are both sphaeromorphs and acanthomorphs. The work is under progress.

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

Visited and collected subsurface rock samples for palynological study from Tatapani-Ramkola and Singrauli coalfields. The samples from bore-holes SMJS-2 (5.70-631.50 m depth) and SMJS-3 (6.0-319.50 m depth) of Singrauli Coalfield have been analysed for recovery of palynomorphs. The strata between 187.20 to 256.80 m depth show presence of key taxa— *Densipollenites magnicarpus* and *Arcuatipollenites pellucidus* indicating Late Permian age. The samples from bore-holes TRBD-2 (315.60-356.45 m depth), TRBD-3 (19.00-515.20 m depth) and TROD-1 (5.66-645.15 m depth) of Tatapani-Ramkola Coalfield have also been processed for recovery of pollen and spores. Preliminary study has been taken up. The samples from TRBD-2 indicate Early Permian age, as presence of taxa *Parasaccites*, *Indotriradites*, *Jayantispores*, *Microbaculispora*, *Faunipollenites* and *Scheuringi-pollenites* has been observed. Also visited Geological Survey of India, Kolkata and discussed about the palynological reports and progress of work.

**Archana Tripathi & Vijaya [under MoU between BSIP & GSI (Coal Wing)]**

Processed coal samples (29) from seams encountered in bore-hole TRBD-3 from Tatapani-Ramkola Coalfield, and samples (3) from bore-hole SCP-9 drilled in Sohagpur Coalfield for petrographic studies. Completed the quantitative estimation of macerals, microlithotypes and associated mineral matters for categorization of coal types. Rank of these coals has also

been determined through reflectivity measurements on maceral vitrinite.

**B.D. Singh & Alpana Singh [under MoU between BSIP & GSI (Coal Wing)]**

Completed processing of samples from bore-holes SGK-64 (12 samples), SGK-69 (50 samples), A/333 (10 samples), and MCP-7 (10 samples) of Godavari Valley coalfields for recovery of palynomorphs. Prepared 8-10 slides of each yielded samples. Microscopic study (quantitative and qualitative analyses) of samples from MSP-27 and A/335 was carried out. Photography of well preserved stratigraphically significant taxa was accomplished. Recorded palynocomposition of each sample and the results communicated to SCCL. New samples from Kothagudem and adjoining areas were collected (by Field/Lab Assistant).

**Neerja Jha [& SCCL (Kothagudem, AP)]**

Biopetrological study of the coal seam samples from Gundala area of the Godavari Valley Coalfield, Andhra Pradesh was carried out. The maceral study has indicated that these coals in general are vitric in nature, containing exinite as the sub-dominating maceral. Mineral matter association is recorded between 11-26%. The reflectance study however has revealed that the maximum vitrinite reflectance ( $R_o$  max. %) of these coals ranges between 0.51 and 0.60%.

**O.S. Sarate [& SCCL (Kothagudem, AP)]**

A wood genus *Calophyllum*, a wet evergreen element, indicating existence of moist tropical conditions in the area was identified while working on fossil woods and sub-fossil logs of Kerala-Konkan basin.

**J.S. Guleria & Rashmi Srivastava [& K.P.N. Kumaran]** (Agharkar Research Institute, Pune)

Morphotaxonomic study of about 45 fossil leaves collected from a road cutting section from Thuligaol-Purniyagiri temple was carried out. A draft manuscript including 8 identified leaves belonging to family Anonaceae, Burseraceae, Fabaceae, Lauraceae and Ebenaceae has been prepared. The habit and habitat and present day distribution of northern equivalent taxa indicate that evergreen to moist deciduous elements were flourishing under warm humid climate in the region, in contrast to the mixed deciduous elements at present day.

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

*Palaeobotanical study on the fossil woods from Java Island, Indonesia*— Fossil woods from Pliocene sediments of different localities of Java Island have been investigated. The assemblage is dominated by Dipterocarps (*Anisoptera*, *Balanocarpus*, *Dipterocarpus*, *Dryobalanops* and a number



of *Shorea* species). Besides, *Croton* or *Mallotus*, *Cynometra*, *Dellinea*, *Polyalthia* and *Terminalia* have also been documented. A few woods are yet to be identified. Further work in this international project is in progress to publish as *A Catalogue of Fossil Woods from Java Island*.

**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 40 samples comprising from Dhansi (10 samples), Surajkund (10 samples) and Baneta (20 samples) formations from cliff sections of Hathnora and adjoining areas (under National Geographic Society Grant # 7386-02). Carried out pollen analysis of samples from Baneta Formation (10 samples palynologically productive). Detailed palynological study is in progress.

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

Palynofacies analysis and dinoflagellate cysts distribution pattern has been studied in 3 Late Quaternary shallow wells (SH-2, SH-29, SH-24: 261 samples) from Krishna-Godavari delta region. The study shows significant variations amongst the distribution pattern of terrestrial and marine organic matter content. Vertical distribution patterns of dinocysts, pollen-spores, various organic matter constituents (charcoal, degraded brown, well preserved cuticles, amorphous) and algal components (*Botryococcus*, *Pediastrum*) have been documented. Significant changes recorded in the relative abundance of these parameters demonstrate fluctuating transgressive/ regressive phases. The marine incursions are identified towards the base and top of the studied succession. The older marine pulse shows remarkable predominance of protoperidinioid dinocysts indicative of relatively high productivity conditions. An attempt has been made to identify various sequence components. Two distinctive marine flooding surfaces (MFS) and Transgressive Systems Tract (TST), High Stand Systems Tract (HST) and one Low Stand Systems Tract (LST) could be recognized.

**N.C. Mehrotra, Vandana Prasad & Rahul Garg** [& **S.N. Swamy** (ONGC, Dehradun)]

Studied larger benthic foraminifera and dinoflagellate cyst assemblages from Lakadong Limestone from Kurtingsiang Hill Section, Mawsynram, Khasi Hills for biostratigraphic and palaeoenvironmental interpretations. The larger benthic foraminiferal assemblage shows occurrence of marker species, viz. *Glomalveolina primaeva*, *Miscellanea juliettae*, *M. misscella* and *M. yevettae* corresponding to Shallow Benthic Zone SBZ3 of Late Palaeocene age. The study indicates a much thicker development of SBZ3 zone in the Mawsynram Plateau as compared to the adjoining Cherapunji Plateau.

**Rahul Garg** [& **Bikash Gogoi** (BSRS, Dibrugarh University)]

Recognised several palynoassociations in the Siwalik succession between 11.5 and 6 Ma exposed at Bhalubang and its adjoining areas. 69 species belonging to 51 genera are identified based on their comparison with extant taxa. The lower part of the succession is represented by the predominant wet evergreen elements, while its upper part shows dominance of moist deciduous elements. Occurrence of a low rain forest type of vegetation is suggested during the sedimentation of the Lower Siwalik rocks in Early Miocene in the studied area. The palynoflora indicates a subtropical humid climate due to the dominant occurrence of fungal spores and conidia. Finalized the results of palynological study carried out on the Siwalik sediments exposed along Suraikhola and Arjunkhola of Central Nepal.

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

Initiated work to contribute nannofossil data in a DST sponsored project entitled 'Ichnology of the Jurassic rocks of the Jara Dome of Western Mainland Kachchh, India'.

**Jyotsana Rai** [& **B.G. Desai** (University of Baroda, Vadodara)]

Silicified plant tissues (phytoliths) preserved in Late Cretaceous coprolites from India show that at least 5 taxa from extant grass (Poaceae) subclad were present on the Indian subcontinent during the latest Cretaceous. This taxonomic diversity suggests that crown-group Poaceae had diversified and spread in Gondwana before India became geographically isolated. This chance discovery of diverse parts of grasses in dinosaur dung firmly pushes back evolution of grasses from 56 million to almost 65 million years raise question about when did grasses first come into existence, how fast they got diversified and how important they are in the diets of various herbivore animals living at that time. The study indicates that the grasses were already diversifying long before the end of the Cretaceous 65 million years ago, and continued on after the Dinosaur went extinct. Other phytoliths extracted from the coprolites suggests that the suspected dung producers fed indiscriminately on a wide range of plants including grasses. These data also make plausible the hypothesis that gondwanatherian mammals with hypsodont cheek teeth were grazers.

**Vandana Prasad** [& **C.A.E. Stromberg** (Swedish Museum of Natural History, Stockholm) & **Habib Alimohammadian** & **Ashok Sahni** (Chandigarh)]

Recorded a new assemblage of calcareous algae from the Shella Formation (Jaintia Group) of South Jaintia Hills, Meghalaya. One paper has been finalized on the aspect. Further work on the taxonomic study of the algal forms and facies analyses are in progress.

**A.K. Ghosh** [& **Ajanta Sarma** (Gauhati University, Guwahati, Assam)]

On land deep cores in Godavari delta (SH-2; SH-10 and SH-17) were carried out. While SH-2 & SH-17 is rich in fresh water algal mass and shows three distinct marine incursions during Late Quaternary with the latest of middle Holocene at 6-8 m depth, the SH-10 core is highly rich in pollen-spores and reveals only two cycles of marine incursion with missing transgressive event of middle Holocene.

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

International project- *Holocene evolution of Chilka Lake, anthropogenic impact and pollution problems*: Lithofacies analysis, geochemical estimates, pollen assemblages and radiocarbon dates have been used to infer an evolutionary history for Late Quaternary vegetation succession and contemporary climatic changes through the analysis of sediment core CHI 9 from Chilka Lake. The synthesis of vegetation dynamics of each zone since 13,000 yrs has clearly envisaged the total scenario of depositional environment and more particularly the land and sea level changes. Sea level elevations are well recorded by the upward transition from *Rhizophora* dominated intertidal mangrove sediments to brackish water swamp. Transgressive sedimentation is interrupted by constructional beach barrier older spit formation around 4,500 yrs. BP, separating Chilka from the open sea and arrested progradation corresponding to a pause in relative sea level rise. Climatic fluctuation is not viewed as a direct factor since the warm and wet regime has remained fairly constant in this region since the early Holocene rather the continuity was interrupted by fluctuating sea level. In brief, Holocene environment and mangrove dynamics at CHI-9 are as follows:

13,000 to 10,000 yrs BP: Dominance of fresh water plants – Fresh to brackish water conditions.

10,000 to 7,000 yrs BP: Transgression of the sea – Development and proliferation of mangrove as a result of stabilization of the sea.

7,000 to 2,500 yrs BP: Maximum sea level highstand around 6000 yr. BP. Recession in the tidal magnitude started and at the same time increase in the fresh water discharge affecting colonization of core mangrove. Mahanadi system developed and fresh water supply increased.

2500 yrs BP - till date: Regression of the sea - Degraded mangroves and establishment of the present day conditions.

The vegetation picture of recent zone is indicative of the fact that aridity and the human influence were enhanced greatly resulting into the erosion of top soil and extermination of the mangrove forest from the landscape which one can witness

today. It has also been recorded that element concentrations of Chilka Lake are composed of anthropogenic and geogenic fractions in low range. However, phosphates and some heavy elements (e.g. As, Cr, Cu) are enriched in the recent sediments. Thus, the environmental stress of the ecosystem is increased by the use of fertilizers and pesticides in agriculture. On the basis of above facts a manuscript entitled 'Vegetation history, climate and sea level variations during the last 13,000 yrs. inferred from a pollen record at Chilka Lake' has been accomplished. Ten samples from 5.40 m deep Chilka Lake's profile CHI-51 (Poz-8505-11, 130 ±90 yrs. BP) have also been palynologically analysed exhibiting good representations of both core and peripheral mangroves along with variety of dinoflagellate cysts, microforaminifera and *Pseudoschizaea*.

**Asha Khandelwal [& M. Mohanti (Utkal University, Orissa) & Burkhard Scharf (UFZ Centre for Environment Research, Germany)]**

Completed palynological analysis from several subsurface sediments from exposed lacustrine sediment section from Polour, Iran. This study provides a broad idea of temporal succession of vegetation vis-à-vis climatic changes during middle part of the last glacial period. It has been recorded that the climate was comparatively moist (less arid) around 33-35000 yrs BP when there was more trees within the steppe vegetation growing under semi arid environment during major time span of last glacial period.

**A. Bhattacharyya & Jyoti Sharma [& Habib Alimohammadian & Ashok Sahni (Chandigarh)]**

Prepared and submitted a project 'Palaeoclimatic conditions in late Quaternary lakes, East Antarctica: a multi-disciplinary study using sedimentological, palynological, geochemical, mineral, magnetic and chronological parameters', which is sanctioned and is currently running. *Phartiyal* conducted field work (from January 14-February 20, 2006) in the Schirmacher oasis region of Antarctica.

**S.K. Bera, Anupam Sharma & Binita Phartiyal [& Neloy Khare (NCAOR, Goa)]**

SEM studies of 5 species of the genus *Rhododendron* (Ericaceae) collected from Sikkim Himalaya have shown micromorphological variations. The species investigated are *R. lepidotum*, *R. leptocarpum*, *R. maddenii*, *R. riveum* and *R. thomsonii*. It was concluded that the testa topography dimensions, especially the ornamentation pattern on the outer periclinal wall can often be helpful in identification of species.

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

## Sponsored Projects' Work

**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)

Finalized the project on Deccan Intertrappean palynoflora and undertook studies on the intertrappean sediments of Padwar (Madhya Pradesh), Anjar (Gujarat), Naskal (Andhra Pradesh) and Lalitpur (Uttar Pradesh). The first three localities yielded rich spore-pollen assemblages, represented by *Gabonispories*, *Mulleripollis*, *Ariadnaesporites* and *Azolla*, which reflect a Late Cretaceous (Maastrichtian) age. Lalitpur is the only intertrappean section that yielded Palaeocene palynomorphs, characterized by *Dandotiaspora dilata*, *D. plicata*, *D. pseudoauriculata*, *Matano-madhiasulcites* and is the only record of Tertiary fossils from an intertrappean bed. The discovery of Palaeocene palynomorphs has opened a new vista for studying the transition of palynoflora at the K-T boundary. A number of new mega and microspores have been recorded from these sections. For the first time, swarm cells of slime molds in sexual conjugation, were reported from the Padwar Intertrappean section.

Most of the palynomorphs are continental in nature, though occasionally forms having coastal affinity have also been recorded, especially from Naskal and Lalitpur. Such forms include dinoflagellate cysts and halophytic palynomorph remains related to *Nypa* and *Acrostichum*. This suggests that the intertrappean sediments were mostly deposited in freshwater bodies, though, at times marked by some degree of salinity/marine influence. The presence of fungal spores and fruiting bodies and some pteridophytic spores in the intertrappean sediments, indicate a warm and humid climate during the terminal Cretaceous/Early Palaeocene.

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)

Research material from Kinnaur (Himachal Pradesh) area had been collected to strengthen the tree ring network and to develop robust climate reconstructions. Tree core samples of *Cedrus deodara* and *Pinus gerardiana* have been collected from Kalpa area. The materials have been crossdated and ring widths measured. The 618-year (AD 1388-2005) chronology has shown strong signal of pre-monsoon precipitation.

R.R. Yadav & K.G. Mishra

**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)

The feasibility of tree-ring width data of *Abies densa* growing distantly located two sites of northeast Himalaya, Yumthang in Sikkim and T-Gompa in Arunachal Pradesh towards dating Palaeoseismic events has been explored. It has been recorded that growth (ring widths) was low either during the same year of known high intensity earthquakes of this region or subsequent year when it happened during non-growing season of the tree. This implies that dated tree ring sequences could be a promising tool in dating palaeoseismic events of the northeast Himalaya. In future, other tree ring features need to be considered along with proper selection of sites for the detailed analyses in this aspect.

Based on the 23 radii of the 6 sub-fossil woods, collected from different sites of Ziro Valley, Lower Subansiri district, Arunachal Pradesh, one floating chronology of 331 years has been prepared. Processing of other sub-fossil wood for the preparation of floating chronology is in progress. Tree ring chronology of broad-leaved taxa *Magnolia* sp based on 14 cores of 5 trees extending from AD 1701 to 1995 (295 yrs) from Lachen, N. Sikkim has been prepared. Analyses of tree growth climate relationship are in progress.

A. Bhattacharyya & S.K. Shah

Carbon isotopic analysis made from sub-surface peat deposit at Ziro Valley, Arunachal Pradesh shows that  $\delta^{13}C$  values range from -29.34‰ to -24.39‰ which suggest that since Late Pleistocene vegetation of that region is predominately of C3 type and climate was cool-moist.

A. Bhattacharyya & S.K. Shah [& I.B. Singh (Lucknow University)]

**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)

The organic walled dinoflagellate cysts occur in wide environmental conditions, i.e. brackish lake, lagoon, estuaries, shallow seas and offshore regions; hence they are considered as tracers for environmental factors, such as pH, temperature, salinity, nutrient richness, etc. Up till now most of estuarine surface sediment studies based on dinoflagellate, have been derived only from mid-high latitudes. The present dinoflagellate cyst studies of surface sediments from various estuarine environments of Saurashtra coast have been taken up with a view to monitor cysts distribution pattern and its comparison with salinity fluctuation as a result of variation in the river

runoff. The study was mostly concentrated on the coastal tracts of the rivers like Bhadar, Shetrunji, Mahi, Narmada and Kim in both Saurashtra and Mainland Gujarat region.

Studied in detail different geomorphic features of tidal mud flats, inter-tidal regions, salt marshes and estuaries, etc. during the field trip and obtained sediment cores from various estuarine zones. The analysis of the surface sediments of Harshad estuary revealed many dinocyst assemblages reflecting various depositional environments and fluctuating climatic conditions of about a few hundred years. The assemblages included several dinocyst forms of diverse morphologies. We encountered many new dinoflagellate cysts. The study shows the dominance of Proteridinioid dinoflagellate cysts, zooplanktons, tintinids, and copepod eggshells indicating high nutrient discharge probably due to south-west monsoonal activity. However, the Gonyaulacoid cysts with less number of zooplanktons and other planktons and indicate low nutrient discharge probably deposited during periods of low precipitation. Phytoliths are microscopic bodies of opaline silica produced in and between the vegetal cells particularly in grasses. Due to their resistance to decay, phytoliths are now being increasingly used for the reconstruction of monsoonal fluctuations of dry regions. Phytoliths studies were carried out on the 7.8 m profile of mid-Late Holocene succession located at Itola, Dhadhar river basin that lies in the sub-humid belt bordering the semiarid zones of western India. The exposed sediment succession consist of interbedded sand, silt, clays with thin layer of terrigenous charcoal partings dated  $3960 \pm 510$  Cal yr BP. The study shows that SW monsoon gradually weakened during mid-Late Holocene while winter precipitation which is known to commenced during early Mid Holocene was still persistent around 3960 Cal yr BP leading to cool and moist climatic conditions. After a brief phase of dry climatic conditions, the winter precipitation gradually died out resulting in a dry climatic condition. The dry and arid phase of few hundred years of Late-Mid Holocene is followed by a period of wet and humid pulse of enhanced SW monsoon during Late Holocene as evidenced by abundant warm season grass phytoliths and cultivated rice phytoliths. The present phytolith studies of late Holocene sequence provide evidence of extremely weak monsoonal activity leading to dry climatic condition during later stages of Mid Holocene which were probably the main cause of the decline of Indus valley civilization from this region.

**Vandana Prasad & Vartika Singh**

**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)

Conducted palynological studies on samples from Akli Formation located in Giral Lignite Mine, Barmer district (Rajasthan) and Tarkeshwar Formation located in Vastan Lignite Mine Surat (Gujarat). Slides prepared from the organic residues of the productive samples were subjected to morphotaxonomic and DOM studies. Base of the Akli

Formation (35 m thick) is represented by shale having borrows and nodules. Beds of this formation are arranged in 2-3 m thick cycles commencing with bentonite, followed by bituminous claystone and ending up with lignite. The Tarkeshwar Formation is about 25 m thick and is represented by claystone, shale, lignite and occasional limestone bands.

Palynoflora from Akli Formation is constituted by dinoflagellate cyst, fungal remains, pteridophytic spores and angiospermic pollen. The assemblage is dominated by angiospermic pollen of which those assignable to the families Arecaceae, Liliaceae, Oleaceae, Caesal-pinaceae, Rubiaceae, Meliaceae, Myricaceae, Onagraceae and Lamiaceae are more frequent. Palynotaxa referable to Arecaceae are abundant indicating deposition of sediments in coastal environment. Many pteridophytic spores and abundant fungal remains in the assemblage indicate warm and humid climate with high precipitation. Most of the families represented in the assemblage are presently confined to tropical-subtropical areas. Considering the high frequency of *Nypa* and *Nypa*-like pollen in the assemblage, it is inferred that the sediments were deposited in an area fringed by thick mangrove vegetation, chiefly constituted by *Nypa*. Presence of dinoflagellate cysts indicates marine influence. Comparison of the present assemblage with those recorded from the Tertiary sediments of Rajasthan, Kutch, Meghalaya and Indus Coal region of Pakistan indicates a Late Palaeocene age for the studied sequence.

Structured terrestrial and amorphous organic matter dominates basal and middle parts of the Akli section, while the top of the section is rich in black debris. The palynofacies analysis indicates moderately oxidizing conditions at the base and reducing condition at middle part, which was gradually replaced by oxidizing conditions at the top of the sequence. Palynological and palynofacies studies from Tarkeshwar Formation are in progress.

**S.K.M Tripathi & Divya Srivastava**

**Project— Glacier morphology and Quaternary glacial history of Durung Drung Glacier, Zaskar, Ladakh, J&K State** (Sponsored by DST, New Delhi, No. ESS/91/21/ 2003)

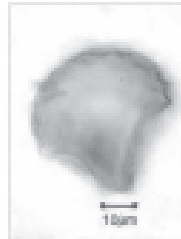
Undertook a field trip to the Durung Drung Glacier (Ladakh), covering an altitude of 4,100-4,400 m, and collected samples (subsurface sediments) from 3 trial trenches around the glacier, in which, two trenches of 73 cm and 54 cm in depths were dug from the modern lake shore of two small Proglacial Lakes close by at an altitude of 4,100 m. Another collection of 1.90 m deep profile from the exposed lacustrine sediments at Panzila (4,400 m) has been done. Thirty-eight samples have been collected at an interval of 5 cm from this profile, so that high-resolution studies could be accomplished. Maceration of these subsurface sediments for pollen analysis is complete. Further, identification and counting of pollen taxa are under progress for the preparation of pollen diagrams.

**A. Bhattacharyya & Jyoti Sharma**

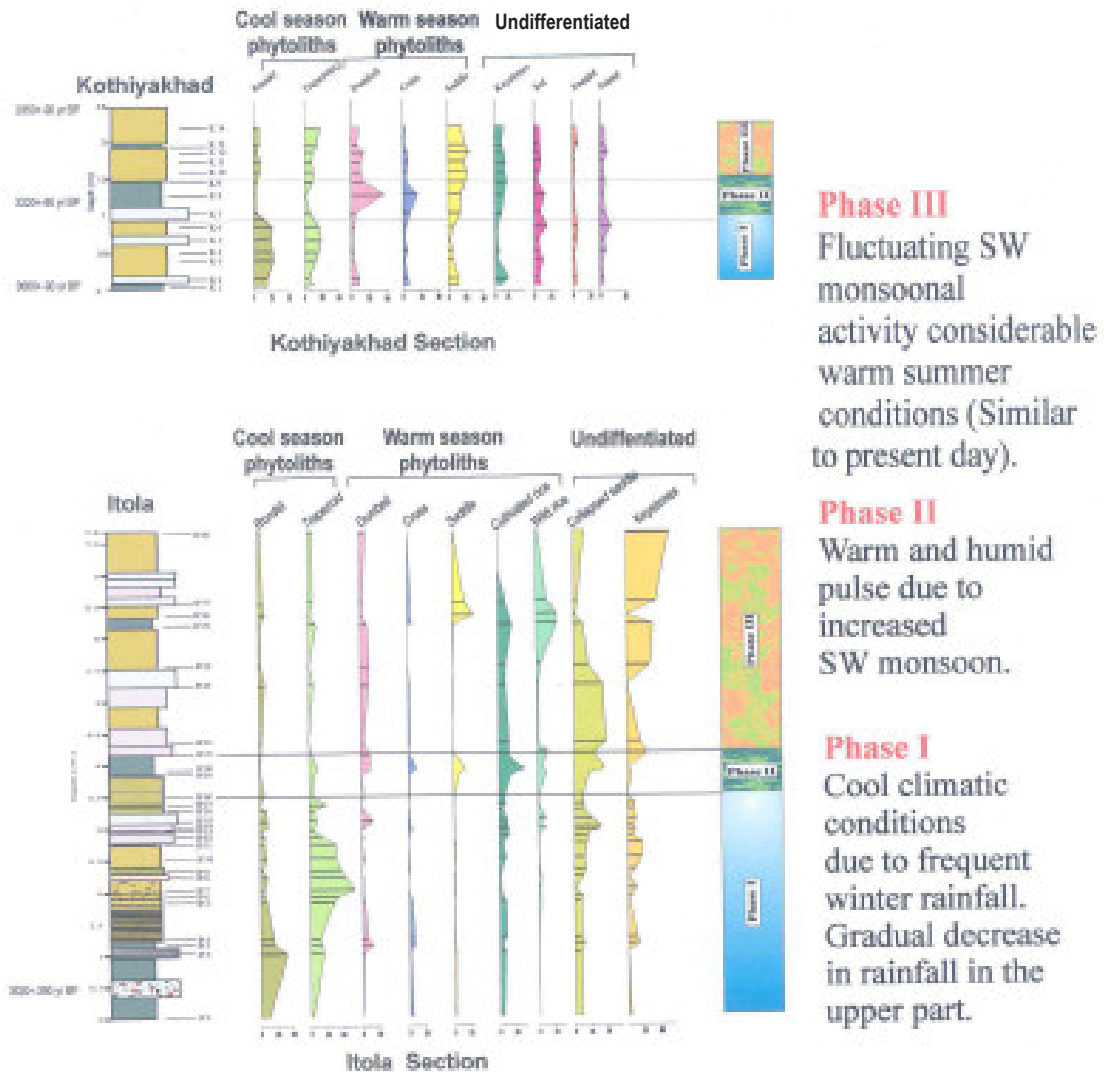




Wild rice bulliform phytoliths showing poorly developed scales.



Cultivated rice bulliform phytolith showing well developed scales on the upper margin from Holocene sediments of Mainland Gujarat.



Distribution pattern of Phytoliths in the Holocene sediments of Mainland Gujarat

Analysed several parameters of environmental geomagnetic experiments, viz. magnetic susceptibility, induced remnant magnetism, anhysteretic remnant magnetism, SIRM, S-ratio, etc. from subsurface sediments collected from the Glacier. Interpretation of data is in progress.

**A. Bhattacharyya & Jyoti Sharma [& N. Basavaiah (IIG, Mumbai)]**

**Project— Analysis of temporal variation of Glacier fluctuation in Satopanth, Bhagirathi-Khark Glacier, Uttarakhand based on Lichens** (CSIR Pool Scientist Scheme, No. 13 (8033-A/Pool/2005)

In order to identify the potential lichen species growing in Alpine region of Himalaya for the lichenometric studies herbarium of National botanical gardens has been consulted. It has been noticed that *Rhizocarpon geographicum*, *Xanthoria elegans*, *Dimelaena oreina* and *Rinodina oreina* are the important species to carry out this aspect very precisely, as these species are common and abundant in the region with high longevity, very slow growing, grows radially which is suitable for measurement of growth rate. Besides this the current status of research work carried out on this discipline in India and abroad has also been done by consulting literature at different libraries and websites to provide good feedback for the interpretation of glacial fluctuations and climatic changes in the Himalaya during last millennia.

**Shantanu Chatterjee** (w.e.f. 27.05.2005)

**Project— Palynological studies around Chaurabari Glacier (Kedarnath) with reference to climatic changes and glacial fluctuations during Holocene.** (Sponsored by CSIR, No. 13/8006-A/2005)

Undertook a field excursion to Chaurabari Glacier, Kedarnath and Garhwal Himalayas. Studied various glacial geomorphic features, like outwash plain, kame terraces, recessional and terminal moraines, supra-glacial lake, etc. and identified potential sampling sites around the glacier. Also undertook a reconnaissance trip on top of the glacier up to the snout of the Mandakini River and Chaurabari Tal (Gandhi Sarovar). Trenches were dug at 3 sites on the outwash plain and samples were collected for palynological analysis and C<sup>14</sup> dating.

**Ratan Kar** (w.e.f. 27.05.2005)

**Project— Tree-ring based millennium-long climatic reconstructions for the Himalayan region** (Sponsored by DST, New Delhi, No. SR/FTP/ES-61/2003).

Tree-ring samples of *Cedrus deodara* and *Pinus gerardiana* from Kinnaur (HP) have been collected. The tree-ring samples have been processed and annual growth rings are precisely dated to the level of calendar year of their formation. Ring-widths of 90 successfully dated samples of both the species were measured. Preparation of millennium-long ring-width chronology of *Pinus gerardiana* and around 800 years long chronology of *Cedrus deodara* is in progress.

**Jayendra Singh** (w.e.f. 25.08.2005)

**Project— Analysis of palaeovegetation and palaeoclimate of hominin bearing Quaternary sediments of central Narmada Valley, M.P.** (Sponsored by DST, New Delhi, No. SR/S4/ES/138/2005)

Initiated (in February 2006) and accordingly processed for the appointment of JRF.

**M.R. Rao**

**Project— Quaternary sedimentary records of Baroda Window, Mainland Gujarat: A multidisciplinary approach** (Sponsored by DST, New Delhi, No. SR/S4/ES-2/ Baroda Window/P1/2005)

Sanctioned and received funds (in February 2006) and accordingly initiated the work, under the Shallow Subsurface Studies Programme of DST.

**Anupam Sharma, S. Chakraborty, Vandana Prasad & Binita Phartiyal** [& Vivek Prasad (Lucknow Univ.)]

**Project— Isotope and chemical tracer analysis to infer Late Quaternary climate variability from lake sediments and terrestrial deposits of eastern India** (Sponsored by DST, New Delhi, No. SR/S4/ES-129/2004)

Sanctioned and received funds (in February 2006) and accordingly initiated the work.

**S. Chakraborty**

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Group Photograph of Members, who attended Meeting of Geological Society of India, North India Chapter held at BSIP on 29th August 2005

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- Tripathi A & Ray A** – Palynostratigraphy of the Dubrajpur Formation (Early Triassic-Early Cretaceous) of the Rajmahal Basin, India. *Palynology.*

## Consultancy / Technical Assistance Rendered

### Radiocarbon Dating Unit

The consultancy services were provided to the following Institutes/Organisations for Radiocarbon Dating of a variety of samples:

- Archaeological Survey of India, Nagpur (9 samples)
- Archaeological Survey of India, Patna (8 samples)
- Archaeological Survey of India, Pune (13 samples)
- Archaeological Survey of India, Vadodra (5 samples)
- Center for Earth Science Studies, Trivandrum (33 samples)
- Cochin University of Science and Technology (3 samples)
- Deccan College, Pune (1 sample)
- Geological Survey of India, Lucknow (1 sample)
- Geological Survey of India, Kolkata (10 samples)
- Indian Institute of Geomagnetism, Mumbai (2 samples)
- Institute of Rajasthan Studies, Udaipur (2 samples)
- K.P. Jaiswal Institute, Patna (4 samples)
- M.S. University, Vadodara (1 sample)
- National Institute of Oceanography, Goa (12 samples)

- Rohilkhand University, Bareilly (6 samples)

### SEM Unit

The unit has standardized techniques to study in-vitro samples (protocorm, leaf, stem, root), microbiological samples, fungal mycelia, pollen-stigma relationship and intestinal parasites. Ultrastructural studies of thin sections and fractures of samples to investigate internal structure have also been undertaken. The unit has provided consultancy services, which include processing of biological samples (living samples– fixation, dehydration, mounting, coating), ultrastructural investigation and microanalysis. The scientists/scholars of following Institutions and Universities have availed the use of our facilities and expertise:

- Botany Department, Lucknow University, Lucknow (35 samples)
- Christ Church College, Kanpur (3 samples)
- Department of AI History and Archaeology, Lucknow University, Lucknow (5 samples)
- Department of Metallurgical Engineering, BHU, Varanasi (3 samples)

- French Institute, Pondicherry (3 samples)
- GB Pant University of Agriculture and Technology, Pantnagar (6 samples)
- KG Dental University, Lucknow (20 samples)
- National Botanical Research Institute, Lucknow (7 samples)
- Physics Department, Lucknow University, Lucknow (4 samples)
- Sant Gadge Baba Amravati University, Amravati (34 samples)
- Zoology Department, Lucknow University, Lucknow (8 samples)

### Electronic Data Processing

The unit has provided one month computer practical training to 4 students of Girls' Polytechnic (Faizabad Road), Lucknow studying for Diploma in Computer Science.

### Library

The unit has provided training to the two apprentice trainees– Miss Reeta Verma and Mr. Ajai Kumar Prajapati from the Board of Apprenticeship Training (Northern Region) Kanpur.

### Scientists

**J.S. Guleria** rendered expert opinion and necessary help on Ghughua fossils and Fossil Park to Mr. Kiran Desai, Programme Director, Centre for Environmental Education, Ahmedabad and to Mr. K. Nayak IFS, Conservator and Director, Kanha Tiger Reserve, Mandla (MP) for modifying the National Fossil Park. Held field meetings with them and other officials at Mandla and Fossil Park site during April 26-27, 2005. A write up on fossils, their methods of studies, radiometric dating and on fossils of Mandla was also provided to these authorities.

**Neerja Jha** provided scientific assistance to Ph.D. students– Miss K. Pauline Sabina and Mr. S Mahesh from Mysore University, Manasagangotri (Karnataka) in palynological studies and identification of pollen and spores.

**B.D. Singh** and **Alpana Singh** provided scientific assistance in Basics of Coal Petrology and in identification of coal macerals (both under normal and fluorescence modes) to two Ph.D. students– Mr. S. Mahesh and Miss K. Pauline Sabina of Department of Studies in Geology, University of Mysore, Manasagangotri (Karnataka).

## Papers presented at Conferences/Symposia/Meetings

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- Singh V & Prasad V** – Phytoliths as indicators of monsoonal variability during Mid-Late Holocene in Mainland Gujarat, Western India. *PAGES 2<sup>nd</sup> Open Science Meet.*, Beijing, China, August 2005.
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- Tripathi SKM, Mathur SC, Nama SL & Srivastava D** – Palynological studies from Late Palaeocene sequence exposed near Matasukh-Kashnou area, Nagaur District, western Rajasthan, India. *XX Indian Colloq. Micropaleontol. Stratigr.*, Visakhapatnam, October 2005.
- Tripathi SKM & Saxena RK** – Fossil microthyriaceous fungi. *Diamond Jubilee Nat. Conf. Challenges in Indian Palaeobiology*, BSIP, Lucknow, November 2005.



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

### DIRECTOR

#### **N.C. Mehrotra, Rahul Garg, Madhav Kumar, Alpana Singh & Vandana Prasad**

Participated in the Group Discussion on 'New Areas of Research and Development (R&D) in Exploration Palynology' organized by the BSIP and held at Wadia Institute of Himalayan

Geology (WIHG), Dehradun during September 15-17, 2005. Also visited various laboratories of KDMIPE (ONGC) and interacted with expert scientists. **Mehrotra** and **Garg** again visited WIHG on November 25, 2005 for discussion on 'New R&D Areas in Palynology'.

### SCIENTISTS

#### **A. Bhattacharyya & S.K. Shah**

Attended DST sponsored SERC School on 'Crustal Deformation and Tectonic Geomorphology Module-1: Concept in Quaternary Geology', IIT, Kanpur; March 27 - April 16, 2005.

Meeting held at New Delhi on February 28, 2006 for presentation of a joint collaborative research programme (with scientists from Institute of Botany, Beijing, China).

#### **C.M. Nautiyal, P.K. Bajpai, Madhavendra Singh, Sanjay Singh & Pawan Kumar**

Deputed to organize and run an exhibition on Institute's activities at 'Technology Fairs-cum-Exhibition on Rural Technology' hosted at Amethi (UP) during February 18-22, 2006.

#### **S. Chakraborty**

Visited Physical Research Laboratory, Ahmedabad during February 19 to March 01, 2006 for doing mass spectrometric analysis of sediment organic matter, and calibration of the Carbon Determination System.

#### **Binita Phartiyal**

Attended acclimatization and pre-induction Training Programme for participation in the 25<sup>th</sup> Indian Antarctica Expedition, conducted by Mountaineering and Skiing Institute, ITBP, Auli during September 30 to October 09, 2005.

#### **Rahul Garg**

Attended Training Programme on 'Contract Labour (Regulation and Abolition) Act-1970' organized by National Institute of Public Administration at Hotel The Capitol (Raj Bhawan Road), Bangalore during March 3-4, 2006. Also visited Office of the Geological Society of India for exploring the possibility of joint publications during Institute's Diamond Jubilee year.

Participated in the XXV (Silver Jubilee) Indian Scientific Antarctica Expedition for three and a half months (December 15, 2005-March 18, 2006) organized by National Center for Antarctic and Oceanic Research (Goa) in association with Department of Ocean Development, (Govt. of India), besides participated in the Fire fighting training, Sea Scan, Panjim (Goa) on December 18, 2005.

#### **J.S. Guleria**

Attended Training Programme on 'Intellectual Property Rights and WTO related Issues' sponsored by DST and organized at Administrative Staff College of India, Hyderabad during January 23-27, 2006.

#### **Vandana Prasad**

Attended the Group Monitoring Meeting held at Indian Institute of Technology, Mumbai on November 12, 2005 in connection with the review of progress of the sponsored project.

#### **Asha Gupta**

Visited Jiangsu Institute of Botany, the Chinese Academy of Sciences and late Prime Minister Dr. Sun Yat Sen's tomb during associated Field Excursions of International Bryological Symposium held at Nanjing Normal University, Nanjing in October 2005.

#### **A. Rajanikanth**

Attended Training Programme on 'Intellectual Property Rights and WTO related Issues' sponsored by DST and organized at Administrative Staff College of India, Hyderabad during June-July 2005.

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

Attended Workshop on 'Implementation of the Provisions of The Right to Information Act-2005' organized by Impact Academy of Training and Consultancy, Gurgaon and held at Hotel Vikram (Lajpat Nagar), New Delhi during November 17-18, 2005.

#### **M.R. Rao**

Attended and presented a project entitled 'Analysis of palaeovegetation and palaeoclimate of hominin bearing Quaternary sediments of central Narmada Valley, MP' at the 5<sup>th</sup> DST-PAC-ESS meeting held at Department of Geophysics, Andhra University, Visakhapatnam during July 30-31, 2005.

#### **R.C. Mehrotra & D.C. Saini**

Attended the Project Assessment Committee (PAC)

Participated in the DST sponsored Training Programme on 'Cretaceous Outcrop Sequence Stratigraphy of

Trichirappalli, India' organized by Department of Geology, Anna University, Chennai and held at Trichirappalli during August 18-21, 2005.

Attended Training Programme on 'Negotiating Strategies in Work Environment' sponsored by DST and organized at Administrative Staff College of India, Hyderabad during January 23-February 4, 2006.

#### D.C. Saini

- 1 Visited Institute of Botany, Chinese Academy of Sciences, Beijing, March 10-April 30, 2005 for discussions regarding a joint project proposal on Comparison of Tropical forest in China and India.

#### Samir Sarkar

Visited Department of Geology and Palaeontology, Masaryk University, Brno; Botanical Institute and Institute of Geology, Academy of Sciences, Prague (Czech Republic) during March 30 to June 15, 2005 under bilateral INSA-ASCR Exchange Programme of the Indian National Science Academy.

Carried out palynological investigation (with Drs. Nela Dolacova and H. Sarka of Masaryk University) of sediments of the Karpathian age in the Karpathian foredeep of Moravia. Studied palynofloral assemblages from several localities—Medloy, Hevlin, Slup, Dolni, Dunajovice, and cores Nosislav-3, Zdanice-67, 68. Pollen and spores confirm a warm to warm-temperate climate. The existence of euxinic conditions in the several parts of the Carpathian marine environment was confirmed by this palynological data. Undertook 4 field trips to different fossil localities, viz. Zbysov, Zidlochovice, Chernovice and Hevlin (Carpathian Stages stratotype locality). Detailed study is in progress.

#### R.K. Saxena

Participated in the 2<sup>nd</sup> NIAS-DST Programme on 'Multidisciplinary Perspectives on Science and Technology' held at Bangalore during July 25 to August 6, 2005.

#### Anupam Sharma

Visited National Bureau of Soil Science and Land use Planning, Nagpur under a Training on Clay Mineral Separation and Identification Techniques from June 19 to July 02, 2005.

#### Jyoti Sharma

Attended the DST sponsored Contact Course on 'Lithofacies Mapping in the Sedimentary Basin of Krishna-Godavari Tract of Andhra Pradesh' conducted by Geological Survey of India Training Institute, Hyderabad during August 24-31, 2005; and Training Programme on 'Microwave Remote Sensing Data Processing and Analysis for Glacier and Snow studies' conducted by IIT, Bombay during October 24-28, 2005.

#### B.D. Singh

Attended Presentation Meeting on 'The Right to Information Act-2005' conducted by Sri Rakesh Malhotra, Under Secretary, Department of Personnel and Training (Govt. of India) and organized in Technology Bhawan (DST), New Delhi on July 21, 2005.

Participated in a pre-Workshop Short Course organized by the Total CBM Solutions (India) in association with Directorate General of Hydrocarbons at New Delhi on November 24, 2005. The course was related to coal bed methane (CBM) life cycle and conducted by two eminent consultants of USA. Dr. Jeffrey R. Levine provided at length about fundamentals and origin of CBM, characterization of coal, estimation of gas, geologic controls on exploration and reservoir assessment of CBM. Dr. Ian Palmer introduced about the recent best practices of drilling technology in CBM production.

Attended National Workshop on 'The Right to Information Act-2005' organized by National Institute of Public Administration at Hotel The Capitol (Raj Bhawan Road), Bangalore during February 24-25, 2006.

#### K.J. Singh

- 1 Visited School of Earth, Ocean and Planetary Sciences, Cardiff University, Cardiff, UK under INSA (India)-Royal Society (London) Exchange of Scientists Programme during March 29 to June 27, 2005.
- 1 Worked with Professor Dianne Edwards, FRS. Fifteen rock samples from Ludford Lane belonging to Silurian and Devonian ages were macerated to extract 40 very small mesofossil specimens. These were studied using light and Scanning Electron Microscope and about 490 SEM images, depicting sporangial sacs, *in-situ* spores (Dyads, Laevigate and trilete spores), tubes, nematophytes and pastry cutter structures, etc. were taken.
- 1 Undertook field visit to Brecon Beacon Mountains and Capelhoreb Hills (Cardiff). The Devonian sediments are very well exposed in the BB Mountains. Very small plant fragments are seen preserved in the gray to greenish colored fine siltstone. Rocks of Late Silurian are preserved in the Capelhoreb Hills. *Cooksoonia* axes and *Lingula* Brachiopods are most predominant in this marginally marine locality. Undertook another field visit to South Wales and Bristol-Somerset coalfields. SW Coalfield in the Wales Country has the distinction of having Anthracite coals of Upper Carboniferous age. One of the best-known localities in B-S Coalfield is Writhlington Geological Nature Reserve known for its well-known Radstock flora of top Westphalian age (Upper Carboniferous). Also attended Linnean Society Annual Meeting on Palaeobotany held at Linnean Society, Burlington House (Piccadilly), London on April 26, 2005.

#### Manoj Shukla

Participated in National Working Group Meeting IGCP-493 'Rise and Fall of Vendian Biota' held at GSI, Kolkata on December 13, 2005.

#### Archana Tripathi

Participated in the Symposium field work programme to 'The Lower Cretaceous around Neuchatel: Jura Mountains, Switzerland' on September 7, 2005. Visited the Hauterivian

historical type locality (Hauterive); Pierre Jaune de Neufchatel outcrop; Early Hauterivian fossiliferous Marne Bleue d' Hauterive; The Nerivea Bed, marker bed of Kimmeridgian-Tithonian (Portlandian) transition and Valanginian historical type locality- Valangin. Also visited museum of Natural History in Neufchatel having special display of fossil fishes described by Louis Aganiz (1807-1873).

**R.R. Yadav**

Attended the Group Monitoring Workshop on Weather and Climate Research programmes held at INSA, New Delhi during January 11-12, 2006.

**R.R. Yadav & A. Bhattacharyya**

Attended INQUA Meeting and DST-BSS Workshop held at PRL, Ahmedabad during March 2-3, 2006.

**ADMINISTRATION****S.C. Baipai**

Attended Seminar on 'Human Values and University Education' held at G.B. Pant University of Agriculture and Technology, Pantnagar during August 24-25, 2005.

**TECHNICAL****P.S. Katiyar**

Attended the National Conference on 'Paradigm Shift through E-Governance' organized by Computer Society of India (Division III, IV) and Lucknow Chapter and held at Hotel Taj Residency, Lucknow during March 4-5, 2006.

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

Attended the National Conference on 'Current Trends in Computer Technology and Bioinformatics (CONMICRO-2005)' held at Lucknow during May 14-15, 2005.

**Kavita Kumar, V.K. Nigam & Dharendra Sharma**

Attended Seminar on 'MCIT Library Consortium Digital

Library Services: Users Awareness Programme' held at Lucknow on March 7, 2006.

**Subodh Kumar**

Participated in the Summer Training Programme on Electron Microscopy held at Department of Anatomy, All India Institute of Medical Sciences, New Delhi during May 16 to June 30, 2005.

**Madhavendra Singh & S.R. Ali**

Participated in the Training Programme on 'Bioinformatics- Tools and Applications' held at Bioinformatics Centre, Lucknow during May 18-20, 2005.

## Deputation to Conferences/Seminars/Workshops/Meetings

### DIRECTOR

#### N.C. Mehrotra

- 1 *14<sup>th</sup> Biennial Convention of Indian Geological Congress & National Conference on Earth Science– Its Relevance to Society* held at Delhi University, Delhi from December 2-4, 2005.

#### N.C. Mehrotra, Rahul Garg, A. Bhattacharyya & S.K. Bera

- 1 *National Workshop on Scientific Investigations during XXV Indian Antarctic Expedition* held at National Centre for Antarctic and Ocean Research (NCAOR), Goa from July 21-22, 2005.

#### N.C. Mehrotra, Rahul Garg, Alpana Singh & Vandana Prasad

- 1 *Seminar on Synergy of Research & Development in Hydrocarbon Sector* organized by Petrotech Society and

held at Goa from December 9-10, 2005.

#### N.C. Mehrotra & Asha Khandelwal

- 1 *AOGS-2005— 2<sup>nd</sup> Asia Oceania Geosciences Society Annual Meeting* held at Singapore from June 20-24, 2005.

#### N.C. Mehrotra, Samir Sarkar, S.K.M. Tripathi, Asha Gupta, Jyotsana Rai & A.K. Ghosh

- 1 *International Seminar on Northward Flight of India in the Mesozoic-Cenozoic– Consequences on Biotic Changes and Basin Evolution* held at University of Lucknow, Lucknow from December 7-9, 2005.

#### N.C. Mehrotra, Manoj Shukla & Mukund Sharma

- 1 *National Seminar on Sedimentary Basins of the Himalaya– Challenges for the Future & XXII Convention of Indian Association of Sedimentologists* held at WIHG, Dehradun from December 21-23, 2005.

### SCIENTISTS

#### S.K. Bera

- 1 *Seminar on Earth Science of East Antarctica– National and International Contribution* held at New Delhi from September 15-16, 2005.

#### A. Bhattacharyya & S.K. Shah

- 1 *National Seminar on Geology and Energy Resources of NE India– Progress and Perspectives* held at Nagaland University, Kohima from November 8-10, 2004.

#### A. Bhattacharyya, S.K. Shah & Vartika Singh

- 1 *PAGES – 2<sup>nd</sup> Open Science Meeting on Palaeoclimate, Environmental Sustainability and our Future* held at Beijing, China from August 10-12, 2005.

#### Supriya Chakraborty

- 1 *Workshop on Accelerator Mass Spectroscopy* held at Inter University Accelerator Center, New Delhi on September 23, 2005.

#### Anjum Farooqui & S.K. Shah

- 1 *3<sup>rd</sup> International Conference on Plants and Environmental Pollution (ICPEP-3)* held at NBRI, Lucknow from November 28-December 02, 2005.

#### Rahul Garg, Samir Sarkar, M.R. Rao, Ram Awatar, A. Rajanikanth, Rajni Tewari, Jyotsana Rai & Divya Srivastava

- 1 *XX Indian Colloquium on Micropalaeontology and Stratigraphy* held at Andhra University, Visakhapatnam from October 24-26, 2005.

#### Rahul Garg, S.K.M. Tripathi & Jyotsana Rai

- 1 *3<sup>rd</sup> Seminar on Academia-Industry Interface* held at INSA, New Delhi from September 23-24, 2005.

#### J.S. Guleria

- 1 *Workshop on Recent Advances and Perspective Challenges in Indian Non-Marine Late Cretaceous* organized by the Gondwana Geological Society and held at Nagpur from April 23-25, 2005,

#### Asha Gupta

- 1 *International Bryological Symposium for Prof. Pan-Chieh Chen's Centennial Birthday* held at Nanjing, China from October 25-31, 2005.

#### Asha Khandelwal

- 1 *10<sup>th</sup> International Conference on Indoor Air Quality and Climate* held at Beijing, China from September 4-9, 2005.

#### R.C. Mehrotra

- 1 *XVII International Botanical Congress* held at Vienna, Austria from July 17-23, 2005.

#### C.M. Nautiyal

- 1 *Seminar on Media, Technology and Rural Development* held at VBS Poorvanchal University, Jaunpur from October 22-23, 2005.
- 1 *Workshop on Geographical Indicators– Protection and Registration* organized jointly by CST-UP & TIFAC-DST and held at Lucknow on January 3, 2006.

#### Mahesh Prasad

- 1 *National Conference on Current Researches in Plants and Microbial Science* held at University of Burdwan, Burdwan (WB) from November 26-27, 2005.

#### A. Rajanikanth

- 1 *National Seminar on Advances in the Frontiers of Environmental Research* held at Visakhapatnam from November 19-21, 2005.

**D.C. Saini**

- 1 *Silver Jubilee Symposium on Ethnobotany in the New Millennium* held at NBRI, Lucknow from January 12-14, 2006.

**Samir Sarkar & S.K.M. Tripathi**

- 1 *National Field Workshop on Sub-Himalayan Palaeogene Sediments in Context of India-Asia Collision* organized by WIHG, Dehradun and held at Chandigarh from March 24-26, 2006.

**Rakesh Saxena**

- 1 *National Seminar on Beyond Petroleum* organized by Petrotech Society & Engineers India Ltd. and held at New Delhi from January 9-10, 2006.

**B.D. Singh**

- 1 *International Seminar on Coal Science & Technology–Emerging Global Dimensions* organized jointly by CFRI and CMRI (Dhanbad) and held at New Delhi from April 12-13, 2005.
- 1 *National Workshop on Coalbed Methane* held at PHD House, New Delhi from November 24-26, 2005.

**K.J. Singh**

- 1 *IGCP-469 – Late Variscan Terrestrial Biotas and Palaeoenvironments* held at National Museum and Galleries of Wales, Cardiff, UK from April 14-16, 2005,

**Chanchala Srivastava, M.S. Chauhan & A.K. Pokharia**

- 1 *International Seminar on First Farmers in Global Perspective* held at Directorate of UP State Archaeology, Lucknow from January 18-20, 2006.

**Archana Tripathi**

- 1 *7<sup>th</sup> International Symposium on the Cretaceous* held at Switzerland from September 5-9, 2005.

**R.R. Yadav**

- 1 *Seminar on Disaster Management– Role of Meteorology and Allied Disciplines* held at Ranchi from April 8-9, 2005.

**R.R. Yadav, M.R. Rao, A. Bhattacharyya, S. Chakraborty, Anupam Sharma, B. Sekar, S.K. Shah, Vartika Singh & Jyoti Sharma**

- 1 *DST-Brain Storming Session Workshop on Palaeoclimate* held at University of Pune, Pune from November 25-27, 2005.

**MAJORITY OF SCIENTISTS**

- 1 *Diamond Jubilee National Conference on Challenges in Indian Palaeobiology– Current Status, Recent Developments and Future Directions* held at BSIP, Lucknow from November 15-16, 2005.



## Lectures Delivered

### DIRECTOR

#### N.C. Mehrotra

- 1 *Application of Palynology in Hydrocarbon Exploration in the petroliferous basins of India* (Chief Guest Lecture) at University Faculty Training Programme, Delta Studies Institute, Visakhapatnam (July 30, 2005).
- 1 *Industrial Palynology and its relevance to Society* (Keynote Address) at 14<sup>th</sup> Biennial Convention of IGC and National Seminar on Earth Sciences, New Delhi (December 2, 2005).
- 1 *BSIP and its capabilities in Hydrocarbon Exploration* (Guest Lecture) at Petrotech Conference Synergy in R&D, Goa (December 10, 2005).
- 1 *High-resolution palynostratigraphy in Earth Sciences with special reference to Hydrocarbon Exploration* (Invited Lecture) at Geological Society of India Meeting at WIHG, Dehradun (December 23, 2005).
- 1 *Palynology– Today* (Prof. D.D. Pant Memorial Lecture) at Department of Botany, Allahabad University, Allahabad (February 3, 2006).

### SCIENTISTS

#### S.K. Bera

- 1 *Palynology, Palaeoclimate and Implications* at Assam Science Society, Goalpara, Assam. (January 28, 2006).

#### A. Bhattacharyya

- 1 *Climatic Changes vis-à-vis Glacial Fluctuations in the Trans Himalayan Region* (Invited Lecture) at Geology Department, Jammu University (September 21, 2005).

#### Supriya Chakraborty

- 1 *Principle of Radiocarbon Dating and its applications* at the Department of Archaeology and Ancient History, Lucknow University (February 11, 2006).

#### Anjum Farooqui

- 1 *Role of Palynology in the study of Deltaic Ecosystem* at University Faculty Training Programme, Delta Studies Institute, Visakhapatnam (July 30, 2005).

#### Asha Gupta

- 1 *Fossil Spores– An overview* at International Bryological Symposium for Prof. Pan-Chieh Chen's Centennial Birthday; Nanjing Normal University, Nanjing, China (October 26, 2005).

#### C.M. Nautiyal

- 1 Anchored a Science Programme for Lucknow Doordarshan (telecast on July 6, 2005)
- 1 *Innovations in Science Projects* at INTEL Workshop for Principals, State Institute for Science Education, Allahabad (September 15, 2005).
- 1 *Physics in Everyday Life* at BTSI College, Kakori, Lucknow under Science Club/ UP-CST (September 27, 2005).
- 1 *Isotopes- From Ocean to Sky* at Refresher Course for Degree and PG teachers, Physics Dept., University of Lucknow (on October 21, 2005).
- 1 *Science Communication: Quo Vadis?* (Keynote Speech)

at VBS Poorvanchal University (October 23, 2005).

- 1 A science- based serial of 10 episodes *Ambar mein Baaraat* by AIR, Lucknow (October-December, 2005)
- 1 *Vigyan evam Prodyogiki ke Badhte Kadam* at Maharaj Ganj Mahotsav under the auspices of Science Club – under UP-CST (February 24, 2006).
- 1 *Criteria for Coordinators* (Invited Lecture) at OTS, Jaipur organized by DST, Rajasthan and NCSTC Network (during March 18-19, 2006).

#### A. Rajanikanth

- 1 *Upper Gondwana Palynology* at GSI Staff Training Institute, Hyderabad (June 27, 2005).
- 1 *Intellectual Property Rights: Strategies and challenges* at Administrative Staff College of India, Hyderabad (July 01, 2005).
- 1 *Past plant signatures- An environmental elucidation* at Department of Environmental Sciences, Andhra University, Visakhapatnam (November 21, 2005).
- 1 *Plant strategies to meet changing physical environment* at AVN College, Visakhapatnam (November 22, 2005).
- 1 *Palaeomolecularbiology* at Govt. Women's College, Andhra University, Visakhapatnam, (November 22, 2005)

#### Samir Sarkar

- 1 *Palynofloral diversification in India through ages (Palaeocene-Pliocene): Stratigraphic and palaeoenvironmental implications* at Department of Geology, Misery University, Brno, Czech Republic (April 2005).

#### K.J. Singh

- 1 *Birbal Sahni Institute and its activities and Gondwana Flora of India* at Department of Earth, Ocean and Planetary Sciences, Cardiff University, Cardiff, UK (April 2005)

## ADMINISTRATION

### S.C. Bajpai

- 1 *Global and National Energy Scenario* (June 7 & 14, 2005) and *Integrated Rural Energy Programme– A case study* (June 10 & 17, 2005) at Training Programme for the Coordinators of Technical Backup Units, Alternate Energy Research Development and Training Centre, Lucknow (Invited Lectures).
- 1 *Solar Energy– Technology and Devices* (Invited Lecture)

at Training Programme for the Officers of NEDA and different Nodal Agencies of various States, Alternate Energy Research Development and Training Centre, Lucknow (July 20 & 27 and August 3, 2005).

- 1 *Introduction of improved Chulha under Gram Seva– An effort to reduce the drudgeries of Rural Women* at Seminar on Human Values and University Education, G.B. Pant University of Agriculture and Technology, Pantnagar (August 2005).

## TECHNICAL

### B. Sekar

- 1 *Radiometric Dating Methods and Techniques* at UGC Staff College, University of Allahabad for Orientation Programmes for University and Degree College lecturers (November 17, 2005).

## GUEST SPEAKERS

**Dr. N.D. Mitra**, Retired Sr. Dy. DG, GSI & Member, Research Advisory Council, BSIP

- 1 *Prospects of Coalbed Methane in India* (February 16, 2006)

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

- 1 *Discovery of Hemp (*Cannabis sativa* L.) in the Yanghai Tombs, Xinjiang, China* (February 25, 2006)

**Prof. Yu-Fei Wang**, Institute of Botany, Chinese Academy of Sciences, Beijing, China

- 1 *New light on Shanwang Miocene flora, Eastern China* (February 25, 2006)

**Prof. Yi-Feng Yao**, Institute of Botany, Chinese Academy of Sciences, Beijing, China

- 1 *Palaeovegetational and palaeoclimatic implications of Eocene palynoflora from Changchang Basin, Hainan, China* (February 25, 2006)

## Recognition

### DIRECTOR

#### N.C. Mehrotra

- 1 Chief Guest, University Faculty Training Programme, Delta Studies Institute, Visakhapatnam, July 2005.
- 1 Special Invitee, National Workshop on Scientific Investigations, Silver Jubilee (25<sup>th</sup>) Indian Antarctic Expedition, NCAOR, Goa, July 2005.
- 1 Chaired Technical Session, International Seminar on

Northward Flight of India in the Mesozoic-Cenozoic: Consequences on Biotic Changes and Basin Evolution, University of Lucknow, December 2005.

- 1 Guest of Honour and Chaired Valedictory Session, National Seminar on Sedimentary Basins of the Himalaya' and 'XXII Convention of Indian Association of Sedimentologists, Wadia Institute of Himalayan Geology, Dehradun, December 2005.

### ADMINISTRATION

#### REGISTRAR

#### S.C. Bajpai

- 1 Chaired an Open Session, Seminar on Human Values and University Education, G.B. Pant University of Agriculture and Technology, Pantnagar, August 2005.

### SCIENTISTS

#### Usha Bajpai

- 1 Awarded for Best Sample Preparation Techniques for Electron Microscopy, I.A.E. Pvt. Limited, Mumbai.

#### A. Bhattacharyya

- 1 Resource Person, DST sponsored SERC School on Crustal Deformation and Tectonic Geomorphology Module-1: Concepts in Quaternary Geology, IIT, Kanpur, March-April 2005.
- 1 Resource Person, DST sponsored Brain Storming Session Workshop on Palaeoclimate, Geography Department, University of Pune, Pune, November 2005.

#### Rahul Garg

- 1 Subject Expert (Earth Sciences), National Workshop on Scientific Investigations, 25<sup>th</sup> Indian Antarctic Expedition, NCAOR, Goa, July 2005.
- 1 Co-chaired Technical Session, XX Indian Colloquium on Micropaleontology and Stratigraphy, Andhra University, Visakhapatnam, October 2005.
- 1 Nominated, Convener, XXI Indian Colloquium on Micropalaeontology and Stratigraphy, Birbal Sahni Institute of Palaeobotany, 2007.
- 1 Elected, Fellow of Geological Society of India, Bangalore

#### Amit K. Ghosh

- 1 Awarded Shri Chandra Dutt Pant Medal-2005 (Scientist - C category).

#### C.M. Nautiyal

- 1 Elected, Fellow, Geological Society of India, Bangalore.

#### Binita Phartiyal

- 1 Received Best Trainee Award during pre-acclimatization Training Course for the XXV<sup>th</sup> Indian Antarctic Expedition pre-induction Training, Mountaineering and Skiing Institute, IITB, Auli (Uttaranchal).

#### Vandana Prasad

- 1 Elected, Fellow of Geological Society of India, Bangalore

#### Jyotsana Rai

- 1 Co-chaired Technical Session, XX Indian Colloquium on Micropaleontology and Stratigraphy, Andhra University, Visakhapatnam, October 2005.

#### A. Rajanikanth

- 1 Chaired, Session on Environmental Awareness, National Seminar on Advances in the Frontiers of Environmental Research, Andhra University, Visakhapatnam, November 2005.

#### Rakesh Saxena

- 1 Elected, Fellow, Geological Society of India, Bangalore.

#### B.D. Singh

- 1 Elected, Fellow of the Geological Society of India, Bangalore.

#### Vartika Singh & Vandana Prasad

- 1 Selected as a Meritorious Abstract (poster presentation) "Phytoliths as indicators of monsoonal variability during Mid-Late Holocene in Mainland Gujarat, Western India", hence invited for oral presentation at *PAGES 2<sup>nd</sup> Open Science Meeting*, Beijing, China in August 2005.

#### Rajni Tewari

- 1 Awarded Dr. P.N. Srivastava Medal-2005 (Scientist - D category).

#### Archana Tripathi

- 1 Chaired Technical Session on Cretaceous Volcanic and Tectonic Processes 7<sup>th</sup> International Symposium on Cretaceous, Switzerland, September 2005.

#### R.R. Yadav

- 1 Resource Person, DST sponsored Brain Storming Session, Workshop on Palaeoclimate, Geography Department, University of Pune, Pune, November 2005.

## Representation in Committees/Boards

### DIRECTOR

#### N.C. Mehrotra

- 1 Chief Editor, *The Palaeobotanist*.
- 1 Member, Indo-French Technical Association, New Delhi.
- 1 Member & Indian Correspondent for Newsletter, American Association of Stratigraphic Palynologists.
- 1 Member, National Organising Committee, Workshop on Accelerator Mass Spectroscopy, New Delhi (September 2005).

- 1 Chairman, National Steering & Local Organizing Committees, Diamond Jubilee National Conference *Challenges in Indian Palaeobiology- Current Status, Recent Developments and Future Directions*, BSIP, Lucknow (November 2005).
- 1 Member, National Organising Committee, Symposium of Materials Research Society of India at Lucknow (February 2006).

### SCIENTISTS

#### Rupendra Babu

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

#### Usha Bajpai

- 1 Member, Executive Committee, Electron Microscope Society of India.
- 1 Member, Technical Advisory Committee of U.P. Environmental Concern.

#### Jayasri Banerji

- 1 Editor, *The Palaeobotanist*.
- 1 Vice President, The Palaeobotanical Society, Lucknow.
- 1 Convener, Local Organizing Committees, Diamond Jubilee National Conference *Challenges in Indian Palaeobiology- Current Status, Recent Developments and Future Directions*, BSIP, Lucknow (November 2005).

#### Anjum Farooqui

- 1 Executive Member, International Society of Plant and Environmental, NBRI, Lucknow

#### Rahul Garg

- 1 Member, Editorial Board, *Journal of the Palaeontological Society of India*.
- 1 Convener, Research Planning and Coordination Cell, BSIP.
- 1 Co-ordinator, Joint Research Committee (BSIP-NIO)

#### A.K. Ghosh

- 1 Judge, District Level National Children's Science Congress-2005, Lucknow
- 1 Judge, State Level National Children's Science Congress-2005, Lucknow (UP).

#### J.S. Guleria

- 1 Member, Executive Committee, Lucknow University's Botany Department Alumni Association.

#### Asha Gupta

- 1 Member, Executive Committee, International Council for Biodeterioration of Cultural Property.
- 1 Member, Organizing Committee, 5<sup>th</sup> International Conference on Biodeterioration of Cultural Property.
- 1 Member, Executive Committee, Society for Plant Research.

#### Asha Khandelwal

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

#### J.P. Mandal

- 1 Joint Editor, *The Palaeobotanist*.

#### C.M. Nautiyal

- 1 Member, Local Organising Committee, Symposium of Materials Research Society of India at Lucknow (February 2006)
- 1 Principal Coordinator, Public Lectures on Science at University of Lucknow (2006)
- 1 Advisor, National Children's Science Congress-UP (2005)
- 1 Member, Jury for Project Evaluation, Regional Science Centre, Lucknow

#### Neeru Prakash

- 1 Member Jury, 13<sup>th</sup> State Level National Children's Science Congress-2005, Bahraich (UP)

**Jyotsana Rai**

- 1 Members, Jury, 13<sup>th</sup> State Level Children's Science Congress (Bahraich).
- 1 Reporteur, Technical Session, International Seminar on Northward Flight of India in the Mesozoic-Cenozoic, Lucknow

**A. Rajanikanth**

- 1 Joint Editor, BSIP Annual Report
- 1 Member, National Working Group IGCP Project- 434.
- 1 Member, International Working Group IGCP Project- 506.
- 1 Member, International Organization of Palaeobotany (India Chapter), Kolkata

**Ram-Awatar**

- 1 Councilor, Executive Council, The Palaeobotanical Society, Lucknow.

**R.K. Saxena**

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

**Mukund Sharma**

- 1 Corresponding Member, International Working Group-IGCP Project-493.
- 1 Joint Editor, Miscellaneous Publications, BSIP
- 1 Joint Secretary, The Palaeobotanical Society of India, Lucknow.
- 1 Organizing Secretary, Diamond Jubilee National Conference *Challenges in Indian Palaeobiology- Current Status, Recent Developments and Future Directions*, BSIP, Lucknow (November 2005).
- 1 Reporteur, Seminar on Sedimentary Basins of Himalaya: Challenges for future, WIHG, Dehradun (December 2005).
- 1 Reporteur, International Seminar on Northward Flight of India in the Mesozoic-Cenozoic: Consequences on biotic

changes and Basin Evolution, Lucknow (December 2005).

**Manoj Shukla**

- 1 Corresponding Member, International Working Group-IGCP Project- 493, The Rise and Fall of the Vendian Biota.
- 1 Member, National Working Group- IGCP Project- 493.
- 1 Treasurer, The Palaeobotanical Society, Lucknow.
- 1 Member, Executive Council, The Palaeontological Society of India, Lucknow.
- 1 Co-Convener, Local Organizing Committees, Diamond Jubilee National Conference *Challenges in Indian Palaeobiology- Current Status, Recent Developments and Future Directions*, BSIP, Lucknow (November 2005).

**B.D. Singh**

- 1 Associate Member, International Committee for Coal and Organic Petrology (ICCP).
- 1 Member, Research Planning and Coordination Cell, BSIP.

**A.K. Srivastava**

- 1 Chief Editor, The Palaeobotanical Society, Lucknow & *Geophytology*.
- 1 Member, Editorial Board and Treasurer, Indian Society of Geoscientists.
- 1 Member, Steering Committee, Project- Conservation Education for Critically Important National Parks and Wildlife Sanctuaries through a Comprehensive Education Programme (Bharati Vidyapeeth Institute of Environment Education and Research, a Deemed University, Pune).

**Archana Tripathi**

- 1 Member, Acritarch Subcommission, Commission Internationale de Microflora du Palaeozoique.
- 1 Member, Spore pollen Working Group, CIMP.
- 1 Member, Subject Expert Committee on Earth and Atmospheric Sciences for WOS-A, DST.
- 1 Joint Secretary, Lucknow University's Botany Department Alumni Association.



## Units

## Publication

### Journal— *The Palaeobotanist*

The journal Volume 54(1-3) was published with state of the art printing technology. Papers for the Volume 55(1) are being processed.

### Annual Report

Bilingual (English/Hindi) Annual Report—2004-2005 was published with a new page design incorporating Institute's activities—Research, Conference participation, Awards, Research papers published/accepted, Abstracts published, Foundation/Founders' Day celebrations, reports of different units, annual accounts and related aspects with relevant graphics and visuals.

### Miscellaneous Publications

**BSIP Newsletter**— A 48-page issue of multicolored BSIP Newsletter 2005 (No. 8) was released on the occasion of Founder's Day on 14<sup>th</sup> November. It consists of different activities of the Institute, articles and reports by the Institute's staff and various notifications by the management.

**Diamond Jubilee Logo**— A new logo of the Institute for the Diamond Jubilee has been designed. It is being used as stamp, on letter heads, visiting cards, on Mementos and in all the correspondences of the institute.

**Handouts**— Two well-designed handouts were brought out giving details of the distinguished speakers and abstracts of their talks on the Foundation Day (10<sup>th</sup> September). Handouts of the Founders' Day (on 14<sup>th</sup> November) speakers' biographical sketches and extract of the Seward and Sahni Memorial Lectures were brought out. Similar handout was also printed for the speaker of the 1<sup>st</sup> Diamond Jubilee Lecture delivered on November 15, 2005.

**Invitation Cards**— Invitation cards for different occasion's viz., Foundation Day, Founder's Day and Diamond Jubilee National conference were printed.

**Abstract Volume**— An abstract volume consisting of detailed abstracts of the Diamond Jubilee National Conference “Challenges in Indian Palaeobiology- Current Status, Recent developments and Future directions” organized by the institute during November 15-16, 2005 was released and distributed to all the participants of the conference.



**New Year's Card**— An attractive New Year Greeting Card (2006) was brought out highlighting the fossil findings and an elegantly decorated building of the institute.

**Flyer**— An informative flyer has been brought out for the proposed International Conference to be organized by the Institute in November 2006.

**Folder**— A colorful folder (designed by a group of scientists) has been brought for distribution. This folder provides information on the strength of the Institute in providing different technical know-how to petroleum and coal industries and in basic researches.

### Sale of Institute Publication

This year the publication of the Institute netted an income of Rs. 197697/-.

## Library

Library is committed to serve to its users efficiently.

The current holdings of library are as under:

Particulars	Additions during 2005-06	Total
Books	65	5,601
Journals	154	12652
	(278 bound volumes)	
Reprints	183	37,273
Reference Books	03	328
Hindi Books	2	2875
Ph.D. Thesis	-	91
Reports	-	46
Maps & Atlases	-	61
Microfilm/ Fisches	-	294
CD	-	72

Currently the library is receiving 154 journals (82 through subscription and 72 through exchange). There are 154 registered card holders using the library facilities.

### Exchange Facility

Institutions on exchange list	65
Individuals on exchange list	144
Journals received on exchange basis	72
Reprints sent out in exchange	1328
Reprints of research papers purchased for exchange	18

### Automation

The computerization of the literature is in progress. Some of the journals are available online to users.

### Other Facilities

**Current Awareness Service**— For the benefit of the readers the information about new arrivals in the library is carried out in form of bimonthly 'Current Awareness Service'.

**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.

Following databases were made available to the scientists on trial basis:

- 1 GSW Millennium Collection
- 1 Open J-gate.com
- 1 Scopus

The following Institutions/Organizations availed the library facilities:

- 1 Agharkar Research Institute, Pune.
- 1 Department of Botany, Institute of Science, Nagpur.
- 1 Department of Geology, Pt. Ravi Shankar Shukla University, Raipur.
- 1 Department of Botany, J.N.V. University, Jodhpur.
- 1 Departments of Botany, Geology and Library Science, Lucknow University, Lucknow
- 1 P.G. College, Kanpur.



Shri V.K. Sibal, DG, Directorate General of Hydrocarbons, New Delhi showing keen interest in Library holdings

## Museum

Institute's Museum continued to play a key role in popularization of Palaeobotany. In this connection some significant fossils along with exhibits related with palaeobotanical studies were displayed at national exhibitions to commemorate the National Science Day in February 2006. Museum was kept open for the students and common public on the Day. For educational purposes, fossil specimens were gifted to 14 colleges/ universities of the country. Eleven educational tour parties and many individuals hailing from different parts of the country visited museum and observed the fossils and displays with great interest. Scientists from Hungary and China also visited the museum.

Research materials collected by the scientists of the Institute from 261 localities of the country under different Institutes projects, DST sponsored projects and collaborative research were deposited in the Museum. Details of additions to the type and figured specimens/slides are as follows:

### Holdings

Particulars Type	Addition during	Total 2005-2006
Type and figured specimens	153	6,618
Type and figured slides	107	12,620
Negatives of above	390	17,211

Samples/specimens collected by the scientists and deposited in the Museum for investigation are as under:

Project	Specimens	Samples
Project- 1	200	314
Project- 2	131	379
Project- 3	1046	108
Project- 5	-	197
Project- 6	1416	137
Project- 7	3	141
Project- 8	-	97
Project- 10	-	207
Project- 11	-	156
Project- 12	-	38
Project- 14	27	312

Samples deposited under Sponsored/ Collaborative Projects:

SCCL & BSIP collaborative project	- 1207 Samples
WIHG & BSIP collaborative project	- 9 Samples
GSI & BSIP collaborative project	- 244 Samples
CSIR sponsored Project	- 31 Samples
DST sponsored Project (SR/S4/ES-75/2003)	- 61 Samples
DST sponsored Project (SR/S4/ES-49/2003)	- 712 Samples

### Fossil specimens gifted

Fossil specimens gifted within the country to the following centers:

- 1 Arts, Science & Commerce College, Amravati (MS)
- 1 Barasat Government College, Kolkata (WB)
- 1 Department of Geology, Government Science College, Jabalpur (MP)
- 1 Department of Botany, Surendra Nath College, Kolkata (WB)
- 1 Department of Geology, M.L. Sukhadia University, Udaipur (Rajasthan)
- 1 Department of Botany, Dayal Singh College, New Delhi
- 1 Department of Botany, Mahila P.G. College, Lucknow (UP)
- 1 Department of Botany, M.L. Sukhadia University, Udaipur (Rajasthan)
- 1 Department of Botany, Modern College of Arts, Science & Commerce, Pune (MS)
- 1 G.M. Exploration, Singareni Collieries, Kothagudem (AP)
- 1 Government Inter College, Lodhia, Almora (Uttaranchal)
- 1 Ranveer Rananjay, P.G. College, Sultanpur (UP)
- 1 Rishi Bankim Chandra College, 24 Parganas, North (WB)
- 1 South Calcutta Girls' College, Kolkata (WB)

### Institutional Visitors

- 1 Cachar College, Silchar (Assam)
- 1 Chander Nagar Govt. College, West Bengal
- 1 Chikhaldara P.G. College, District Amravati (MS)
- 1 D.A.V. College, Gorakhpur (UP)
- 1 Department of Botany, Amravati University, Amravati (MS)
- 1 Department of Chemistry, University of Delhi, Delhi
- 1 Forest Range Officers Training Institute, Kanpur (UP)
- 1 Mahila P.G. College, Lucknow (UP)
- 1 R.R.P.G. College, Amethi, Sultanpur (UP)
- 1 Saraswati Vidya Mandir Inter College, Pratapgarh (UP)
- 1 South Calcutta Girls' College, Kolkata (WB)



Visitors showing curiosity towards Museum exhibits

## Herbarium

About 1,008 plant specimens, 90 samples of fruits/ seeds and 5 samples of wood blocks were collected from North Anuppur Forest Division in MP, and processed all the plant materials. 200 plant specimens were mounted on herbarium sheets and registered. Digitized inventory of pollen slides (5,000), plant specimens (1,200) and wood blocks/ slides (150) was prepared including the name of botanical plant, family, accession number, date of preparation (if available) and locality. About 15 living plant samples of medicinal value were also collected from tribal localities of aforesaid area for planting in the garden of the Institute.

### Holdings

Particulars	Addition during 2005-2006	Total
<b>Herbarium</b>		
Plant specimens	200	22,571
Leaf specimens	-	973
Laminated mounts of venation pattern	-	66
<b>Xylarium</b>		
Wood blocks	5	4,153
Wood discs	-	68
Wood cores	500	6,332
Wood slides	-	4,180

Palm slides (stem, leaf, petiole, root.)	-	3,195
<b>Sporothek</b>		
Polleniferous materials	-	3,016
Pollen slides	-	12,237
<b>Carpothek</b>		
Fruits & seeds	90	4,421
Museum Samples		
Medicinal & food plants	-	91

### Visitors

- 1 Prof. Cheng-Sen Li, Institute of Botany, Chinese Academy of Science, Beijing.
- 1 Prof. Yu-Fei Wang, Institute of Botany, Chinese Academy of Science, Beijing.
- 1 Dr. Yi-Feng Yao, Institute of Botany, Chinese Academy of Science, Beijing.
- 1 Rakhi Menon, REJIL, Annie, Argentina.
- 1 Students of Government Model Science College, Jabalpur (MP).
- 1 Forest Guards (Trainees) of Forestry Training Institute, Kanpur (UP).
- 1 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) is functioning 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 been configured, so that the Windows users can use Linux security and services.

This year Institute has procured 14 new Laser Printers (Model: HP 1020) for various labs, 19 Compaq P-IV systems with UPS and Printers and 25 Iomega Pen Drives. An Anti

Virus Program F-Prot has also been procured with 50-user license to protect the system from viruses and worm.

Institute's web site (<http://www.bsip.res.in>) has been hosted on the Institute's Server. Section is maintaining the day-to-day updation. List of Palaeobotanical words for spelling check has been updated.

Computer Section has organized a training program on MS-PowerPoint Software and usages of USB pen drive to the Institute staff. Payroll, Form 16 and Pension packages are also modified as per the requirements and also the annual accounts, budget and revised estimates are prepared. Section is providing help to the scientists in preparing the multimedia presentations, charts, graphs, lithologs and other diagrams for their scientific publications and documentation.

## Section Cutting Unit

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 over 300 samples were cut and about 826 slides were prepared. In addition, 244 slices were made and polished for detailed examination by the scientists.

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

## Right to Information

- As per the Government Notification RTI Act 2005 has been implemented in the Institute. The following personal have been nominated.

### Central Public Information Officer

**Dr. R.C. Mehrotra**, Scientist-D

### Assistant CPIOs

**Dr. B.D. Singh**, Scientist-D,

**Mrs. V. Nirmala**, Section Officer

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

- Infrastructural facilities have been created to facilitate implementation of the RTI Act.
- Most of the information as directed under the Section 4 (1) (6) of the act have been provided in the Institute Website ([www.bsip.res.in](http://www.bsip.res.in)).
- RC Mehrotra CPIO was nominated to attend Workshop on Implementation of RT Act 2005 from 17-11-2005 to 18-11-2005 conducted by Impact Academy of Training and Consultancy.

## 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



Director addressing the Staff on Republic Day, 2006



## Status of Official Language

Efforts to promote use of official language in official work continued this year also. The staff was encouraged to do more and more work in Hindi. The Institute remained an active member of Nagar Rajbhasha Karyanvayan Samiti (NARAKAS) Unit-6 and participated in its 54<sup>th</sup> and 55<sup>th</sup> Meetings, also receiving Appreciation Certificates for holding Workshops. The Quarterly and Half-yearly reports were submitted to Department of Science and Technology and NARAKAS timely. The Institute was nominated as Member of the Joint Advisory Committee for Official Language this year.

Abstracts of the research papers were prepared in Hindi for the Institute's Journal '*The Palaeobotanist*' and published. The Annual Report-2004-05 is published in Hindi also. The contents of Newsletter of Institute are in Hindi and English both. During the year, several scientists of the institute delivered lectures on science in Hindi, published popular articles and broadcast programmes on radio and TV in Hindi. AIR Lucknow broadcast science-based serial 'Ambar mein Barat' in ten-episodes by Dr. CM Nautiyal. A book 'Gatik Prithvi aur Jaivik Itihas' in Hindi by Dr. SKM Tripathi was released during the year on Science Day. Appointment of Hindi Translator was also done this year.

To promote the use of official language, 4 Workshops were organized during the year at the Institute. In these Workshops held on— May 20, 2005 (on '*Efficient Use of Hindi Software*', by Mr. M. Mehrotra), on September 19, 2005 (on '*Shabd Nirman ki Kala*' and '*Swatantryottar Bharat mein Hindi ka Vikas*', by Prof Usha Sinha), on December 27, 2005 ('*Parivardhit Hindi Software ka Kushal Upayog*'), and on March 31, 2006 (on '*Rajbhasha Neeti, Adhiniyam va Niyam*' by Mr. Ashok Kumar), the audience had a good interaction with the speakers.

### Hindi Pakhwara

During September 10-26, 2005, the Institute celebrated Hindi Fortnight with great enthusiasm. It was inaugurated on the Institute's Foundation Day by Sri Ravi Shanker, Former Director General, GSI by delivering a popular lecture in Hindi. A Kavi sammelan was organized on 23<sup>rd</sup> September in which many invited and 3 of Institute's talents enthralled the audience till late in the evening.

Various competitions were organized for the staff members during this period. Ms Sudha Kureel, Mr. Deepak Pandey and Mr. Ram Ujagar were declared I, II and III respectively in 'Hindi typing'. Ms Reeta Verma, Mr. T.K. Mandal and Mr. D.K. Pal bagged I, II and III prizes respectively in 'Essay Writing'. In the 'Galati Dhoondo' Contest; Mr. Deepak Pandey

was I, Dr. R.K. Saxena and Mr. Avinash K. Srivastava II and Mr. Avaneesh K. Srivastava III. The teams of Dr. (Mrs.) Rashmi Srivastava and Dr. (Mrs.) Rajni Tewari was declared I in the 'Antakshari Competition' while II and III prizes were bagged by teams comprising of Mr. P.K. Mishra and Mr. Rajesh Awasthi (II) and Mrs. Shail S. Rathore and Ms Jyoti Sharma (III). In 'Quiz', the prizes went to Mr. T.K. Mandal, Mr. A.K. Arya and Mr. D.K. Pal (I); Dr. A. Rajanikanth, Dr. (Mrs.) Rajni Tewari and Ms Anupam Jain (II) and Dr. R.K. Saxena, Dr. A.K. Ghosh and Mrs. Kavita Kumar (III). On the last day, a 'Debate Competition' was held and Dr. A. Rajanikanth, Mr. T.K. Mandal and Mrs. Reeta Banerji won the first 3 positions.

Prof. Vinod Behari Jauhri, formerly of IIT, Madras was the Chief Guest who delivered an interesting and informative lecture on "Asit Oorja: Brahmand mein ek Nai Khoj" (Dark Energy: A New Discovery in the Universe).

### Hindi Protsahan Puraskar

To encourage the use of Hindi, prizes were awarded to Dr. J.S. Guleria and Mr. R.K. Takru (both I), Dr. R.K. Saxena, Mr. T.K. Mandal and Mr. I.J.S. Bedi (all II) and Dr. A. Rajanikanth, Mr. Mishri Lal, Mr. V.S. Panwar, Mr. S.R. Yadav and Mr. P.K. Mishra (all III). The prizes were given away by Chairperson Prof. M.P. Singh, Member Governing Body on the occasion of the Founders' Day Function on 14<sup>th</sup> November.

### Miscellaneous

Some more forms and formats were translated in Hindi/made bi-lingual to promote the use of Hindi in official work. Correspondence in Hindi has also been on increase. Apart from making Hindi and English fonts available on Institute's computers, progress has also been made towards making the computers bi-lingual. In various exhibitions where the Institute participated, the exhibits were explained in Hindi and the displays made bi-lingual. During the year, all the rubber-stamps of the Institute and vehicle-plates have also been made bi-lingual.

### Deputation to Workshops/ Meetings

#### S.C. Bajpai, R.L. Mehra & M. Pillai

Attended the various sessions of 'Hindi Karyashala' organized by NARAKAS and held at CDRI, Lucknow during June 29-30, 2005.

#### N.C. Mehrotra & C.M. Nautiyal

Attended 22<sup>nd</sup> Meeting of the Joint Advisory Committee for Official Language (Sanyukt Salahkar Samiti - Rajbhasha) held at New Delhi on September 26, 2005.



**C.M. Nautiyal**

Attended two Meetings of NARAKAS held at CDRI, Lucknow on August 22, 2005 and February 27, 2006.

**B.D. Singh, T.K. Mandal, V. Nirmala, N.U. Kannan & Ashok Kumar**

Attended the various sessions of 'Hindi Karyashala' organized by NARAKAS and held at CDRI, Lucknow during December 26-27, 2005.



A view of Hindi Pakhwara celebrations



## Staff

### Director

Dr. Naresh C. Mehrotra

### Scientists

#### Scientist 'F'

Dr (Ms) Jayasri Banerji  
 Dr Rahul Garg  
 Dr Ramesh K. Saxena  
 Dr Manoj Shukla  
 Dr Ashwini K. Srivastava  
 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 (retired w.e.f. 30.06.2005)  
 Dr Mulagalapalli R. Rao  
 Dr Samir Sarkar  
 Dr Rama S. Singh  
 Dr Surya K.M. Tripathi  
 Dr (Ms) Vijaya  
 Dr Ram R. Yadav

#### Scientist 'D'

Dr Rupendra Babu  
 Dr Samir K. Bera  
 Dr Amalava Bhattacharyya  
 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 Awatar  
 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 (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

#### Scientist 'A'

Dr (Mrs) Binita Phartiyal  
 Dr Anil K. Pokharia

#### Emeritus Scientist

Dr (Mrs) Chhaya Sharma (tenure ended w.e.f. 31.07.2005)  
 Dr K.S. Saraswat (tenure ended w.e.f. 31.03.2006)

#### Birbal Sahni Research Scholar

Mr Himanshu D. Dwivedi (tenure ended w.e.f. 18.10.2005)  
 Ms Ruby Ghosh (tenure ended w.e.f. 2.12.2005)  
 Mr Bikash Gogoi (tenure ended w.e.f. 20.10.2005)  
 Ms Shruti Mishra (tenure ended w.e.f. 22.10.2005)  
 Mr Om Prakash (tenure ended w.e.f. 22.10.2005)  
 Ms Aradhana Singh (tenure ended w.e.f. 11.10.2005)

#### Technical Personnel

##### Technical Officer 'D'

Dr B. Sekar

##### Technical Officer 'C'

Mr P.K. Bajpai  
 Dr (Mrs) Madhabi Chakraborty  
 Mrs Indra Goel  
 Mrs Asha Guleria  
 Mr P.S. Katiyar  
 Dr E.G. Khare  
 Mr T.K. Mandal  
 Mr V.K. Singh

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

**Technical Officer 'B'**

Mrs Reeta Banerjee  
Mrs Sunita Khanna  
Mrs Kavita Kumar  
Mr Chandra Pal  
Mr Prem Prakash  
Mr V.P. Singh  
Mr Y.P. Singh (under suspension w.e.f. 18.09.2005 FN)  
Mr Avinesh K. Srivastava

**Technical Officer 'A'**

Mr Madhukar Arvind  
Mr Subodh Kumar  
Mr R.L. Mehra  
Mr R.C. Mishra  
Mr Pradeep Mohan  
Mr V.K. Nigam  
Mr Keshav Ram

**Technical Assistant 'E'**

Mr Chandra Bali  
Mr A.K. Ghosh  
Mr V.S. Panwar (retired w.e.f. 31.03.2006)  
Mr S.R. Yadav

**Technical Assistant 'D'**

Mr Syed R. Ali  
Mr D.S. Bisht  
Mr D.K. Pal  
Mr S. Suresh K. Pillai  
Mr Dharendra Sharma  
Mr Madhavendra Singh  
Mr S.K. Singh  
Mr R.K. Tantua (on lien w.e.f. 04.03.2005)  
Mr C.L. Verma  
Mr S.M. Vethanayagam

**Technical Assistant 'B'**

Mr Avanish Kumar  
Mr M.S. Rana  
Mr S.C. Singh  
Mr Ajay K. Srivastava

**Technical Assistant 'A'**

Mr Pawan Kumar  
Mr Om Prakash

**Administrative Personnel**

**Registrar:** Mr S.C. Bajpai

**Accounts Officer:** Mr R.K. Takru  
(retired w.e.f. 31.01.2006)

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

**Section Officer**

Mr I.J.S. Bedi  
Mr R.K. Kapoor

Mr I.J. Mehra (retired w.e.f. 31.05.2005)

Mrs V. Nirmala

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

**Stenographer:** Sri Murukan Pillai

**Assistant**

Mrs Ruchita Bose  
Mrs Usha Chandra  
Mr Hari Lal  
Mrs Swapna Mazumdar (Officiating)  
Mr K.P. Singh (Officiating)  
Mr Koshy Thomas (Officiating)  
Mrs Pennamma Thomas

**Upper Division Clerk**

Ms Chitra Chatterjee (Officiating)  
Mr N.U. Kannan  
Mr Mishri Lal  
Mr S.S. Panwar  
Mr Rameshwar Prasad (Officiating)  
Mrs Shail S. Rathore  
Mr Gopal Singh  
Mr Avinash K. Srivastava  
Mrs Renu Srivastava

**Lower Division Clerk**

Mr Akhil Antal

**Driver**

Sri Nafis Ahmed ('IV')  
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 Prem Chandra  
Sri Ram Deen  
Sri Ram Kishan  
Sri Haradhan Mahanti  
Smt. Munni  
Sri Ram Singh  
Sri Kesho Ram  
Sri Shree Ram

**Attendant 'II'**

Sri K.K. Bajpai  
Smt. Maya Devi  
Sri Ram Dheeraj  
Sri Hari Kishan

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

Sri Dhan B. Kunwar

Sri Kailash Nath

Sri Mani Lal Pal

Sri Mohammad Shakil

Sri Bam Singh

Sri Ram Ujagar

Sri Kedar N. Yadav

**Attendant 'I'**

Sri R.K. Awasthi

Smt. Beena

Sri Vishwanath S. Gaikwad

Smt. Ram Kali

Sri Deepak Kumar

Sri Inder Kumar

Sri Ramesh Kumar

Sri Subhash C. Mishra

Km. Nandani

**Mali**

Sri Rameshwar Prasad Pal ('III')

Sri Ram Chander ('I')

Sri Ram Kewal ('I')

Sri Mathura Prasad ('I')

**Sponsored Project Personnel**

Dr. Ratan Kar, PI (tenure ended April, 2005)

Mr Santosh K. Shah, SRF

Mr K.G. Mishra, JRF

Ms Divya Srivastava, JRF

Ms Vartika Singh, JRF

Ms Jyoti Sharma, JRF

Mr Jagdish Prasad, Field/Lab Assistant



*Director felicitating Accounts Officer Mr R.K. Takru, who retired on 31.01.2006*



## Appointments and Promotions

### Appointments

Sri Sadhan Kumar Basumatary, Scientist 'B' w.e.f. 15.06.2005 (FN).

Sri Veeru Kant Singh, Scientist 'B' w.e.f. 15.06.2005 (AN).

Sri Ajay Kumar Arya, Scientist 'B' w.e.f. 24.06.2005 (FN).

Dr Hukam Singh, Scientist 'B' w.e.f. 25.01.2006 (FN).

Dr Srikanta Murthy, Scientist 'B' w.e.f. 01.02.2006 (FN).

Sri Biswajeet Thakur, Scientist 'B' w.e.f. 01.02.2006 (FN).

Dr. K.S. Saraswat, Emeritus Scientist w.e.f. 01.04.2005.

Sri Sumit Bisht, Technical Assistant 'D' w.e.f. 12.07.2005 (FN).

Sri Ashok Kumar, Hindi Translator w.e.f. 11.08.2005 (FN).

Miss Sudha Kureel, Lower Division Clerk w.e.f. 12.05.2005 (FN).

Miss Manisha Tharu, Lower Division Clerk w.e.f. 03.01.2006 (FN).

Sri Ravi Shankar, Attendant w.e.f. 12.05.2005 (FN).

Sri Dipak Kumar Dutta, Accounts Officer w.e.f. 28.03.2006 (FN).

Miss Bhasha Dubey, CSIR- Senior Research Fellow (Extended) w.e.f. 19.04.2005 (Her tenure ended w.e.f. 31.03.2006).

Dr Ratan Kar, Sr. Research Associate under CSIR Scientist's Pool Scheme w.e.f. 27.05.2005.

Dr Shantanu Chatterjee, Sr. Research Associate under CSIR Scientist's Pool Scheme w.e.f. 27.05.2005.

Dr Jayendra Singh, Project Investigator w.e.f. 25.08.2005.

Miss Abha, Technical Assistant w.e.f. 27.10.2005.

Sri Suneel Kumar Yadav, Field/Laboratory Assistant w.e.f. 16.05.2005 (Expired on 29.11.2005).

### Promotions

Sri R.K. Kapoor, Section Officer w.e.f. 13.10.2005.

Sri Shree Ram, Attendant 'III' w.e.f. 11.07.2005.

Smt. Munni, Attendant 'III' w.e.f. 11.07.2005.

Sri Ram Ujagar, Attendant 'II' w.e.f. 11.07.2005.

Sri Ram Dheeraj, Attendant 'II' w.e.f. 11.07.2005.

Sri Dhan Bahadur Kunwar, Attendant 'II' w.e.f. 11.07.2005.

Sri Krishna Kr. Bajpai, Attendant 'II' w.e.f. 11.07.2005.

Sri Hari Kishan, Attendant 'II' w.e.f. 11.07.2005.

Sri Nafis Ahmed, Driver 'IV' w.e.f. 27.01.2006.

Sri C.L. Verma, Technical Assistant 'D' (Redesignated w.e.f. 30.03.2006).



Section Officer Mr I.J. Mehra who retired on 31.05.2005 with his colleagues