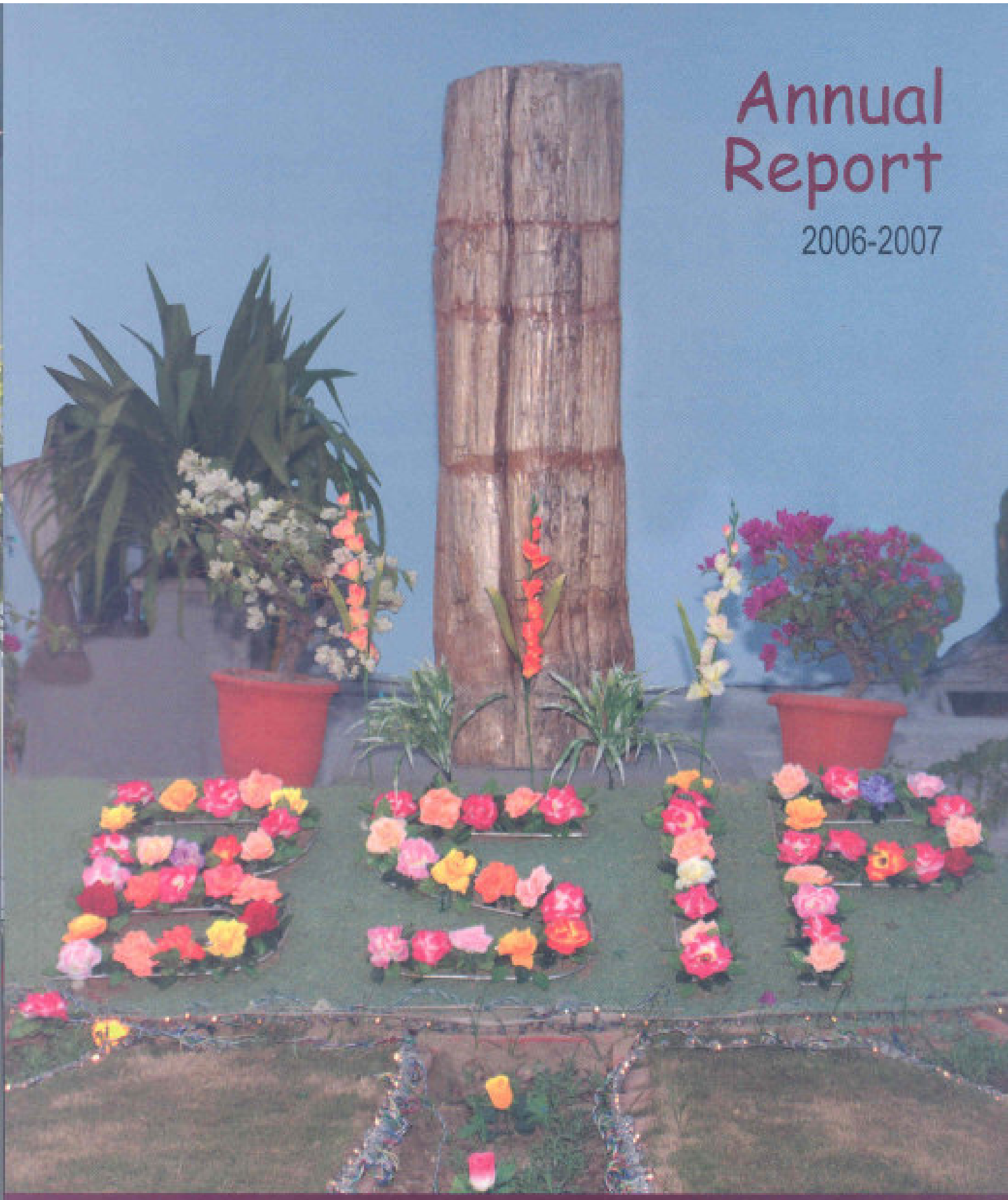

Annual Report

2006-2007

Birbal Sahni Institute of Palaeobotany, Lucknow

An Autonomous Institute under Department of Science & Technology
Government of India, New Delhi

1946

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(w.e.f. 20.12.2006 to 19.12.2009)

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New Delhi-110 016

(w.e.f. 20.06.2003 to 19.06.2006)

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(w.e.f. 01.10.2003 to 30.09.2006)

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Deputy Director General
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(w.e.f. 20.12.2006 to 19.12.2009)

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Registrar
Birbal Sahni Institute of Palaeobotany

Foundation Day

On September 10, 2006 the Institute celebrated its 60th Foundation Day. This year being the Diamond Jubilee Year, following lectures were organized to mark the occasion:

Professor V.S. Ramamurthy, Former Secretary, DST, Govt. of India delivered (on 8th September) '10th Jubilee Commemoration Lecture' on the topic "*Management of Intellectual Property Assets in a Basic Research Environment*".

Dr. Deepak Mehrotra, Director, Geological Survey of India Training Institute, Northern Region, Lucknow delivered a series of lectures on "*Vigilance Awareness*" on 9th September.

Dr. Rakesh Tuli, Director, National Botanical Research Institute, Lucknow delivered a Special Lecture on the theme *DNA in Botanical Diversity and Crop Improvement*. On the same evening of 10th September, Guest of Honour Dr. Jauhari Lal, Secretary General & CEO, Petrotech Society, New Delhi delivered a popular lecture in Hindi on *Future of Science in the Age of Information Technology* to mark the beginning of Hindi Pakhwara.

Founder's Day

On November 14, 2006–the Founder's Day, the Institute's staff and distinguished guests from other organizations offered *Pushpanjali* on the *Samadhi* of the Founder Professor Birbal Sahni, FRS in the campus. Same day in the evening Sahni Memorial and Diamond Jubilee lectures were organized.

Prof. Cheng Sen Li, Institute of Botany, Chinese Academy of Sciences, Beijing delivered the '36th Birbal Sahni Memorial Lecture' on the topic "*Eocene Climate Changes in China with ISOGRAM Map*".

Prof. Robert A. Spicer, The Open University, United Kingdom delivered the '52nd Sir Albert Charles Seward Memorial Lecture' entitled "*Palaeobotany and its Role in predicting future Climate Change*" at the inaugural function of the Diamond Jubilee International Conference on November 15, 2006.

Padmashri Prof. Harsh K. Gupta, Former Secretary, Department of Ocean Developments (Govt. of India) and presently Raja Ramanna Fellow at NGRI, Hyderabad presided over the function. Many guests and scientists from outside the Institute and several conference delegates attended the occasion.

Diamond Jubilee Lecture

Dr. B.S. Venkatachala, Former Director, Birbal Sahni Institute of Palaeobotany delivered the 2nd Diamond Jubilee Lecture on the topic *Economic Palynology– Industrial Applications* on the Founders' Day (November 14, 2006). Lifetime Achievement Award-2006 was also conferred on Dr. Venkatachala on this occasion.

Diamond Jubilee International Conference

On the auspicious occasion of its Diamond Jubilee Year the Institute organized an International Conference on *Changing Scenario in Palaeobotany and Allied Subjects* during November 15-17, 2006 in continuum of Founders' Day programme. The Conference covered diverse aspects of fundamental and applied researches in Palaeobotany and Allied Earth System Sciences. The Conference dealt with various aspects of Palaeobotany and related topics under the following ten themes–

- Origin and evolution of early life
- Biodiversity through time
- Gondwana floristics and biostratigraphy
- Patterns of angiosperm origin and early evolution
- Quaternary palaeoclimate and palaeobotanical proxies
- Archaeobotany and anthropogenic activities
- Palynology and fossil fuel exploration
- Mass extinctions, time boundaries and fossil record
- Applications of modern tools/techniques in the palaeobotanical research
- Geochronometry.

The Conference was inaugurated by His Excellency Shri T. V. Rajeswar, the Governor of Uttar Pradesh. Dr. Harsh K. Gupta, then General President, Indian Science Congress Association was the Guest of Honour of the inaugural function. On this occasion special Postal Cover and Cancellation Cachet of the BSIP were released by Mrs. Neelam Srivastava, Chief Post Master General, Department of Post and Telegraph, UP.

The Conference was attended by about 200 delegates from India and abroad. Scientists from the countries like Brazil, Canada, Czech Republic, France, Germany, Japan, Panama, China, Russia, UK and USA presented their work/contributed to the Conference. Indian participants came from various states, representing 19 Universities (Allahabad, Amravati, Bhopal, Burdwan, Delhi, Guwahati, HNB Garhwal, Kumaon, Kolhapur, Kolkata, Lucknow, Madras, Mangalore, Manipur, MS Baroda, Nagpur, Osmania, Punjab, Hyderabad). Besides, scientists from 25 Institutions participated in the Conference, viz. Agharkar Research Institute (Pune), Bose Institute (Kolkata), Botanical Survey of India (Shillong), Central Fuel Research Institute (Dhanbad), Deccan College PG Research Institute (Pune), Delta Studies Institute (Visakhapatnam), French Institute (Pondicherry), Forest Research Institute (Dehradun), Geological Survey of India, Indian Institute of Geomagnetism (Mumbai), Indian Institute of Technology (Bombay, Kanpur, Kharagpur, Roorkee), Indian Institute of Tropical Meteorology (Pune), Institute of Science (Nagpur), National Botanical Research Institute (Lucknow), National Centre for Antarctic & Ocean Research (Goa), National Institute of Oceanography (Goa), Oil India Limited, Oil & Natural Gas Corporation (Dehradun, Kolkata), Physical Research Laboratory (Ahmedabad), Singareni Collieries Company Limited (AP) and Wadia Institute of Himalayan Geology (Dehradun). Representatives from DST, New Delhi also attended the event.

More than 135 research papers were presented on varied aspects of Palaeobotany dealing with biota of early life (Precambrian- 3.6 billion yr. old) to Holocene including the usage of Palaeobotany in the fossil fuel exploration. The papers were discussed during three days of the Conference in 3 concurrent and 3 poster sessions. In addition, 6 Plenary Lectures were also delivered by eminent scientists, such as *Palaeobotany in Hydrocarbon exploration* (by Manoj Asthana), *Future energy scenario in India: Coal a key player* (by S.K. Srivastava), *Fossil record of angiosperm evolution* (by D.L. Dilcher), *Climate change from Tree rings in India* (by Edward R. Cook), *Palaeophytographic reconstructions* (by Sun Kequin) and *On the use of non intrusive and non-destructive techniques: CLSM and Raman imagery* for the study of Precambrian microorganisms and also for investigation of higher plants (by J.W. Schopf). Similarly, 12 key-note addresses were given by learned speakers, like D.S.N. Raju, Balesh Kumar, Sun Ge, M.N.V. Prasad, Jianhua Jin, Ashok Sahni, Yongdong Wang, R. Ramesh, Xiaoqiang Li, and Rajiv Sinha in their respective fields.

The various sessions were chaired by eminent scientists, viz. Kuldeep Chandra (Dehradun), D.L. Dilcher (USA), Carlos Jaramillo (Panama), B.R. Arora (WIHG, Dehradun), M.P. Singh (Lucknow), R.A. Spicer (UK), Ashok Sahni (Chandigarh), S.N. Bhalla (Delhi), S.D. Chitaley (USA), Cheng-Sen Li (China), Sun Weiguo (China), Sun Keqin (China), Rasik Ravindra (Goa), S.K. Srivastava (Dhanbad), Shanmukhappa (ONGC, Kolkata), S.K. Srivastava (OIL, New Delhi). Institute's scientists– A.K. Srivastava, J.P. Mandal, M.R. Rao, Asha Khandelwal, C.M. Nautiyal, Rupendra Babu, Rashmi Srivastava, M.S. Chauhan and A.K. Ghosh acted as Session Managers during various technical sessions of the Conference.

Following are some important findings emerged from various deliberations:

The discovery of early primitive aquatic angiosperms, like *Archaefructus* and *Hyrcantha* in the western China shows that early diversity of angiosperms took place in east Asia (China) in pre-Cretaceous time. More remains of *Hyphaene* and *Musa* have been reported from the Deccan Intertrappean sediments of India. A number of papers dealt with the history of angiosperms in Himalayas. Elaborated discussion on the biodiversity of India during the Deccan Intertrappean time showed the relationship of vertebrate fossils of Seychelles Madagascar and India. Deccan volcanic eruptions have been


15th-17th NOVEMBER 2006
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DIAMOND JUBILEE INTERNATIONAL
Sponsored by :- D S T, New Delhi

considered to be the cause of extermination of dinosaurs at the K/T boundary in India. Coprolites have been investigated to know the dietary requirements of dinosaurs and other ancient cattle.

The issue of global warming was also discussed and it was pointed out that the quantity of CO_2 in the atmosphere has increased rapidly upto the level of 400 ppm. The increase in CO_2 level is a cause of great concern. Oxygen isotope studies were utilized to decipher past variation in Indian Monsoon. Significance of calcerate/alluvial carbonates was shown as palaeoenvironmental/ palaeoprecipitate indicator. Likewise magnetic character of major iron oxides was used to determine past climatic changes of the Sambhar lake sediments of Rajasthan. The issue of effect of rising temperature on the dynamics of tree species was discussed on the basis of dendrochronology.

Microfossil investigations of the spores-pollen, dinoflagellate cysts and foraminifera of the Cambay, Cauvary, Ganga and Assam basins provided evidences of the occurrence of conducive conditions for the generation of hydrocarbons in these basins. The work has also provided high resolution biostratigraphy. Palynofacies integrated studies involving data on dinoflagellates, nannoplanktons, diatoms and other algal remains have been effectively used for deciphering the palaeoenvironment.

It was revealed that Mesoproterozoic biota of India and Russia differed in their specific taxonomic composition. Oldest records of metazoans (pre-Ediacaran) have been reported from both China and India. The origin of primitive filicalean family Gleicheniaceae took place in China in Permo-Carboniferous time. A reorientation about the traditional concepts of worldwide uniform Lepidodendropsis flora of Early Carboniferous was stressed based on recent findings of early Carboniferous flora of Kashmir. A synangiate pollen organ *Nidianthus* resembling *Caytonanthus* of the order Caytoniales has been reported from the Triassic sediments of Madhya Pradesh. The order has not been reported from Gondwanaland countries so far, whereas it has been widely reported from the Northern Hemisphere. Delegates also discussed the past floristic of China, Europe, America, India and Antarctica and the changes that have undergone in floras. There were also papers which dealt with new methods, softwares and techniques for studying plant fossil material.

The most significant outcome of scientific interactions has been the keen interest shown by several scientists for entering into collaborative research in the areas of mutual interest with BSIP. Foremost amongst these are: Prof. R.A. Spicer (from UK), Prof. Cheng-Sen Li and Prof. Sun Ge (China) on Tertiary Palaeobotany and Palaeoclimate based on Megafossil study. Prof. Z. Kvacek (of Czech Republic) offered to help in the estimation of occurrence of CO_2 during the past and thereby deciphering palaeoclimate based on the stomatal studies in the fossil leaves. Dr. Carlos Jaramillo (STRI, Panama) wished to carry out collaborative work on a global perspective of equatorial climate based on palynological data from India, Nigeria and Columbia. Prof. Edward Cook (USA) evinced keen interest on tree-ring study and Quaternary pollen modelling. Dr. V.N. Sergeev (Russia) and Prof. Sun Weiguo (China) wished to carry out joint work on early life. The collaborative programmes of mutual interest with some of the above organizations are being finalized.

Dr. T. Ramasami, Secretary DST, Govt. of India presided over the valedictory function of the Conference. He appreciated the need of basic research, but emphasized that it should be coupled with utility/applied research.

A view of cultural programme

National Science Day

BSIP has been celebrating Science Day with enthusiasm and this year also it was celebrated by involving a large number of people especially children from Lucknow and nearby places. The Science day programme was spread over several days and the process was initiated in the first week of February. The programmes included three competitions for 3 groups: schools, colleges and the free category.

The first event to be held at campus was 'On the Spot Collage' competition on 26th of February on the topic *Water Conservation* for students of class VI-VIII. The topic was chosen in line with the theme for the Science Day. The students who came early had a chance to see parts of the sci-fi movie 'Jurassic Park'. A total of 207 students made collage on the topic in the allotted one hour displaying their skills. A total of 10 students' entries including 7 for consolation prizes were selected for prizes.

For the students of class IX-XII, an Essay Competition was organized on *Water and Life*. There were 130 entries from 10 schools. The best 10 entries were selected for prizes which included 5 consolation prizes. Slogan Competition on *Importance of Water* had 180 submissions from 13 institutions. The best 8 entries were selected for prizes.

Institute participated in an exhibition of fossils at Aminabad Inter College and three posters depicting Institute activities were exhibited at CIMAP. During February 27-28, 2007 the best 10 selected collage (entries out of the 207 made by students) were displayed outside the Institute's auditorium and the exhibition was inaugurated by Sri Mohd. Ahsan, IFS, Chief Wildlife Warden (UP). Sri Ahsan delivered two lectures on 27th February at the Institute auditorium which also formed part of Hindi Workshop. The speaker elaborated on wild life in India and environment in Hindi poetry.

The Institute observed open house for public on Science Day. People visited Institute's laboratories such as Radiocarbon laboratory, Scanning Electron Microscope as well as herbarium, and museum. Institute scientists and other officers also delivered lectures and made presentations at other places on Science Day.

The Science Day programme was concluded with prize distribution on 28th February by Sri K.L. Gupta, Retd. DGP. The Director Dr. N.C. Mehrotra welcomed the Chief Guest and said on Science Day, we should also resolve to adopt a scientific attitude in whatever we do. This can take care of biases even in our societal conduct. The Chief Guest said that science is not only specialized knowledge; studying science trains one's mind to be analytical. He said the achievements of Raman and Sahni serve as guiding beacons for the coming generations. He also gave away prizes to the 26 winners.

The programmes received good response and were well covered by media including newspapers and radio.

Distinguished Visitors

His Excellency Hon'ble Sri T.V. Rajeswar, Governor of Uttar Pradesh.

Dr. T. Ramasami, Secretary, Department of Science and Technology, New Delhi.

Prof. V.S. Ramamurthy, Former Secretary, Department of Science and Technology, New Delhi.

Padmashri Dr. Harsh K. Gupta, Former Secretary, Department of Ocean Development, New Delhi.

Prof. Robert A. Spicer, CEPSAR, The Open University, Walton Hall, Milton Keynes, UK.

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

Prof. D.L. Dilcher, Florida Museum of Natural History, University of Florida, Gainesville FL, USA.

Dr. S.D.(Shya) Chitaley, Cleveland Museum of Natural History, Univ. Circle, Cleveland OH, USA.

Prof. Ashok Sahni, CAS in Geology, Panjab University, Chandigarh.

Prof. S.N. Bhalla, Ex-Chairman, Geology Dept., AMU (Savita Vihar, New Delhi)

Dr. Jauhari Lal, Secretary General & CEO, Petrotech Society, New Delhi.

Dr. B.R. Arora, Director, Wadia Institute of Himalayan Geology, Dehradun.

Dr. S.K. Srivastava, Director, Central Fuel Research Institute, Dhanbad.

Dr. Edward R. Cook, Lamont-Doherty Earth Observatory Palisades, New York, USA.

Dr. J. William Schopf, University of California, Los Angeles, USA.

Prof. Gerta Keller, Princeton University, Princeton, USA

Dr. Rakesh Tuli, Director, National Botanical Research Institute, Lucknow.

Dr. Baleshwar Kumar, National Geophysical Research Institute, Hyderabad.

Dr. Zlatko Kvacek, Charles University, Albertov, Praha, Czech Republic.

Dr. Carlos Jaramillo, Smithsonian Tropical Research Institute, Unit 0948, Panama

Shri Rasik Ravindra, Director, National Centre for Antarctic and Ocean Research, Goa

Dr. M. Shanmukhappa, Dy. GM (Palynology), Western Onshore Basin, ONGC, Vadodra

Dr. Sun Ge, Research Center of Paleontology, Jilin University, Changchun, China.

Dr. Sun Weiguo, Nanjing Institute of Geology and Palaeontology, Nanjing, China.

Dr. C.M. Pandey, Director, Geer Foundation, Gandhinagar.

Sri Mohamad Ahsan, IFS, Chief Wildlife Warden, Uttar Pradesh.

Mrs. Neelam Srivastava, Post Master General, UP Circle, Lucknow.

Dr. B.K. Chandrasekher, Chemical Chemist, Massachusetts, USA.

Research Report

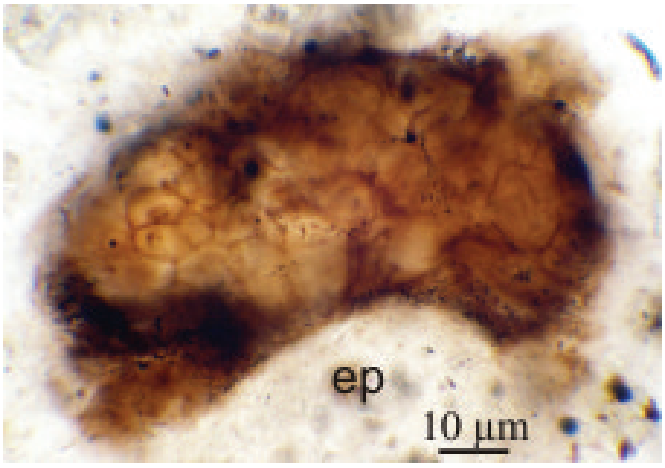
THRUST AREA: PRECAMBRIAN BIOTIC EVENTS

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 well diversified organic walled microfossils (OWMs) in petrographic thin sections of the silicified chert lences intercalated in limestone and carbonaceous metaphyte fossils belonging to Nagod Limestone and Sirbu Shale formations (Bhander Group) and Chitrakoot Formation (Semri Group) exposed in localities of Satna and Chitrakoot districts, Madhya Pradesh. These OWMs comprising acritarchs and cyanobacterial remains of both single to multicellular prokaryotes and eukaryotes, and are structurally three/two dimensional, cellularly preserved represents solitary spheroidal cells, groups of spheroidal cells and small sized fragments of unicellular septate trichomes, simple tubes with/ without mucilaginous sheath resemble with the extant forms belonging to Chroococcales and Nostocales orders.

Recovered for the first time 3 taxa of cyanobacterial remains belonging to order Chroococcales and Oscillatoriales in pisolitic/oolitic cherts of Nagod Limestone Formation. These include 3 groups of preservation– i) the euendolithic group represent the rock driller organisms, viz. *Cunicularious* Green, ii) the epilithic group represent organisms follow the contours of the pisoid/ooid surface, viz. *Parenchymodiscus* Green, and iii) the clast bound group represent organisms that originally found in carbonate clasts that were transported into the zone of coated grain deposition. Fossils include *Myxococcoides* Schopf, *Perulagranum* Green, *Obruchevella* Reitlinger, *Siphonophycus* Schopf, *Biocatenoides* Schopf, simple ornamented sphaeromorphs like *Leiosphaerids* Eisenack, etc. Recovered fossil assemblage suggests a shallow marine environment for the Nagod Limestone Formation.



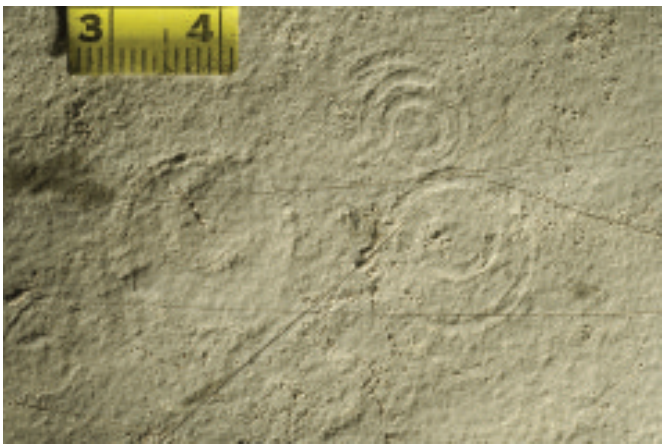
Parenchymodiscus Green, Nagod Limestone Formation

Collected and studied well-preserved and diversified carbonaceous macroscopic multicellular metaphyte (algal remains) fossil remains found along the bedding plane in dark grey and black shale from the two stratigraphic units (Nagod Limestone and Sirbu Shale formations) exposed around Satna-Maihar-Nagod-Amanganj areas. These forms comprise fan shaped, lanceolate carbonaceous films with holdfast at base, dichotomously branched filaments, pitcher shaped forms and mesh of thin filaments, including reproductive structures. The fossils assemblage comprises following taxa– *Flabellophyton, Protoarenicola, Huangshanophyton, Protoconites, Sitaulia* gen. et sp., *Doushantuophyton, Eopalmaria, Konglingiphyton*, *Aggregatosphaera* and *Enteromorphites* along with some unusual forms. The fossils assemblage is morphologically distinguished and is compared with modern algae-Rhodophytes, Phaeophytes and Chlorophytes. The cyanobacterial fossil assemblage from the Chitrakoot Formation dominates ornamented large and simple sphaeromorphic *Leiosphaeridia* Eisenack followed by dominant acanthomorphic acritarchs, viz. *Cymatiosphaeroides* Knoll *et al.*, coccoid form comparable to an apparently planktonic alga *Eozygion* Schopf & Blacic; septate and nonseptate trichomes, viz. *Siphonophycus* with pyrite inclusion.

The recovered biotic communities from the Semri and Bhander groups show the evolutionary trend ranging in age from Stenian to Ediacaran age in ascending order. The data also enhances our knowledge about the diversity of life forms in understanding the palaeoecology, biostratigraphy, age and palaeoenvironment for the Vindhyan Supergroup. Prepared a provisional draft on the palaeobiology of the Bhander Group, Vindhyan Supergroup.

Manoj Shukla (till 06.06.2006) & V.K. Singh

Mesoproterozoic (~1600 Ma old) Rohtas Limestone (Semri Group) exposed in Katni district, Madhya Pradesh preserves abundant megascopic carbonaceous fossils on the shales partings occurring between the limestones. These megascopic remains have been collected from Bistara, Bomengaon and Kymore areas. The carbonaceous assemblage belongs to *Grypania spiralis, Katnia singhii* and large oscillatorian



Grypania spiralis, an Early Mesoproterozoic eukaryotic megafossil from the Rohtas Limestone Formation exposed in Murli Pahar, Rohtas, Bihar

filaments. Besides *Chuaria*, some unidentified discoid dubiofossils are also recorded. *Grypania* or similar carbonaceous fossils are known only from seven localities in the world. The present occurrence is the third report from the Vindhyan Supergroup. The gigantism noted in the organisms is probably because of the fluctuation of the oxygen level in the atmosphere during the Palaeo-Mesoproterozoic boundary. In a recent fieldwork in the Rohtas district, Bihar, another well-preserved specimen, with a number of *Grypania spiralis*, has been recorded from the Rohtas Limestone Formation exposed in Murli Pahar area. This is the second occurrence from the area after the discovery by Beer (1919). Samples of the Olive Shale (Koldaha Shale) belonging to Semri Group exposed in the Newari area have confirmed the presence of multicellular thalloid algae.

Mukund Sharma

Examined the shale and intercalated cherts in Rehatikhol 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 *Cymatio-sphaeroides kulingii* and acanthomorphs of the subgroup Sphaerohystrichomorphida viz. *Pterospermo-psimorpha, Micrhystridium* and *Tappania*. The cyanobacterial remains are represented by *Glenobotrydion aenigmatis, Archeonema longi-cellularis* 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

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

Studied biological remains both organic walled microfossils (OWMs) and carbonaceous mega-remains from the shales and intercalated cherts in Rehatikhol, Saraipali and Chhuipali formations of Singhora Group exposed in Khamaria-Bandhalimal and Chhuipali-Manpali sections located in southeastern margin of Singhora protobasin of Chhattisgarh Basin in Mahasamund district. The recovered assemblage is structurally, three/two dimensionally cellularly preserved, represented by planktonic and benthonic forms of 2 distinct biocommunities– i) protists: 9 genera, and ii) cyanobacterial remains: 4 genera. The simple and small sized predominated acritarch taxa are— *Leiosphaeridia incrassata, L. laminarita, L. minutissima, Diplomembrana producta* followed by rare ornamented sphaeromorphic taxa– *Satka squamifera, Pseudofavosphaera obsoleta, Cymatiosphaeroides kulingii, Stictoshaeridium formosum* and also few spinated/ciliated forms *Pterospermopsimorpha. Micrhystridium* and *Tappania* belonging to 2 subgroups of acritarchs, viz. Sphaeromorphida and Sphaerohystrichomorphida. Cyanobacterial remains are represented by the solitary, spheroidal cells forming colonies and thin sized fragments of unicellular trichomes, viz. *Myxococcoides minor*, *Palaeopleurocaps wopfneri* and *Siphonophycus robustum* resembled with the extant forms belonging to Chroococcales and Nostocales orders. The multicellular thalloid structures with/without rhizoids like structures are comparable with the extant primitive forms of red/green algae from the top part of the Rehatikhol Formation.

Studied compressions/impressions of carbonaceous mesoscopic forms from the sediments of Chhuipali Formation. These forms are one to 5 mm in size with variant morphology– leafy, cordate shaped associated with unusual structures cf. with extant forms of algae-Chlorophyta, Phaeophyta and Rhodophyta. The detailed study is in progress. Cryptic thalloid algae and mesoscpoic carbonized thin films are being recorded for the fist time from the sediments of Rehatikhol and Chhuipali formations. The OWMs are also being recorded for the first time from chert belonging to Saraipali and Chhuipali formations.

The finer evaluations of the findings of micro- and macrofossils (based on both qualitative and quantitative) indicate Late Palaeoproterozoic-Early Mesoproterozoic age and heterogeneous environs by any episodic effect for Rehatikhol, Saraipali and Chhuipali formations. Acritarchs shows evolutionary trends from Rehatikhol Formation onwards. The

present generated data supports the earlier summarized data (reported couple of the information on other aspects) from the Chhattisgarh Basin and its equivalents isolated other basins of Purana Formation (Das *et al.* 2001). These assemblages closely resembled with the known assemblage of other parts of the world, viz. China, Australia, Canada including India. Also collected relics of biological communities (macroscopic and stromatolites) and palynological samples from the Chandarpur and Singhora groups exposed in Mahasamund district (Chhattisgarh) and its adjoining areas (in Bargarh district, Orissa). Prepared lihocolumns of few localities. Provisional two drafts have been prepared from the recovered palaeobiological evidences of Singhora Group.

Rupendra Babu & Manoj Shukla (till 06.06.2006)

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

Palynological study is being taken-up on the samples encountered in bore-hole RRK-1 of 117.30 to 608.20 m thick strata comprising Permian and Mesozoic successions. Microscopic studies in search of spores-pollen species for palynozonation are in progress amongst the productive samples.

Vijaya

Processed and macerated about 124 rock samples from bore-hole EBM-1 drilled in East Bokaro Coalfield, Damodar Basin, and observation of palynotaxa (preliminary study) in the productive samples is being done. Photographed significant spores-pollen specimens for study purpose and tentatively identified the palynotaxa. Macerated another set of 30 samples from bore-hole EBM-2 of the coalfield and preliminary microscopic observation on productive samples is in progress. Also visited GSI (Coal Wing), Kolkata for discussion regarding geological information, field work and collection of borecore samples for biostratigraphic studies.

Vijaya & Srikanta Murthy

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

Palynological analysis of 36 samples from bore-hole SCP-9 has been carried out, and identified Late Permian (1.20-34.65 m), Upper Barakar (131.35-85.85 m) and Talchir (312.35-314.30 m) palynofloras. Quantitative analysis of the productive samples and photo-documentation of important taxa are in progress. The palynological analysis of 5 samples from bore-hole SNB-2 (238.71-371.55 m depth) has been completed. Most of the slides show full of woody debris except sample No.SNB-7/2, in which striate bisaccate dominance pollen (*Faunipollenites, Striatopodocarpites, Crescentipollenites*) have been recorded in association with few monosaccates. Late Permian age has been assigned to the above strata. Under took a field work and collected out crop samples from Sohagpur Coalfield.

Ram Awatar

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

Processed surface samples from Chharchharia Nala section near to Rajpur village, but found to be devoid of any pollen and spores. Samples from Lakhanpur are also found to be barren. Compilation and documentation of palynological data recovered from Talchir Formation exposed in a Tributary of Hasdo River, near Bankunth village of Mahendragarh area (Chhattisgarh) is in progress. Finalized paper on a pioneer report for the presence of marine form in the Ib-River Coalfield. Similar palynological results have also been obtained from the bore-holes IBL-3, IBL-5, IBSK-1 at different localities of Ib-Himgir Basin. On the basis of the palynological studies, the upper 4 seams resemble the Raniganj coal, while the deepest seam compared with the Barakar coal. Also visited Ib-Himgir Basin Coalfield in districts Jharusuguda and Sundargarh (Orissa) and collected sub-surface and surface samples for further palynological studies.

K.L. Meena

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

Macro- and micro fossil study of Tekan, South Rewa Basin, has been carried out. The one meter thick carbonaceous shale (of 5.5 m thick section) embody well-diversified spores-pollen assemblage, viz. *Microfoveolatosporites* sp., *Dictyophyllidites equiexinus*, *Concavisimisporites punctatus*, *Contignisporites* sp. *Alisporites australis*, *Callialasporites* spp., *Cycadopites* sp, *Araucariacites* sp., *Podocarpidites ellipticus* along with sporadic recycled Permian saccate pollen grains. The megafloral assemblage comprises number of species of conifers, e.g. *Elatocladus, Brachyphyllum, Pagiophyllum, Araucarites* and *Allocladus* etc. Conifers and pteridophytes mainly dominate megafloral assemblage. Cycad is represented by single genus– *Taeniopteris* (*T. spatulata*), while *Todites*, *Gleichenites* and *Onychiopsis* are representative genera of pteridophytes. Occurrence of *Ginkgo* leaves in the entire basin is important because of its long survival history during geological past and its resemblance with extant *Ginkgo* leaves.

The palynofacies analysis of various sedimentary sections exposed along mine and river cuttings at Bansa, Marwa Ghat, Khareri Ghat, Tekan, Patpara, Chhoti Pali and Braham Baba areas in South Rewa Basin have been carried out. It has been observed that charcoalified plant tissues are dominating elements over other organic matter types. This may be due to the result of local burning of vegetation prior to the deposition of these sequences. The preservational biases of charcoal and other organic matter occurred in various lithotypes in these sections, have been compared with each other and inferred that the deposition of these section took place under fluvio-lacustrine regime with occasional impact of draught conditions.

Madhav Kumar & Neeru Prakash

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

Around 120 megafossil specimens collected from Dipika and Gevra Colliery's extension sites have been processed, identified, photographed (34 specimens) and studied. Seven species of G*lossopteris*, viz. *Glossopteris nimishea*, *G. communis, G. pandurata, G. browniana, G. major, G. raniganjensis* and *G. arberi* along with the taxa *Vertebraria indica, Cordaites* sp. *Gangamopteris* sp., scale leaves and stem casts have been identified. An equisetalean genus *Sakoarota*, described from Madagaskar, has been reported for the first time from the Indian Gondwana. This taxon is preserved in the form of rhizomes/stems in the Gevra Colliery.

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

Grouping, sorting, cleaning, photo-documentation and tentative identification of megafossils have been carried out from Barakar Formation of Makardhokra and Umrer OCPs (Umrer Coalfield) of Wardha Basin. The assemblage includes a number of species of the genera *Glossopteris, Noeggerathiopsis,* besides equisetalean axes, *Phyllotheca*, *Euryphyllum*, *Palaeovittaria* and a variety of seed taxa, viz. *Samaropsis, Cordaicarpus, Cornucarpus* and *Alatocarpus*. Study is under progress. Rock samples from Barakar Formation of Makardhokra OCP have also been macerated for palynomorph studies. The samples have yielded a variety of megaspores.

Plant megafossils and rock samples for recovery of megaspores, seeds, etc. have been collected from Chintalpudi Formation, near Kerlacheruvvu, Polasigudem and Raghavapuram villages of Elluru district in Chintalpudi sub-basin (Krishna-Godavari Basin). Good sections measuring about 10 m in thickness consisting of Lower Sandstone about 1-2 m) followed by thin intercalation of fine clay with carbonaceous streaks and calcareous hard compact buff claystone, Upper Sandstone followed by conglomerate and recent alluvium are exposed in these areas. The Plant megafossils and rock samples were collected from fine intercalations. The plant fossils include *Vertebraria*, equisetalean and calamitalean axes, woods and ?cycadaeoidean axis.

Rajni Tewari

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

Quantitative and qualitative palynological studies of samples from Majri, Hindustan Lalpeth, Durgapur and Ballarpur collieries, Wardha Valley have been carried out. A rich Upper Karharbari palynoassemblage has been recorded in lithologically designated Barakar Formation in Hindustan Lalpeth and Majri area. Study of gula and gulate megaspores has been compiled and finalized (with **Rajni Tewari**).

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

Recent collection of plant fossils from different collieries of Kanhan Valley Coalfield, viz. Tandsi, Nandan 1&2, Ghorawari, Ambara, Mohan, Damua and Datla have been sorted out, categorized and grouped. Their observation, description and photo-documentation are carried out. The taxonomic identification of the assemblages reveals the presence of different species of G*angamopteris, Noeggerathiopsis, Glossopteris, Neomariopteris, Phyllotheca, Vertebraria, Samaropsis, Cordaicarpus*, equisetalean and probable calamitalean axes. Lycopsid axes showing fertile structures in attachment have been discovered for the first time in the Lower Gondwana succession of India. The axes show the presence of mega- and microsporangium and microscopic examination of the fossil indicates the bursting stage of megasporangium where in the trilete megaspores are scattered over the surface of fossil. The cuticular preparations and examination of structural features of the plant are under progress. The chemical processing of samples from almost all the collieries of Kanhan Valley has yielded a variety of megaspores. These megaspores have individually been picked up to examine their external and internal features.

The samples collected from underground mines of Pathakhera, Chatarpur, Satpura, Shobhapur and Tawa of Pathakhera Coalfield have apparently not yielded well-preserved plant mega fossils, but maceration of samples have helped to recover well-preserved spores and pollen assemblages which are useful in stratigraphic correlation. The dominance of monosaccate pollen and trilete spores suggests their comparison with the mioflora of lower Karharbari Formation.

The comparison of fossil assemblages of Kanhan Valley with that of Pench Valley indicates their similarity in having the species of *Gangamopteris, Noeggerathiopsis, Glossopteris* and different types of seeds and megaspores. However the typical genera like *Botrychiopsis, Buriadia, Euryphyllum,* and *Rubidgea* are absent in the flora of Kanhan Valley. In general, the flora is comparable with the Karharbari flora of Lower Gondwana.

Systematics and evolutionary features of different genera of *Glossopteris* flora are being reviewed to examine the development of flora in different horizons of Permian. The megaspores known from the Lower Gondwana beds of India have been studied to confer the diversity trend in the character affiliation of different genera and species. The records of gall-inducing arthropods from Indian sediments are discussed and it has been observed that in Indian sub-continent the gall-inducing arthropods evolved as early as in the early Permian and they continued into the Mesozoic flora. They had an active role in angiospermous flora of Late Cretaceous and Tertiary.

A.K. Srivastava

Component 5: Mesozoic terrestrial ecosystems of peninsular India

The Mesozoic petrified woods in the east coast recorded from different sedimentary basins– Cauvery, Palar, Krishna-Godavari and Pranhita-Godavari have been evaluated to infer various environmental regimes. These woods are preserved in varying colours and their anatomical features help to categorize their botanical affinity. The taxa assignable to Araucariaceae, Podocarpaceae, Taxaceae, Cupressaceae and Ginkgoaceace recorded from the basins suggest luxuriant growth of gymnosperms. Since woods are used to interpret evolutionary biology and palaeoclimate analysis, comparative assessment of different preservational contexts in the east coast has been attempted. A need to intensify integrated approaches in

permineralisation studies is emphasised. Distribution of permineralised woods in the east coast provides a clue to environmental variations. Permineralizcd fossil coniferous woods are most common elements in the east coast Mesozoic flora and cellular characters constitute reliable tool to understand environmental influence. Tracheidal features are potent indicators of changing physical parametres. Permineralisation as a process is not well understood and replacement minerals should be analysed for possible interpretation of deposition mileau. Variations with in the wood characters are attributable to micro-environmental necessities and/or taphonomic constraints.

Data accrued on palaeoflora of Pranhita-Godavari Graben has been assessed for taphonomic and palaeoecologic inference. Circumstances under which the flora survived in the selected geographic region are analysed. Selective processes acted prior to deposition and during diagenesis and a distinct floral assemblage varied through geographic distance with in the studied basin. Relative distribution of floral components was dictated by nature of sediment and environmental factors existed during the burial and subsequent preservation. Plant taxa assignable to Bryophyta, Pteridophyta, Pteridosperms, Cycadales, Bennettitales, Ginkgoales and Coniferales are variously represented in the basinal flora. Within the assemblage intermingling of plants belonging to distinct/distant habitats delimit explicit environmental inferences. The taphoflora distributed in different sedimentary environments exhibits quantitative and qualitative differences. Case study of *Ptilophyllum* floral constituents recovered from various sub-environments of the graben establishes compatibility of environment/plant part representation in ancient sediments. Leaf and wood evidences are used to derive ancient environments in the backdrop of selective processes which provide a partial understanding of past climates. An apparently monotonous vegetation of conifers, cycads, cycadeiods, and other gymnosperms with a limited ground cover of ferns and their allies in damper sites distinguish this flora. Since every province has an environmental spectrum preservation of different parts of plants was conditioned. Environmental variations at the regional to global scale are indicated by distribution pattern of various taphonomic modes. Field work has also been undertaken to Krishna-Godavari, Palar and Pondicherry basins and collected a number of sediments and specimens for laboratory analysis.

A. Rajanikanth

Early Cretaceous conifer leaf fossil (*Elatocladus*) from the Vemavaram Shale, Uppugundur area, Krishna-Godavari Basin, Andhra Pradesh

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

Studies have been carried out on megafossils and palynological samples from Kuar Bet Beds located in the Great Rann of Kutch, Kutch district (Gujarat). The re-investigation has been taken for the age of the beds that have been hotly contested with faunal evidence, suggesting a Bathonian (Middle Jurassic) age based on ammonite and foraminiferal occurrences, whereas palaeobotanical evidence suggesting an Early Cretaceous age based on presence of the index fossil *Onychiopsis* sp. cf. *psilotoides* (Stokes & Webb) Ward. Previously reported palynological evidence documented numerous angiosperm pollen taxa, lending further support to an Early Cretaceous age. But the present investigation (palaeobotanical and palynological) of the Kuar Bet Beds discounts earlier identifications of *Onychiopsis*, considering these specimens to represent a new species of the genus *Coniopteris*, *C. kuarbetensis* sp. nov. The plant macrofossil assemblage also contains ovulate scales of *Araucarites* Presl and rooting organs.

Palynological preparations revealed a diverse assemblage that includes ?*Sphagnumsporites*, *Cyathidites*, *Dictyophyllidites, Todisporites*, *Concavissimisporites*, *Klukisporites, Densoisporites*, *Callialasporites* (2 sp.), *Alisporites* spp., ?*Podocarpidites*, *Araucariacites* and *Ginkgocycadophytus,* all of which are long-ranging Mesozoic forms that occur in both Jurassic and Cretaceous sediments. Angiosperm pollen has not been observed. The angiosperm pollen reported by Mathur is here regarded as contaminants, introduced during the laboratory treatment of rock samples. Refuting the presence of *Onychiopsis* and angiosperm pollen from the Kuar Bet Beds discounts an Early Cretaceous age, with the plant fossils and palynological assemblage being more consistent with a Middle Jurassic age, in general agreement with faunal data. However, the precise position within the Middle Jurassic remains uncertain with palaeobotanical and palynological results being most comparable with a late Middle Jurassic (Bathonian or Callovian) age while faunal evidence supports an early Middle Jurassic (Bajocian) age. Also visited GSI (Kolkata) for consultation at the Central Library, and also to consult the concerned geologists.

B.N. Jana

Project 4: Floral evolution and Biostratigraphy of Rajmahal Basin

Component 1: Terrestrial megafloral change during Mesozoic in Rajmahal Basin

Detail study of silicified plant remains from Hiranduba locality has been carried out. Two new genera– *Hirandubia cupressoides* gen. et sp. nov. and *Rajmahaliospermum podocarpoides* gen. et sp. nov. of the family Cupressaceae and Podocarpaceae are recorded in association with *Elatocladus*-type leaves, male cone (*Podostrobus rajmahalensis* (Rao) Rao & Bose) and bennettitalean remains (*Ptilophyllum* and *Dictyozamites*) etc. Co-dominance of conifer and bennettitalean remains indicates that a mixed conifer and bennettitalean vegetation was probably growing there. Rare occurrence of pteridophytes shows that perhaps pteridophytes were flourishing near water bodies and shady places only during Early Cretaceous times in this area.

Jayasri Banerji & A.K. Ghosh

Component 2: Biostratigraphy of Gondwana sediments in Rajmahal Basin

The preliminary study of subsurface material from bore-hole BRS-2 (64.25-603.2 m depth) is done for the spores and pollen. The samples at various depths from 64.25 m to 214.25 m depth show presence of *Araucariacites*, *Callialasporites turbatus, C. trilobatus, Podocarpidites ellipticus, P multesimus, Cyathidites, Contignisporites* and *Concavissimisporites* suggesting the Upper Gondwana affinity of the palynoflora. The taxa could be identified up to generic level only as specimens are charred and blak. The organic matter recovered is black in colour due to thermal effect of volcanic activity.

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

Samples (40) from the new mine section of Neyveli area have been studied. Quantitative and qualitative studies of maceral composition suggests high incidence of huminite group of maceral followed by liptinite and inertinite group of macerals. Huminite generally ranges from 76.4-82.8%. It mostly consists of humodetrinite (attrinite and densite), textinite, carpohuminite and gelinite. Liptinite group constitutes sporinite, cutinite, suberinite, resinite and alginate (*Botryococcus*) and ranges from 3-15%. Inertinite group constitutes semifusinite, fusinite, inertodetrinite and sclerotinite and vary from 4-18%. Mineral matters (quartz, clay, pyrite) have also been recorded in these samples. Fluorescence studies have shown the characteristic presence of suberinite, resinites. Typical cross section of rootlet has been recorded. Maceral data has been plotted on triangular diagram, suggests the fluctuating oxidative and reducing conditions operating during the development of palaeoecosystem in Neyveli swamp. Reflectance studies have been carried out to ascertain the maturity trends in the area. Reflectance varies from 0.29-3.39% in oil. This suggests its low maturity in comparison of Panandhro lignites (3.90-4.50%).

Rakesh Saxena

Consulted literature and prepared nearly 200 reference cards of important papers related to coal petrology. Learned the techniques (crushing, grinding, embedding and polishing) for the preparation of coal/ lignite pellets. 15 pellets from Vastan lignite mine, Surat (Gujarat) have been prepared. The microscopic study of pellets under normal and blue reflected light is in progress. Study shows the presence of huminite, liptinite and inertinite groups of macerals along with mineral matter. Huminite constitute mainly humocollinite and humodetrinite. Liptinite generally comprises sporinite, cutinite, alginite and resinite. Inertinite mainly composed of fusinite, inertodetrinite, sceleronite, etc., while mineral matter generally consist of pyrite (FeS_2), calcite ($CaCO_3$), siderite (Fe_2CO_3) etc.

Hukam Singh

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

The coal samples representing Mailaram area of the Godavari Valley Coalfield have been studied for their petrological characteristics. In general, the coals representing the Queen Seam of this area contain the dominance of vitrinite and inertinite group of macerals and contain low frequency of mineral matter association. Thus, the coal in this area is of better quality.

O.S. Sarate

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

Compiled, tabulated and plotted the macerals, microlithotypes, associated mineral matters, and vitrinite reflectance (for rank) data accumulated on the coals (encountered in 4 bore-holes) from Hura (representing seams I – IV), Chuperbhita (seams I – VIII) and Pachwara (seams I – IX) coalfields. The vitrinite reflectance ($R_{o\,max.}$ 0.40-0.58%) suggests that these coals are of sub-bituminous A to high-volatile bituminous C rank. The ratio between various reactive and non-reactive constituents indicates that coals are of inferior quality for selective utilization, because of the predominance of mixed (vitrinite-rich: fusovitric + inertinite-rich: vitrofusic) coal types associated with poor contents (up to 14%) of liptinite macerals. In fact, intimate association of high inherent argillaceous inorganic (mineral) matters with liptinite macerals; tend to mask them, rendering their identification difficult or even impossible under normal incident mode. However, observations under blue light excitation show manifold increase in liptinite contents, chiefly constituted by sporinite (up to 58%, with wide range of preservational stages from well preserved to highly degraded and fragmented), liptodetrinite (up to 22%) and alginite (*Botryococcus* and lamalginite, up to 8%). Cutinite, fluorinite, resinite and exsudatinite are in subordinate amount. High amounts of hydrogen-rich macerals (liptinite+perhydrous vitrinite: 24-75%) in the Rajmahal coals render them suitable for hydrogenation. Evidently, it appears that the seams have formed dominantly from hypautochthonous to autochthonous woody vegetation in rapid seasonal fluctuations with wet-reducing to occasionally dominant dry-oxidative conditions.

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 photographs of selected varieties of semifusinite and fusinite macerals of the inertinite group observed in Indian Permian Gondwana coals (of low rank), taking into consideration their cell structure, cell wall thickness, reflectance, degree of oxidation, etc. Based on their morphology, structure, presence of canals/vesicles, etc., categorized (into 4-5 types) the varieties of secretinite maceral (= resino-inertinites/ fusinised resins) of the group recorded from these coals. Besides, up-dated the 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

A number of silicified woods collected from the Eocene and Neogene sediments of south Gujarat have been studied. Four types of dicot woods are identified from the Eocene sediments of Surat district. In addition, woods of *Hopea* (Dipterocarpaceae), *Ficus* (Moraceae), *Millettia-Pongamia* (Leguminosae) and *Palmoxylon* (Palmae) are identified from the Neogene sediments of Bhavnagar. The assemblage indicates existence of moist tropical conditions in the area during Plio-Pleistocene time as compared to the drier conditions of Bhavnagar today.

J.S. Guleria

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

Continued palynological and palynofacies studies on litho-succession representing Akli Formation of Barmer Basin. The studied section of this formation is exposed in open-cast lignite mine located near Giral (Barmer). Emphasis has been laid on quantitative analysis of organic matter (OM) present in macerated residue. Lower part of the section representing the gray shale showed presence of structured terrestrial palynodebris, constituted by leaf cuticle and woody tissues in abundance (40%), but these contents decreased in upper part of the bed. In bottom grey shale, the biodegraded terrestrial contents ranged between 20-40%, amorphous matter 6-40%, and black debris between 10-12%. Spores/pollen content in this part is represented by 2 to 4% only. All lignite seams of the sequence exhibited almost uniform distribution patterns of various types of OM, though some variation in frequency of amorphous and black debris is noticeable. Frequency of biodegraded phytoclasts in lignite samples is observed to be higher in comparison to other litho-types. Another remarkable feature observed in lignite samples is the presence of pyritized amorphous matter. Black debris, indicative of prevalence of anoxic condition after burial of sedimentary detritus, is noticed to occur in low frequency in the lignite. Clay beds contained structured terrestrial (10-35%) and biodegraded terrestrial (up to 50-65%) OM. Frequency of black debris in clay beds is high in topmost bed, whereas the pyritized amorphous OM is either extremely low or absent.

Abundance of biodegraded terrestrial and amorphous types throughout the sequence may be attributed to high

microbial activities. It also indicates dominance of anoxic conditions after burial of OM in bottom and middle parts of the section. Lower frequencies of biodegraded terrestrial and amorphous OM at the upper part and an increased amount of black debris are indicative of gradual prevalence of moderate oxic conditions. Occurrence of resin lumps throughout the sequence indicates involvement of plant fragments derived from higher plant groups, mostly the arboreal angiosperm trees, dwelling in lagoonal swamps.

Palynofacies analyses supported the conclusions drawn from the palynological studies. Presence of dinoflagellate cysts in some samples indicated the association of palaeo-shoreline with the swamps where large amounts of detritus from adjacent area were accumulated. The neighboring area was inhabited by vegetation chiefly dominated by Arecaceae, Liliaceae, Oleaceae, Guttiferae, Lamiaceae and Onagraceae. Prevalence of fragments of land plants and their transportation to depositional site indicated dominance of higher plants in surrounding vegetation. Presence of dinoflagellate cysts in some beds indicated mixing of sediments with marine water near the shore-site, whereas their low frequency might have been due to dilution of marine entities because of high influx of terrestrial components in the basin. Higher concentration of terrestrially derived OM suggests proximity of deposition site to the shoreline. Well-preserved structured phytoclast and quite good amount of biodegraded amorphous and pyritized amorphous OM in lignite seams suggest prevalence of anoxic condition after burial of the sediments. Palynodebris from clayey beds are characterized by high frequency of biodegraded and amorphous matter indicating moderate anoxic condition. The microbial action at the time of diagenesis of these beds was comparatively less than that in lower and middle lignite seams. Degradation of OM in the studied section exhibited different degree of microbial activity which is clearly evident in different lithotypes. Phytoclasts obtained from clay and shale samples showed good morphological details in comparison to those recovered from lignite. Black debris in increased amount in the top of the section evidenced gradual prevalence of oxic conditions which appears to be due to coarser lithology and supply of detritus in lesser quantity. These attributes allowed structural phytoclast to come into contact with air for a larger period resulting into oxidation and transformation of OM in black colour or in opaque condition.

S.K.M. Tripathi

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

Carried out sorting and documentation of plant megafossils (fruits, leaves, carbonized woods) collected from Cochin, Cannanore, Payangadi clay mine, Kundra clay mine (Kerala), Warkala; Neyveli Lignite (Tamil Nadu), Bahur Basin (Pondicherry) and its adjoining areas, and continued studies on previously collected fruits, leaves, and carbonized woods from Ratnagiri, Deogarh, Sindhudurg and Sawanthwadi (Maharashtra) and its adjoining areas. Prepared thin sections of 20 carbonized woods from Ratnagiri, Neyveli, Warkala and Payangadi. Photographed certain fossil fruits from Payangadi and Neyveli Lignite and their morphotaxonomical study is in progress. Processed 7 more carbonized woods from Neyveli Lignite and 8 petrified woods from Pondicherry from recent collection.

Described first record of *Terminalia* from Miocene of Payangadi Mines (Warkalli Beds), Cannanore District (Kerala). Documented and finalized a manuscript on floristics and diversity of the fossil leaf assemblage from Neyveli Lignite deposits. Reported a conifer wood from Kallamedu Formation of Cauvery Basin.

Anil Agarwal

Component 4: Palaeofloristics of sedimentary sequences associated with Deccan Traps

Investigated angiospermous fossil woods from Yawatmal district, Maharashtra, and one of them has been identified as *Barringtonia* of the family Barringtoniaceae (Lecythidaceae). Further work is being done to identify other woods and to finalize the paper. A paper dealing with a wood infected with fungi is finalized. Some fossil woods have been studied from Ghughua National Fossil Park. Most of them were already reported from the area. In one of the fossil wood of *Sterculia,* some additional characters, such as bark anatomy, vertical gum canals, etc. are studied in detail. Further work is being done to finalize the paper (with **J.S. Guleria**). A few palm leaves and rootlets have also been studied from Binori Reserve Forest.

Rashmi Srivastava

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

Recovered a new palynological assemblage from the thin sedimentary beds exposed in isolated patches near the village Rangapur, Andhra Pradesh. The assemblage, although not very diverse, is quantitatively rich and is significant in terms of palaeobiogeographical inferences. The bed is marked by the presence of eutherian mammals (Eurasian affinity) and is located not very far to Naskal, another well known mammal bearing locality of the Deccan Intertrappeans. Presence of *Mulleripollis bolpurensis* Baksi & Deb, *Ariadnaesporites intermedius* Hall, *Triporoletes reticulatus* (Pocock) Playford, *Gabonisporites vigourouxii* Boltenhagen and *Azolla cretacea* Stanley in the assemblage indicates a Maastrichian age for these beds. This corroborates with the palaeontological data as the animal fossils also represent a Late Cretaceous age. Like the eutherian mammals, the spore-pollen assemblage contains typical African and Eurasian elements, indicating some sort of connectivity of the Indian plate with Eurasia by an early collision of the Indian plate or by land connections through an island-arc complex. The palynoassemblage is dominated by the pteridophytic spores (*Cyathidites, Triporoletes, Gabonisporites, Todisporites, Polypodiisporites*) and fungal remains indicate a warm and humid climate during the time of deposition of the sediments. The associated remains of aquatic freshwater ferns (*Ariadnaesporites*, *Azolla* and *Minerisporites*) belonging to Salviniaceae indicate that the deposition took place in small freshwater bodies, formed due to the obstruction of drainage by the lava deposits of the Deccan volcanism. The earlier recovered assemblages from various localities of the Deccan Intertrappean are also being studied and complied. Late Cretaceous sediments from Anjar (Gujarat) and new localities of Madhya Pradesh and Maharashtra are also collected for study.

R.S. Singh

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

Nypa fruit from Disang Eocene sediments, Wokha District, Nagaland

A large number of petrified woods collected from various localities of Tipam Sandstone Formation of Tripura have been systematically studied and described. A nicely preserved fruit collected from the Disang sediments of Wokha district (Nagaland) is systematically studied, identified and described. It belongs to *Nypa* of Arecaceae which indicates the coastal environment during the period of deposition. Besides, documented a paper on 'Evolutionary history of angiosperms in India on the basis of their megafossils'.

R.C. Mehrotra

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

A number of leaf impressions from the Kasauli sediments of Himachal Pradesh have been examined and some of them are found to represent the following genera, viz. *Donax* (Marantaceae), *Syzygium* (Myrtaceae), *Semecarpus* (Anacardiaceae), palm leaves and some legume leaflets. The forms indicate occurrence of tropical moist-deciduous vegetation near Kasauli during early Miocene as compared to the temperate vegetation of Kasauli today. The change in climate and vegetation is the result of Himalaya uplift.

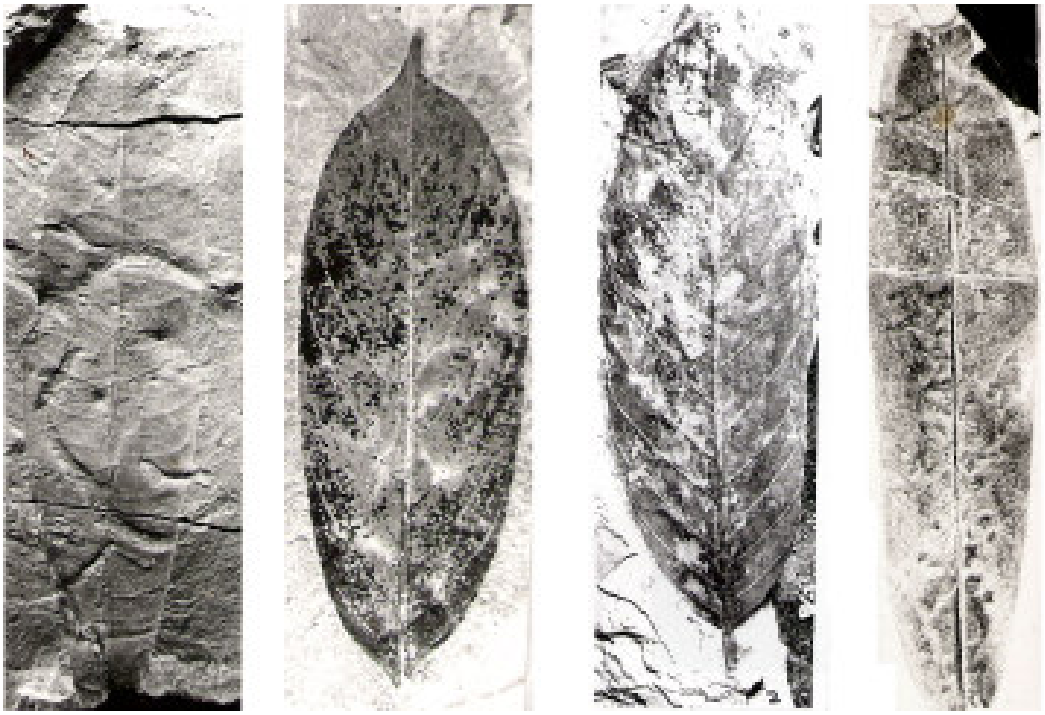
J.S. Guleria & Rashmi Srivastava

Component 8: Siwalik foreland basin: Floristics, evolutionary pattern and climate

Carried out morphotaxonomical study of the plant megafossils from Siwalik sediments of Tanakpur (Uttarakhand), Oodlabari (WB) and Koilabas (western Nepal) areas. Photo-documentation and detailed description of already identified leaf and fruit impressions from Tanakpur area have been completed. Collected fresh plant megafossils (woods, leaf and fruit) impressions from the Siwalik sediments of the area for further study. The lithocolumn of well exposed section is prepared and photographed. A rich and diversified assemblage of plant fossils comprising 26 new species of 13 angiospermous families has been recovered from Lower-Middle Siwalik sediments of Darjeeling district. The investigation has been done to explore and workout systematics of the plant fossils especially leaf impressions of Lower Siwalik sediments exposed in Koilabas area in the Himalayan foot hills that records 20 new species to the fossil flora of Siwalik. On the basis of available data, reconstruction of the palaeofloristics, palaeoecology and phytogeography of the area have been discussed.

The angiospermous fossil leaves so far recorded from the Siwalik foreland basins of India, Nepal and Bhutan have been analysed and an attempt has been made to deduce palaeoclimate and phytogeography of the region during Mio-Pliocene times. The physiognomic characters of the fossil leaves have been critically examined. The dominance of entire margined species (about 92%) in the Siwalik leaf assemblage indicates the prevalence of tropical climate. The presence of conspicuous drip tips and other features, like leaf size, leaf texture, nature of petiole and venation density collectively suggest tropical climate with heavy rainfall during Mio-Pliocene times.

Mahesh Prasad



Cerbera odallum (Apocynaceae) | *Millettia auriculata* (Fabaceae) | *Uvaria hamiltonianum* (Anonaceae) | *Diospyros argentia* (Ebenaceae)

New fossil leaves from Siwalik Group, Darjeeling District, West Bengal

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

Chemically processed surface rock samples of Kimin Formation exposed on Pasighat-Ledum Road, East Siang District, Arunachal Pradesh. All the samples unfortunately turned out to be unproductive.

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

Samples collected (35) from the Kopili Formation (Late Eocene) exposed along Umrongso-Haflong Road, North Cachar Hills (Assam) have been macerated. Scanning of slides, photo-documentation and study of palynofossils are being completed. A rich and diverse palynoassemblage has been recorded, which includes fungal remains, pteridophytic spores, gymnospermous and angiospermous pollen and reworked palynofossils. The important palynotaxa of the assemblage are– *Lygodiumsporities eocenicus*, *Foveosporites triangulus*, *Striatriletes susannae*, *S. multicostatus*, *S. paucicostatus*, *Intrapunctisporis intrapunctis*, *Polypodiaceaesporites indicus*, *Monolites mawkmaensis*, *Polypodiaceaesporites mawkmaensis*, *P. speciosus, Podocarpidities ellipticus*, *Inaperturopollenites punctatus*, *Spinizonocolpites echinatus*, *Proxapertites assamicus*, *Tricolpities minutus*, *Densiverrupollenites eocenicus*, *Pellicieroipollis langenheimii*, *Tricolporopollis matanomadhensis*, *Palmidities plicatus*, *Palmaepollenites nadhamunii*, *Margocolporites sahnii*, *M. complexum*, *Verrucolporites verrucus*, *Tricolporopilites robustus*, *Dermatobrevicolporites dermatus*, *Triporopollenites* sp., etc. Reworked Gondwana palynofossils are represented by *Strotersporites*, *Klausipollenites* and *Callialasporites*. The palynoflora indicates a tropical-subtropical, warm-humid climate with heavy precipitation during the sedimentation of the Kopili Formation. The environment of deposition has been interpreted as coastal with ponding conditions nearby. The source area of the reworked Permian palynofossils may be Lower Gondwana exposures in Singrimari, Garo Hills. The present assemblage is identical to the Kopili assemblages recorded from the Garo Hills and Jaintia Hills of Meghalaya and is Late Eocene in age. Scanning, photo-documentation and study of palynofloral assemblage from the Rewak Formation of Garo Hills has also been completed.

R.K. Saxena & G.K. Trivedi

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

Completed palynological study of a section near village Chasara exposed along Khari River. The lower clayst one part of the section (Chasara Formation) has yielded 20 species of pollen and spores belonging to 16 genera. The important palynotaxa are– *Striatriletes susannae, Khariasporites granulatus, Abiespollenites* sp., *Graminidites* sp., *Palaeomalvaceaepollis paucispinosus, P. mammilatus, Perfotricolpites neyvelii, Foveotricolpites prolatus, Albertipollenites retibaculatus, Verrutricolporites* sp., *Dermatobrevicolporites dermatus*. The assemblage is devoid of any fungal remains. *Striatriletes susannae* overwhelmly dominates the assemblage while the other taxa are poorly represented. It indicates that *S. susannae* was a local element and other taxa have been transported from a distance to the depositional site. Presence of a few broken palynomorphs and reworked Mesozoic spores corroborate this finding. The presence of characteristic taxa *Striatriletes, Khariasporites, Palaeomalvaceaepollis, Perfotricolpites* and *Abiespollenites* indicate Miocene age. Earlier recorded assemblages from Khari Nadi (Kutch), Quilon and Warkalli (Kerala) formations grossly compare with the present one.

J.P. Mandal

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

A rich palynological assemblage has been recovered from Niniyur Formation exposed at Periakurichchi limestone mine section, Perambalur district (Tamil Nadu). The palynoassemblage consists of 21 genera and 29 species of algal remains (4 genera & 6 species), pteridophytic spores (2 genera & 2 species) and angiosperm pollen (12 genera & 16 species). Reworked elements (Cretaceous, 3 genera & 5 species) and Gymnosperm pollen have also been recorded.

Qualitative and quantitative analyses reveal that the angiosperm pollen is dominant over algal remains. Some of the important genera recorded are– *Lygodiumsporites, Cyathidites, Podocarpidites, Palmidites, Liliacidites, Tricolpites, Warkallipollenites, Retitrescolpites, Palaeosantalaceaepites, Lanagiopollis,* and *Graminidites*. The palynomorphs in the assemblage have been compared with the pollen and spores of modern taxa and the distribution of the families represented by the fossil taxa suggest a tropical-subtropical climate during the sedimentation.

Palynomorphs belonging to low-land (*Lanagiopollis, Tricolporopollis, Retistephanocolpites, Retitrescolpites, Clavaperiporites, Monoporopollenites*), fresh water swamp and water edge (*Azolla, Zygnema, Lygodiumsporites, Cyathidites*), coastal (*Liliacidites, Palmidites, Proxapertites, Retimonosulcites*), Mangrove (*Palaeosantalaceaepites, Warkallipollenites*) and Marine *(Achomosphaera, Lingulodinium)* have been identified. The presence of zygospores of Zygnemataceae and *Azolla* are indicative of stagnant shallow and more or less mesotrophic freshwater habitat. The presence of algal remains, fern spores and high incidence of grass pollen indicates that the prevailing flora was mainly of wet, open and mixed nature. The presence of dinoflagellate cysts and mangrove elements in the palynoassemblage indicates that the deposition took place in a shallow marine environment. Algae, Foraminifera, Ostrocodes and Molluscs also support the above view. The gymnosperm pollen possibly was derived from the high mountains. The studied sequence has been dated as Early to Late Palaeocene age on the basis of palynomorphs, viz. *Proxapertites, Palmidites, Retimonosulcites, Retitrescolpites, Rhoipites, Tricolporopollis* and *Retistephanocolpites*. Benthic and planktonic foraminifera also corraborate the view.

M.R. Rao

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

Palynofacies analysis of 2 coaliferous sequences exposed through mine cutting at Tirap Colliery and Dilni River Section near Dilni Colliery of Tikak Parbat Formation (Late Oligocene) have been carried out by means of palynoflora and sedimentary organic matter (OM). The stratigraphic beds of coal and associated lithotypes are extensive and undisturbed at colliery, while regular and parallel sided beddings are exposed at river section. The palynotaxa recorded in these sections are– *Cyathidites australis*, *C. minor*, *Lygodiumsporites* sp., *Striatriletes* complex, *Pteridacidites africanus*, *Lycopodiumsporites globatus, Polypodiaceaesporites chatterjii, Seniasporites minutus, Podocarpidites khasiensis, Meyeripollis nahorkatensis, Polyadopollenites miocenicus, Palmaepollenites nadhamunii*, *Langapertites* sp., *Neocouperipollis kutchensis*, *Pelliceroipollis langenheimii*, *Retitrescolpites decipiens*, *Favitricolpites ornatus*, *Perfotricolpites neyvelii*, *Tricolpites reticulatus, T. levis* and a few fungal fruiting bodies of *Phragmothyrites* sp., *Pluricellaesporites* sp. with some reworked Permian saccate pollen grains.

The sedimentary OM shows dominance of amorphous, biodegraded terrestrial, structured terrestrial, resins, gelified matters and black debris, etc. The amorphous and biodegraded OM derived from coal and shale contain rich framboidal pyrites (FeS_2), which indicate prevalence of reducing condition during their burial stage. The palynofloral and palynofacies contents have been used to observe their behavioral pattern in older to younger sequences and comparison of depositional pattern of both the sections situated at distant places in the basin. These palynological assemblages are also compared with other contemporaneous subsurface deposits of the region. The analysis indicates that the palynoflora and OM are dominated by land derived terrestrial entities, and exhibits depositional set up under swampy deltaic condition during Late Oligocene.

Madhav Kumar

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

Two kinds of fossil aquatic fungi of the ingoldian-type are reported for the first time from the Miocene sediments of Mizoram. The ingoldian-type of conidia has been recovered from 12 m thick section exposed adjacent to the Tlangsam on the India-Myanmar border, roughly 50 km east of Champhai. The section belongs to the Dulte Formation of Bhuban subgroup. At the base of the exposure there is a gravel bed and the rest exhibits an alternation of the claystone and sandstone, occasionally some minor shale bands are also found in between them. The yielded shale samples are rich in fungal elements, pteridophytic spores and pollen of angiosperms and gymnosperms. The presence of *Striatriletes susannae, Pinuspollenites crestus, Abiespollenites cognatus, Hibisceaepollenites splendus* and *Palaeomalvaceaepollis mammilatus* in the samples indicates a Miocene age. The fossil fungal remains are about 20% of the total elements and consist of hyphae, spores and other forms, e.g. *Colletotrichum, Cucurbitariaceites, Phragmothyrites, Dicellaesporites,* etc.

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

The Jara Dome, situated on the NW extremity of mainland group of islands in the Kutch Basin, exposes the upper part of the Chari Formation. It has yielded well-preserved, diverse and datable nannofossil assemblage comprising over 20 species. This part of the Chari Formation is exposed in a stratigraphic section (GPS value 23°43'38"N:68°59'42"E) and is divisible into the basal gypsiferous shales of ca 1m in thickness overlain by non-gypsiferous shaly unit followed by the marker Dhosa Oolitic limestone bands. The two shales are separated by a thin microammonite bearing horizon. Ammonites help to date the sequence as late Callovian-early middle Oxfordian. It is only the non-gypsiferous shale unit, which has yielded the nannofossil flora while the other two units are practically devoid of nannofossils due to unsuitable facies of the gypsiferous shales and recrystallization of nannofossils in hard Dhosa Oolite.

The recovered nannofossil assemblage includes *Ansulasphaera helvetica, Biscutum constans, Cyclagelosphaera margerelii, Ethmorhabdus gallicus, Lotharinguis crucicentralis, L. sigillatus, Podorhabdus grassei, Stephanolithion bigotii bigotii, S. bigotii maximum, S. hexum, S. speciosum, Thoracosphaera saxea, Watznaueria barnesae, W. britannica, W. manivitae, W. ovata, Watznaueria* spp., *Zegrhabdotus erectus,* etc. Amongst the above cited taxa, the age of the sampled stratigraphic level of the basal non-gypsiferous shaly unit is constrained by the FAD of *S. bigotii bigotii* in the European late early Callovian *calloviense* zone and the LAD of *A. helvetica* in the late late Callovian *lamberti* zone. This interval corresponds to the NJ 13 *Stephanolithion bigotii bigotii* zone.

Record of *Crepidolithus granulatus, C. pliensbachiansis, Stradnerlithus clatriatus, Scizosphaerella punctulata* in the assemblage indicates reworked elements from older Chari and the oldest Patcham Formation which is exposed in the Patcham Island. The Patcham Formation is dated as Bajocian-Bathonian on rare records of ammonites' evidences. The earliest transgressive event in the region is postulated during Bajocian by several workers. Record of reworked nannofossils strongly suggests an earlier trangressive event, possibly during Pliensbachian-Torcian time in the Kutch Basin. Co-eval records of nannofossils containing *C. granulatus* and *C. pliensbachiansis* from Queen Charlotte Island, British Columbia (Bown 1992) and *C. granulatus, S. punctulata* from Masirah Island, Sultnate of Oman (Perch-Nielsen 1997) suggests existence of a seaway in the form of an arm of the Tethyan sea between Arabia-Africa and in the western part of India. The present nannofossil find, thus has much wider implications not only in dating of early Jurassic sediments but also on the palaeogeographical position of India during this time.

Jyotsana Rai

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

Taxonomic analysis of calcareous algae on collected samples from the Late Cretaceous to Early Palaeocene sequence of Pondicherry, Vriddachalam and Ariyalur areas of Tamil Nadu has been done. The calcareous algal assemblage is represented by families Hapalidiaceae, Corallinaceae and Sporolithaceae (Rhodophyta) in addition to Dasycladaceae (Chlorophyta). Family Hapalidiaceae is represented by the taxa belonging to subfamily Melobesioideae. Corallinaceans are represented by the taxa belonging to subfamilies Lithophylloideae and Corallinoideae. Sporolithaceans are represented by the genus *Sporolithon*. Photomicrography, description, identification of the taxa and interpretation on palaeoenvironmental significance has been made. Finalization of the manuscripts is in progress. A field work has also been undertaken in the Pondicherry and Ariyalur areas for the collection of samples pertaining to the study of calcareous algae. About 10 localities have been visited in Pondicherry and Ariyalur areas. In all the localities outcrops are measured and more than 60 samples have been collected for the study in thin sections.

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

Key for the identification of different Wetzelielloid genera is finalized. On the basis of cyst outline Wetzelielloid genera are grouped into typically pentagonal to roundly pentagonal in shape (*Wetzeliella*, *Apectodinium*, *Charlesdowniea*, *Wilsonidium* and *Kisselovia*), rhomboid (*Rhombodinium*) and triangular (*Dracodinium*). Typically pentagonal to roundly pentagonal shaped genera are further grouped as forms with processes (*Wetzeliella, Apectodinium, Charlesdowniea* and some of the species of *Wilsonidium*), and forms without processes or with ornamentation of low relief (*Kisselovia* and some of the species of *Wilsonidium*). *Wetzeliella, Apectodinium, Charlesdowniea* and some of the species of *Wisonidium* with processes are differentiated on the basis of cyst wall relationship as well as the ornamentation. Genus *Wetzeliella* is typically cavate generally with nontabular processes sometimes with intratabular processes. *Apectodinium* is circumcavate to cornucavate with nontabular processes. Ornamentation in *Wilsonidium* is intratabular with parasutural processes whereas in *Charlesdowniea* processes are connected distally to form platewise ectophragm. Pentagonal to roundly pentagonal cysts with ornamentation of low relief (*Kisselovia* and some of the species of *Wilsonidium* with ornamentation of low relief are differentiated on the basis of arrangement of ornaments. Ornamentation in *Kisselovia* is reticulate with free pandasutural areas whereas in *Wilsonidium* it is parasutural. *Rhombodinium* and *Dracodinium* differ from rest of the Wetzelielloid genera in being rhombic and triangular to subtriangular in shape respectively.

Wetzelielloid taxa recovered from Lakadong Sandstone Unit of Sylhet Limestone Formation exposed at Jathang section, Mawsynram area, Khasi Hills resemble *Wetzeliella, Apectodinium, Charlesdowniea, Wilsonidium* and *Kisselovia* in cyst outline being typically pentagonal in shape but differing in ornamentation, whereas resembling *Rhombodinium* and *Dracodinium* in periphragmal ornamentation but differing from both in cyst outline as *Dracodinium* is triangular and *Rhombodinium* is rhombic in shape whereas present forms are typically pentagonal in shape, hence a new genus is proposed and a manuscript is finalized.

Frequency occurrence of dinoflagellate cysts recovered from the Upper part of Tura Formation and Siju Limestone Formation exposed along Tura Dalu Road and Dilni River sections and variations in dinoflagellate cysts/organic matter distribution in the vertical section are plotted for biostratigraphic and palaeoenvironmental interpretations. Low diversity dinoflagellate cyst assemblage occurs in the Upper part of Tura Formation, whereas it is well diversified and rich in Siju Limestone Formation. This indicates a sudden change from marginal/coastal marine conditions to more stabilized shallow inner shelf normal marine depositional environment.

Undertook a field work in Cherrapunji area, Khasi Hills, Meghalaya to study and sample the Upper Cretaceous-Palaeogene succession. Detailed sampling at closer intervals for phytoplankton and palynofacies study has been done across time boundary intervals.

Rahul Garg, Khowaja Ateequzzaman & Vandana Prasad

Based on combined study of palynology, palynofacies and sedimentology, a depositional history of Lakadong Sandstone (Late Palaeocene-Early Eocene), Khasi Hills Meghalaya has been reconstructed. The study shows that the coal-bearing Lakadong Sandstone facies have been deposited as a result of inundation of coastal low land areas in a back barrier swamp formed during lateral migration of distributory channels in a deltaic setting. This transgressive event is stepwise retreat of the coast resulting in drowning of barrier sand/beach back swamp deposit and development of bay-fill sequences in a proximal setting landward. Barrier retreat hence represents a suite of punctuated transgressive process with overall increase of sediment supply and temporary regression of coastline. Parasequences were developed during flooding event that resulted in the formation of bay followed by gradual inundation of barrier sand and barrier swamp. Five parasequences have been identified within the transgressive systems tract during Late Thanetian at the time of deposition of Lakadong sandstone unit in this region. Each progressive progradational parasequence shows gradual increase in marine influence. A paper on the aspect has been finalized.

Vandana Prasad, Rahul Garg & Khowaja Ateequzzaman

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

Palynostratigraphical study of the Lower Tertiary sediments of Dharmsala and its adjoining areas, Himachal Pradesh has been continued. Palynofossils recovered from 3 measured stratigraphic sections of the Dharmsala Formation, viz. Banda-Kandi, Palampur-Kandi and Phargote-Thotri Road sections are analysed for palaeoenvironmental interpretation. In all, 37 genera and 49 species are recognized in the palynofloral assemblages. Some significant constituents of the assemblages are– *Striatriletes*, *Pteridacidites, Polypodiisporites, Compositoipollenites, Polyporina, Polyadopollenites,*

Bombacacidites, Monoporopollenites and *Pinuspollenites*. Quantitatively, the assemblage is dominated by gymnosperm pollen followed by angiosperm pollen and pteridophytic spores. The overall composition of the assemblage indicates the prevalence of wet semi-evergreen type of vegetation and warm-humid climate during the deposition of these sediments in the studied areas. On the basis of comparison of the present assemblage with the palynofloral assemblages known from Indian Tertiary sediments, an Early Miocene age has been assigned to the Lower Dharmsala sediments of the studied stratigraphic sections.

A diatom assemblage consisting of 7 genera and 16 species has been recovered for the first time from the sediments of Kasauli Formation exposed near the Kasauli market at Kasauli town, Solan district (Himachal Pradesh). Quantitatively, the pinnate forms are dominant, sharing more than 85% of the total assemblage. On the basis of comparative morphology, the recorded taxa have been assigned affinities to extant genera/ families. Significant taxa in the assemblage include *Amphora* spp., *Cymbella* spp. *Nitzschia* spp. *Pleurosigma* spp and *Pinnularia* spp. The present day distribution of such taxa suggests a tropical-subtropical climate with plenty of rainfall. The environment of deposition has been interpreted mainly as fresh water swamp with little brackish water influence in the system. A paper has been finalized on palynological and palynofacies aspects of the Subathu Formation (Early Ypresian-Middle Lutetian) of Morni Hills, Lesser Himalayas. Also undertook field work for collection of palynological samples of Dharmsala and Subathu formations of Dharmsala and its adjoining areas.

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 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 Palaeoseismisity

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 1.75 m deep sediment core from Tula-Jalda Swamp, Shahdol district has shown the dominance of non-arboreals and low frequencies of arboreals. The tree taxa, viz. *Shorea robusta*, *Madhuca indica*, *Lagerstroemia*, *Radermachera*, *Terminalia*, *Symplocos*, *Aegle marmelos*, *Acacia*, etc. are sporadically recorded. On the other hand, the rich ground flora comprises mainly grasses, sedges, Asteraceae, Caryophyllaceae, *Artemisia*, *Polygonum* sp., etc. The overall vegetation assemblage is suggestive for the existence of open mixed tropical deciduous forests in the region under a warm and moderately moist climate during the Late Quaternary Period. The excessively high frequencies of sedges together with other

marshy elements throughout the sequence portray that the swamp might have been quite large in expanse during the course of sediment accumulation. Ferns and their allies occurred luxuriantly in vicinity of swamp as obviously indicated by the consistently high values of monolete and trilete spores.

The pollen analytical investigation of 6 surface samples from tropical deciduous sal forest at Padauna, Shahdol district has revealed the relatively much higher frequencies of non-arboreals (herbs) as compared to the arboreals (trees and shrubs). Among the trees, *Shorea robusta* (sal) has been recorded with an average frequency of 6% (range 2-10%) only, irrespective to its being a high pollen producer. The under-presentation of sal could be inferred to poor preservation of its pollen in the sediments. The associates of sal, viz. *Madhuca indica*, *Holoptelea* and Sapotaceae, despite their consistent presence, are also recovered in low frequencies, whereas *Emblica officinalis*, *Terminalia*, *Sterculia*, *Schleichera*, *Acacia*, *Lagerstroemia*, *Adina cordifolia*, etc. are represented sporadically. This irregular representation of all these taxa could be attributed to their low pollen productivity as they exhibit a strong tendency of entomogamy. The non-arboreals are marked by the abundance of Poaceae pollen followed by moderate values of Cyperaceae, Asteraceae, Caryophyllaceae, Cheno/Am, etc. Thus, the good presence of all these taxa in the pollen rain corresponds closely with their actual composition in the herbaceous complex. The retrieval of pollen of Cerealia, *Artemisia*, Brassicaceae, Urticaceae and *Xanthium*, though sporadically, denotes the proximity of habitation to the investigated site.

M.S. Chauhan

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

Geochemical investigation of 2 profiles (one each from bore-core and exposed section) from Saria Tal has revealed the knowledge of past organic matter (OM) and climate of the temperate zone of Kumaun Himalaya since around Middle Holocene. In the beginning of sequence, the investigated area had low representation of OM and moisture with sufficient carbonate contents, indicating less humid (dry) conditions in the region. Near Late Holocene OM and moisture showed little increase with decrease in carbonate contents, reflecting change in climate to humid conditions. Soonafter, moisture showed abrupt enhancement with increase in OM and carbonate contents, indicating establishment of more humid conditions. Their high representation continued onwards but with fluctuations (with inverse relation in OM and carbonate contents), reflecting fluctuating humid conditions during Late Holocene. Also prepared research note reporting Holocene Molluscan shells from Saria Tal. The knowledge of these shells is useful to assess past vegetation and climate as Molluscs feed plant material and live in specific climatic conditions. Molluscan shells have been recovered since around 2770 ±135 yrs. BP ahead and showed specific distribution of taxa in both profiles which reflects that the investigated area enjoyed watery condition near the onset of Late Holocene which continued onwards with fluctuation.

Prepared a research finding reporting concealed neotectonic disturbance at Sukha Tal, Kumaun Himalaya. Data generated from multidisciplinary analysis of lacustrine sediments revealed that the investigated profile is not a continuous sequence and is divisible in to 2 units– upper unit consists sediments from ca 8260 ±170 yrs. BP, while lower unit from 3790 ±90 yrs. BP to 2690 ±90 yrs BP. Presence of younger sediments below the older ones, normal order of superposition in both units, repetition of bed ranging from 3790 ±90 to 2690 ±90 yrs. BP in both units, and resemblance in OM recovered from contemporary beds of both units reflect that investigated region has concealed fault, caused possibly due to neotectonic disturbance. The splitting of rock took place sometime after 2690 ±90 yrs. BP and two units acquired position one above the other due to displacement of rock.

Asha Gupta

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

In sequel to the earlier observations successful mapping and selection of key areas for polar sediment traps in dry palaeolake beds distributed in Schirmacher Oasis has been made during 25th Expedition and sampled them for multi-proxy data generation. Evidences from the presence of >1 m thick sedimentary fill in the oasis predict that the oasis must have been a host of big lake systems in the recent past. The present lakes interspersed over the area are the remnants of those huge water bodies which once occupied the oasis. The study also records the presence of 6 major lakes in Quaternary times. 20 sediment samples were processed for diatom and pollen analysis. Diatom like *Pinnularia*, *Gomphonema*, *Hantzchia*, *Nitzchia*, *Fragilaria*, *Achnanthes* and *Navicula* spp. are recorded as major important taxa. The further detail study on distribution pattern of diatoms in various sediments will help to assess the response to modern environmental changes before carrying out any climatic interpretation. Study on 34 polar lake water samples has been undertaken to assess air temperature, water temperature, pH, oxidation-reduction potential (mV), conductivity, total dissolved solid (TDS) and salinity.

S.K. Bera, Anupam Sharma & Binita Phartiyal

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

Pollen analysed additional 20 samples from sediment profile from Bhagwanpur, Orissa (BS-1152; ±30,625 yrs. BP). Three types of depositional environments have been envisaged in the samples investigated so far:

1) Regressive (drier) Phase– between depths of 0-6 m earthy colour, silty clay, top sediments are characterized by a high frequency of hinterland and ubiquitous plants such as Oleaceae, Fabaceae Rubiaceae, Malvaceae, Meliaceae, *Emblica, Holoptelea, Acacia, Casuarina, Anacardium, Holoptelca*, *Salvadora*, Poaceae, Cyperaceae, Amaranthaceae/ Chenopodiaceae, Asteraceae, etc. along with a few fern spores. The sediments were deposited during a regressive phase. In a marine regressive episode, the emergence of a new land area pushed seaward movement of coastline and thus allowing seaward migration and colonization of mangrove species. The plant succession in associated, sheltered new muddy, swampy wetland initiated colonization of some salt tolerant grasses where stray occurrences of mangrove forest such as *Sonneratia* and *Avicennia* were also registered.

2) Transgressive Phase– between depths of 6-13 m yellowish fossiliferous limestone bearing sediments exhibited predominance of Rhizophoraceous members along with other members of core and peripheral mangroves but meagre presence of midland and fresh-water taxa. During the transgressive episode, the fresh water/saltwater interface was pushed further landward and the water table rose. The mangrove forest comprised of Rhizophoraceae, *Sonneratia, Avicennia, Excoecaria, Xylocarpus, Acanthus,* and *Heritiera* trove very well in this episode probably because there had been an equilibrium between relative sea-level rise and the rate of sedimentation, connected with an appropriate salinity.

3) Regressive Phase– between depths of 13-29 m yellowish limestone horizon exhibited reduction in Rhizophoraceae, moderate rise in *Avicennia, Excoecaria, Heritiera*, etc. and spurt in mangrove associate taxa suggest that this change in the vegetation complex might have been due to the recession in the tidal magnitude and at the same time increase in the fresh water discharge. The pattern of vegetation composition of pollen has revealed reduction in overall values of core-mangroves and instead salt-tolerant taxa having preference for brackish water environment flourished. Thus, it provides a clear cut picture of marine regression and an increased fresh-water discharge with moderate values of Poaceae, Amaranth/ Chenopod, Cyperaceae, Urticaeae, Apiaceae, Asteraceae, Lamiaceae, etc.

Asha Khandelwal

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

Undertook a field work in North Lakhimpur district Forest Division, Assam. Pollen spectra of 15 moss and dry soil samples portrays presence of only 20% of local forest plant taxa and over 50% of exotics, however fern spores have been encountered at the value of 15% along with 5% of degraded pollen and 10% of fungal remains. The study of two soil profiles (80-100 cm) reflects paucity of pollen grains excepting few grasses and degraded fern spores. Alkaline nature (pH 6.8-7.2) of sediments indicate deposition of microbiota. The study of 10 day's air catches over Cinatollia tea estate of North Lakhimpur district, Upper Assam records the occurrence of very low frequency of pollen grains, however the presence of large number of fungal spores including *Xylaria*, *Tetraploa*, *Curvularia, Alternaria*, *Nigrospora*, *Diplodia,* Microthyriaceae and Ascospores may cause various diseases on most valuable tea crops. The presence of exotic conifers along with other high altitude taxa in the aerospora proves high wind activity over the tea garden.

S.K. Bera

Occurrence of poor value of pollen grains with degraded fern spores along with fungal remains indicates the biological degradation during sedimentation as evidenced from Hasila, Urpad and Deepor Beels of Lower Assam. Biotic exploitation due to massive human interference causes sudden climatic fluctuations which threaten the loss of biodiversity around most endangered wetlands in northeast India. Palynological assemblage from sedimentary profiles from Margherita and Lekhapani Forest Division of Upper Assam predicted the existence of moist tropical forest under arid to cool and moist climatic regime since last 1000 years. Evidence of *Areca catechu* pollen in bottom wetland sediment (80 cm) suggests the existence of luxuriant growth of *Areca* plant in and around Deepor Beel in recent past.

S.K. Bera & S.K. Basumatary

Carried out pollen morphological studies of 40 major tropical arboreal taxa belonging to moist deciduous forest of Assam and adjoining areas. The habit and habitat, mode of pollination and their phenology have also been recorded. The microphotographs have been documented from the studied slides. The pollen morphological study will help in precise identification of sub fossil pollen in order to reconstruct palaeofloristics of tropical region in Assam and adjoining areas in time and space.

S.K. Basumatary

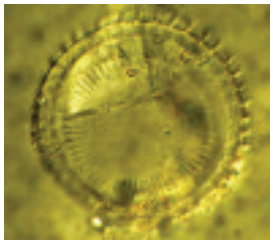
Project 11: Proxy climatic signals from Marine and Coastal sediments during Late Quaternary

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

With a view to understand the organic matter (OM) production, preservation and degradation in Arabian Sea sediments, palynofacies analysis of surface sediments from 15-3000 m depth in a 14.47-14.40^{0}N-70.77-74.25^{0}E transect have been carried out. For the study of palynofacies in the Arabian sea sediments qualitative and quantitative estimation of various OM types has been done. This involves the study of relative distribution of terrestrially derived OM content (oxidized, degraded and structured debris) and in situ marine component (phytoplankton, copepod egg envelopes, tintinids, scolecodonts, zooplanktons and amorphous OM aggregates). It is observed that the productivity, preservation and degradation of OM content are controlled by runoff related changes, hydrodynamic conditions and rate of sediment accumulation. There is a marked change in the palynofacies characteristics of the OM recovered from various depth zones. Unique ecological conditions, i.e. high precipitation rate and warm tropical conditions at surface waters during monsoon favours primary productivity. The high proportion of algal material (Dinoflagellate cyst and other algae) formed in the photic zone can be readily degraded and transforms into amorphous OM content. However, charcoal and woody plant tissue are resistant to decay and are transported to continental slope regions of greater depths. Detailed documentation of dinoflagellate cysts has been carried out.

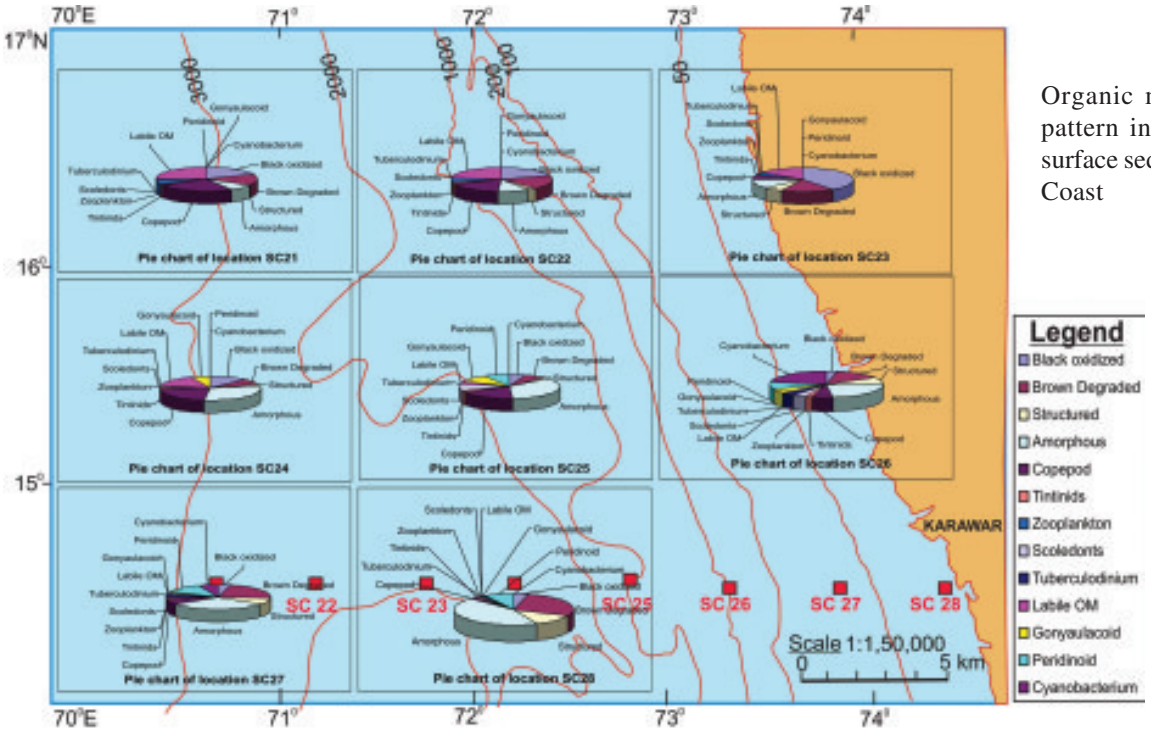
Rahul Garg, Vandana Prasad & Khowaja Ateequzzaman

Study of diatoms from a shallow sediment core SK117/SC06 off the Karwar Coast, Arabian Sea (samples provided by Dr. Rajiv Nigam, NIO) from ~50m water depth (15^0 30' E & 73^0 35' N) shows a remarkable association of fresh water and marine diatoms. The abundance of diatoms in the core is indicative of nutrient richness and surface water productivity. The assemblage shows predominance of centric fresh water diatoms *Cyclotella spp.* and *Stephanodiscus sp.* over marine planktic forms mainly comprising of *Coscinodiscus spp.*, *Thalassiosira spp.*, *Actinocyclus spp.* The fresh water pennate diatoms are represented by *Cymbella spp.*, *Navicula spp.* and *Nitzchia spp.* etc., whereas the marine pennate forms include *Diploneis* species, etc. Samples at 14-16 cm and 20-22 cm depth shows 60:40 ratio between fresh water and marine diatom population. The sudden flux of fresh water diatoms in the marine core from the continental shelf is attributed to increased run off due to enhanced southwest monsoon activity. It is presumed that fresh water and marine diatom ratio may be considered to monitor periodic run off linked productivity changes on spatial and temporal scale.



Cyclotella sp.

Biswajeet Thakur, Vandana Prasad & Rahul Garg



Organic matter distribution pattern in Arabian Sea from surface sediments off Karawar Coast

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

Continued analysis of surface and subsurface sediments containing diatom assemblages collected from Kalyani Lake and its adjoining areas of Nadia district. The soil sediments from lake area ranging from 3 to 5.5 m depth from the surface dates back to 2000 to ±3500 BP. Diatom taxa present in the cores display a wide range of species, with majority of taxa being typical of Oligohaline conditions. Some of the significant constituents of the assemblage are– *Nitzchia, Achnanthes, Cocconeis, Synedra* and *Gomphonema.* Recorded diatom assemblages are indicative of salinity changes as Mesohalobus forms (*Cyclotella, Cymbella* & *Diploneis*) are dominant in the older horizons of the profiles. Diatom inferred salinity trend curve has been prepared for the 3 short cores of Kalyani Lake. It has been inferred that reduction in the water salinity occurred sometimes during ±2500 BP in the studied area. The mixed diatom assemblages in middle part of the succession points towards the prevalence of a more widely fluctuating salinity conditions during the deposition of the sediments.

Undertook a field visit to Digha and Sarsanka areas of East Midnapur district and Kalyani and its adjoining areas of Nadia district and collected surface as well as water samples from different depth levels. Hydrological data are also collected from different environmental setup using soil and water analysis kit. Also visited Central National Herbarium, Shibpur and Howrah for comparative study of modern and fossil spores and pollen grains as well as for identification of Diatom taxa.

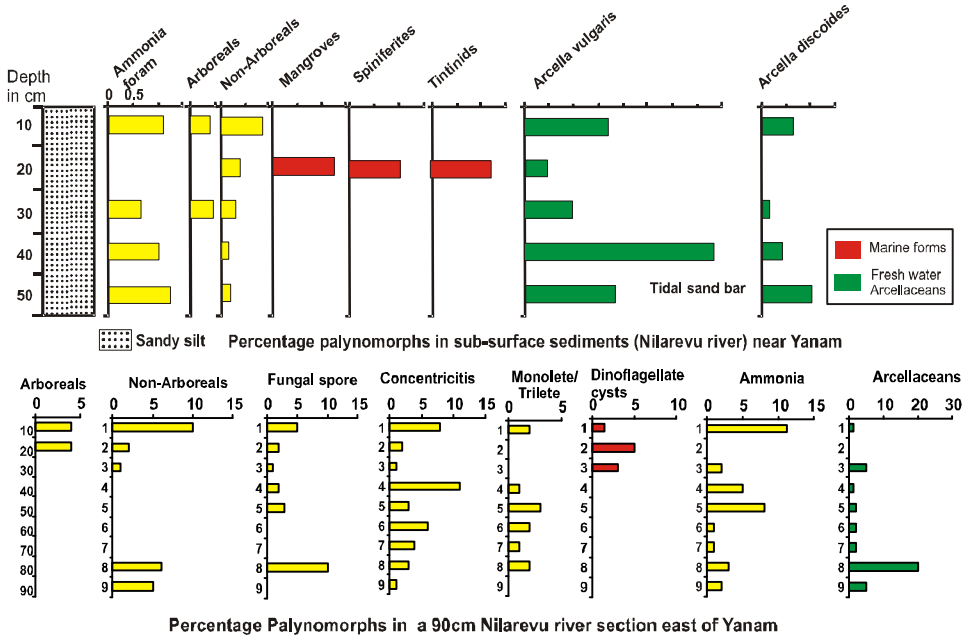
Samir Sarkar

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

The palynological study carried out in a 3.5 m core (Off Godavari– SK-187-GC-23) has been interpreted and finalized. The palynological study carried in a 2.1 m core (Off Godavari– SK-187-GC-30) has also been interpreted. Anothet study carried in a 5.2 m core (Off Godavari– SK-187-GC-18) has been interpreted and documented. The documentation of work carried out in on-shore deep boreholes SH-2 and SH-10 is under progress. Pollen/spores, Arcellaceans and algal studies have also been carried out in two sedimentary soil sections of about 1 to 1.5 m depth collected along the Nilarevu River (Godavari tributary). Radiocarbon dates are modern. The data provides a clear succession of fresh water Arcellaceans and marine forms indicating the sporadic events of marine influx. Terrestrial pollen grains are low and mangroves are poorly represented. Algal abundance mainly constitutes *Ankistrodesmus.* Its abundance in most of the surface and sub-surface samples indicate the depth of the water column, which may not have increased more than a metre even during seasonal hydroperiods. Intermittent abundance of fresh water forms in succession suggests the magnitude of seasonal hydroperiods.

Palynomorphs: Indicators of abrupt sea level changes like Tsunami

Abrupt dominance of marine forms like Tintinids, Dinoflagellate cysts and estuarine forms along with metals constituting high Fe, Ti, Mn, Rb etc. And reduction in fresh water forms like Arcellaceans in sub-surface sediment (20-30cm), 10-12 km inland near Yanam: probable indicators of events like Dec. 2005 Tsunami



Arcellaceans and marine dinocysts, tintinids, etc. in surface and subsurface soil sediment, respectively from Yanam (~10 km from the present shoreline) indicate the extent of Tsunami driven marine water towards land. Palynological succession from Nilarevu river (opening in Bay of Bengal) thus provided very good evidences of abrupt marine events like the recent Tsunami event and cyclicity of ecological changes with respect to climate and marine influx subject to gradual change in the configuration of the area due to sedimentation pattern in the very recent past, a decade or two.

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 site at Lahuradeva, Sant Kabirnagar district, UP

Analysed archaeobotanical samples from an early lake-side settlement at Lahuradewa datable to c.4000-3200 yrs. BP (Chalcolithic). The evidence revealed an advanced state of agriculture. The finds include the remains of *Oryza sativa* (Rice), *Triticum aestivum* (Bread wheat), *Triticum sphaerococcum* (Dwarf wheat), *Hordeum vulgare* (Hulled barley), *Sorghum bicolor* (Jowar-millet), *Lens culinaris* (Lentil), *Pisum arvense* (Field-pea), *Cicer arietinum* (Chick-pea), *Lathyrus sativus* (Grass-pea), *Macrotyloma uniflorum* (Horse-gram), *Vigna radiata* (Green-gram), *Vigna aconitifolia* (Moth-bean), *Trigonella foenum-graecum* (Fenugreek), and *Gossypium arboreum/ herbaceum* (cotton). Associated with these crop remains as an admixture, the remains of the seeds and fruits of weeds and other wild taxa have also been identified as *Vicia sativa*, *Setaria* cf. *glauca*, *Oryza rufipogon*, *Chenopodium album*, *Grewia asiatica, Ziziphus nummularia* and species of *Polygonum, Cleome*, and *Melilotus.*

Participated in the excavation and collected botanical remains from the Harappan site, Kanmer close to Little Rann, in Kachchh district, Gujarat, being excavated jointly by Institute of Rajasthan Studies (Udaipur), Gujarat State Archaeology Department, and Research Institute for Humanity and Nature, Kyoto (Japan).

A.K. Pokharia

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

Carried out morphological investigation of seed and fruit remains from ancient site at Sanchankot/Ramkot, District Unnao from cultural horizon of P.G.W., N.B.P.W., Sunga and Kushana Periods (approx. 1000 BC-300 AD) to build up plant economy practiced by the ancient settlers and the ecological conditions in this region of Ganga Plain in the past. The site exhibits ancient plant economy comprising of the field-crop finds belong to cereals, viz. barley, rice, sawan, kodon-millet; pulses-lentil, pigeon-pea, khesari/grass-pea, field-pea, green gram, black gram, horse-gram/kulthi, aconite/moth bean; seeds of oil yielding plant-field brassica; jujube and Leguminous fruiting pod; seeds of silk-cotton fibre. Now nearly 30 types of weeds and wild taxa have been recovered, belonging to wild grasses, viz. *Andropogon* sp. (Blue stem grass), *Dactyloctenium aegyptium* (Crow-foot grass), *Eleusine indica* (Goose grass), *Panicum* sp. (Panicum grass), *Poa* sp. (Blue or Meadow grass); sedges viz., *Cyperus* sp. (Flat sedge), *Elaeocharis* sp. (Spikerush sedge), *Fimbristylis* with 3 species (Fimbristylis sedge), *Scirpus* sp. (Bulrush), *Scleria ciliate*; other finds are of *Desmodium gangeticum* (Tick-clover/Savivan), *Indigofera* sp. (Indigo), *Indigofera hirsuta* (Hairy Indigo), *Medicago* sp. (Blue alfalfa), *Melilotus alba* (Sweet clover, Safed Senjhi), *Asphodelus tenuifolius* (Piazi), *Verbascum thapsus* (Mullein), *Vicia sativa* (Common vetch), *Amaranthus* sp. (Pigweed), *Chenopodium album* (white Goose-foot, Bathua), *Commelina benghalensis* (Day-flower faint), *Trianthema portulacastrum* (Lalsabuni), *Solanum* sp. (Night-shade); *Polygonum barbatum*, *Rumex dentatus* (Labbibi, Khat-palak), *Sida* sp., and some Convolvulaceae members.

Dactyloctenium aegyptium and all *the* sedges, *Commelina benghalensis*, *Trianthema portulacastrum* may have been the weeds in summer group crops like rice, where as *Indigofera hirsuta*, *Melilotus alba*, *Vicia sativa*, *Amaranthus* sp., *Chenopodium album* represent the weed components in winter crops like wheat and barley in the ancient agriculture at the site. *Verbascum thapsus* (Mullein) is an occasional member along water channels where as *Polygonum barbatum* and *Rumex dentatus* represent moist and swampy localities in the surrounding of ancient habitational deposits.

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

Ring width chronology of *Cedrus deodara* has been prepared using tree-ring samples collected from various moisture stressed sites in Kinnaur, Himachal Pradesh. To maximize the low-frequency signals in the chronology the Regional Curve Standardization method is used. The chronology thus prepared spans from AD 1286-2005. However, the sufficient replication of samples reached back to AD 1415 only. This mean chronology has been found to be sensitive to change in premonsoon precipitation. This relationship is being used to develop long-term climate reconstruction.

The tree-ring samples of Himalayan cedar collected from different river basins in western Himalaya have been studied to understand the basinal specificity in precipitation. The study has shown that the cool and wet climatic extremes are highly basin specific as compared to hot and dry ones. The ring-width chronology of *Pinus gerardiana* (AD 919-2005) developed from Kinnaur has also been studied to understand relationship with climate variables.

R.R. Yadav

Completed pollen analysis of a 1.2m deep lacustrine profile from Tundabhuj, depicting the vegetation and climate change in the sub-alpine belt of Kullu District (HP) during Holocene. The study has shown that prior to 10,000 yrs BP alpine-scrub vegetation constituted of *Betula* together with other broad-leaved taxa *Corylus*, *Quercus*, *Carpinus*, etc. occurred in the region under a warm and moist climate. *Juniperus* probably occurred in pockets on dry sunny hill slopes. Between 10,000 to 4,500 yrs BP, the much expansion of *Betula* and associated broad-leaved taxa and a simultaneous decline in *Juniperus* suggest the prevalence of relatively more-moist climate. The climate turned cold and dry around 4,500 to 3,000 yrs BP as inferred from the sharp reduction in most of the broad-leaved elements. Thereafter, the region has witnessed warm-moist and cold-dry climatic events around 3,000 to 2,300 yr BP and 2300 yr BP to present respectively as envisaged by the fluctuating trends of *Betula* and *Juniperus*.

M.S. Chauhan

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

Tree-ring samples of *Pinus gerardiana*, a dry temperate conifer collected from the two sites of the Himachal Pradesh have been analyzed to understand its dendroclimatic potentiality. Analyses of tree growth climate relationship suggest that temperature of current year's March-June and precipitation during March-May have significant role on the growth of this tree. Chronology of *Pinus gerardiana* has been also compared with the available river water discharge data of the Sutlej river from 1967-1990. The correlation between these two parameters has been found positive and is highest (0.580 p=0.01) for the period 1983-1990.

Subsurface sediments (17 samples) collected at an interval of 5 cm for palynological studies from 1.40 m deep exposed varved clay sediment at Sangla, Kinnaur (HP) have been macerated. Two sediments of this profile have also been dated at AMS lab, Bhubaneshwar. These dates are 1,718 ±200 yrs BP and 12,844 ±330 yrs BP at the depth of 1-10 cm and 120-130 cm respectively. Detailed palynological studies of this profile to observe temporal change of palynoflora are under progress.

Amalava Bhattacharyya

Project 14: Special Activities

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

Mineral magnetic analysis of the samples from Khalsar palaeolake section, Shyok Valley has been completed and statistical analysis is in progress. 8 magnetozones (MZI-VIII) have been defined from ~27 to ~6 ka yrs BP, indicating 4 cold (MZI, MZIII, MZIV and MZVII) and 4 comparatively warm phases (MZII, MZIV, MZVI, MZVIII). LGM is defined at 20 ka BP in the trans-Himalayas and very good signatures of the older Dryas, younger Dryas and the Heinrich 2 (~24 ka BP) ka; and Heinrich 1 (~16 ka BP) stage are evident in the Khalsar section. A cold phase MZ VII is observed at 6-7 ka BP correlates with the other records found from Indian subcontinent. Palaeoseismic studies reveal the occurrence of (10 levels at Spituk-Leh, Indus Valley and 8 levels at Khalsar, Shyok Valley) soft sediment deformation structures (seismites) at multiple levels indicative of palaeo-earthquakes during the Late

A new palm leaf *Amesoneuron ladakhensis* from Hemis Formation, Tsokar, Eastern Ladakh

Quaternary times. One of us (BP) also visited WIHG, Dehradun for sample analysis for mineral magnetic parameters.

Completed chemical processing of samples from Kiato Limestone (Jurassic/ ?Cretaceous) and Lingti-Lalung Road Section (Permian-Triassic). Quantitative analysis and microphotography is in progress. A well-preserved new palm leaf has been described from Singbuk area, about 12 km NNW of Tsokar, Eastern Ladakh. The leaf identified as a new species– *Amesoneuron ladakhensis*. Geochemical analysis of samples from Tsokar Lake has been partly done by one of us (AS) at JNU, New Delhi and results are interesting, however more data is required to arrive at any conclusion. Samples from Spituk palaeolake has been physically processed and geochemical analysis would be carried out. Also undertook field work to Lahaul-Spiti and adjoining areas for collection of palaeobotanical and Quaternary samples (glacio-fluvial-lacustrine sediments, present lake sediments, aeolian sediments, etc.).

Ram Awatar, Anupam Sharma & Binita Phartiyal

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

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. Therefore, the component proposal has been dropped in 2003 (**A.K. Srivastava & A.P. Bhattacharyya**).

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

Data on the occurrence of growth rings in dicotyledonous and gymnospermous woods of Tertiary Period has been compiled and their climatic significance has been deduced. A paper on the importance of growth rings in the fossil woods is under preparation.

J.S. Guleria

New additions- one each of *Podacarpoxylon* and *Araucarioxylon* species to the wood flora of Jurassic sequences of Pranhita Godavari Graben has been made. Compiled wood evidences of the graben for comparative analysis.

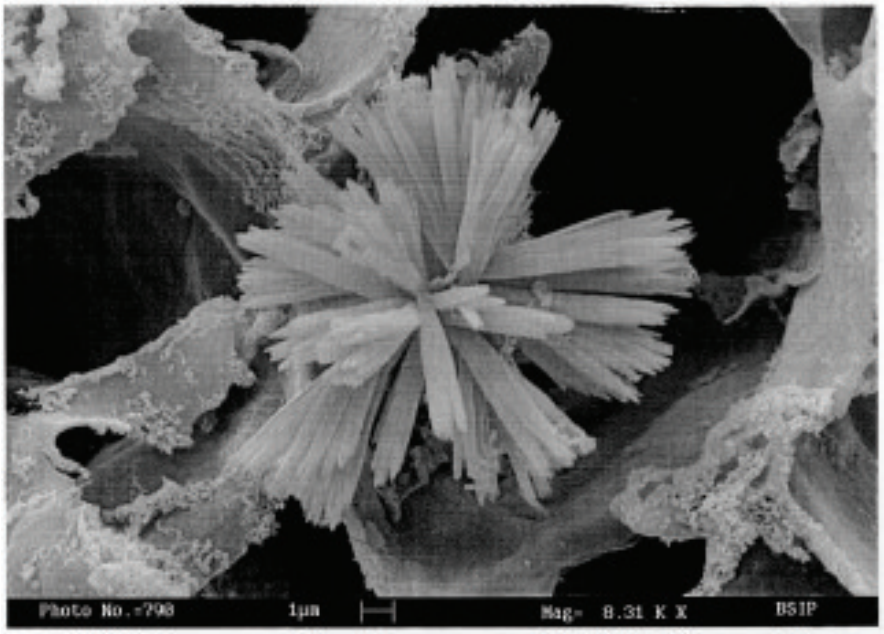
A. Rajanikanth

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

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

Carried out LM/SEM of fruits of some taxa of family Arecaceae. Mostly in all the taxa it is found that the fruits are one seeded drupes. The pericarp comprises epicarp, mesocarp and endocarp. The epicarp is made up of epidermis and hypodermis.The cells of the epidermis are polygonal, rectangular to cubical covered with thick cuticle. The cells of hypodermis vary in number from 1-10 cells in different taxa. The shape of the cells is generally squarish to rectangular and compactly arranged. In young fruits, the cells are collenchymatous at maturity converts into brachysclereids.



Mimosops elengi (Sapotaceae) - Crystal rosette-highly divided at the fringes

Under SEM the wall shows conspicuous pits. These pits are filled with tenniniferous material. The mesocarp is made up of sclerieds, fibre bundles, fibrovascular bundles, tannin cells and raphides, etc. Mostly in all the genera the fibrovascular bundles are arranged in a ring except in *A. catechu*. The mesocarp is strengthned by sclerotic cells either distributed throughout the mesocarp as in *A triandra, A. sp*. The raphide sacs are found in all the studied species of *Areca*. The arrangement of these sacs is important for taxonomic character. The endocarp consist of locular epidermis, the cells are rectangular, tangentially oriented and noncrystalliferous.

LM/SEM studies of fruits of some species of Verbenaceae and Sapotaceae are carried out. A large number of oil droplets and crystals of various shapes and ornamentation have been reported in fruits of *Vitex* for the first time. All the 3 species investigated show variation in crystal structure. New forms of crystals are reported in one species of *Madhuca*, 2 species of *Mimosops* and a species of *Sapota* of family Sapotaceae. In *Madhuca indica* 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 dumbbells often join at the center; the other end is free. In *Mimosops 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 morphological 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

Added more data in a monograph entitled **'**An atlas of air-borne pollen grains of Lucknow plants and their allergenic significance**'.** The photo-documentation of air-borne pollen grains, graphs pertaining to meteorological data and pollen incidence are under process. The proposed illustrated guide embodies phenological, aerobiological and clinical data of allergenic plants of Lucknow. The clinical history of patients was procured from K.G.M.U and Balrampur hospitals, pertaining to Atopic and Nonatopic allergies. Some of the topics dealt in detail are– Aerobiological network in India; Aerobiology at BSIP; Air samplers, sampling sites and pollen calendars of Lucknow; Pollination periods; Morphotaxonomic details of allergenic plants and their pollen; and Pollen allergy. The compiled data will be of great help to Allergologist /Allergists/ Clinicians of Lucknow and adjoining districts for therapeutic treatment of allergic patients.

Asha Khandelwal

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

Studied the flora of Shahdol Forest Division in MP and **c**ompiled an account of 1,200 plant species belonging to 643 genera and 358 families. The ethnobotanical information of about 400 plant species (259 plant species as medicine, 112 species as food, 13 species as timber and 16 species as fibre and cordage) have been documented from tribal localities of the area. Finalized data medicinal plants of Pusprajgarh in Anuppur district of Madhya Pradesh. Also collected living and fossil data of about 4 plant species from published literature for herbarium data base of living and fossil plants. Photo-documentation of about 48 extant plant and 4 related specimens of fossils are 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

Basing on elemental carbon, nitrogen and pollen analyses on various aliquots from different depths of sediment samples from Motiyadol, Madhya Pradesh and the radiocarbon date, the climatic evolution has been traced for the area. Pollen profiles are prepared for deciphering the vegetation and climatic dynamics in revealed that 8000 yrs ago, a warm and moist climate prevailed in the region as evidenced in mixed open deciduous forest while by about 3000 yrs ago, it changed to more moist conditions possibly due to active summer monsoon. The data are being integrated with the elemental data which ranges from about 12 to 33 for carbon to nitrogen ratio. The manuscript of Loktak study has been converted into a new format. During the period, processing for the procurement of elemental analyser is also completed.

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 work of dating the Institute and consultancy samples and up-gradation and capacity building of the laboratory continued during the year. A total of 45 Institute sample have been dated in the laboratory (in addition to those under consultancy). These included carbonate, wood, charcoal and sedimentary materials. A number of glass parts and other components for a new system were got fabricated/ procured. Assembling of this parallel acetylene-, benzene-preparation system has been started. The system for graphite target preparation is also in progress which will make it possible to handle smaller samples for AMS (elsewhere). Routine maintenance and part- replacement work continued throughout the year. Several new equipments have been added to the laboratory, which include a sensitive balance, an RO system, new rotary pumps in the gas preparation system.

C.M. Nautiyal, Supriya Chakraborty & A.K. Arya

Component 10: Stable isotope mass spectrometry laboratory for palaeoenvironmental studies

A high vacuum glass system that was made previously for carbon concentration determination purposes has been calibrated by analyzing international standards, such as IAEA-C3 and NBS Oxalic acid-I. These standards were combusted using the above-mentioned system and the gas samples were taken to PRL for isotopic ratio measurement. Several sediment organic matter have been analyzed using this system and measured for $ä^{13}C$ using the PRL isotope ratio mass spectrometer. Apart from this many samples that are received for C-14 dating purposes have been analyzed to determine the carbon concentration. Collaborative work is underway with the PRL, Ahmedabad in regard to the stable carbon isotopic analysis of sediment organic matter.

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.

Anupam Sharma

Additional Research Contributions

Finalized draft of catalogue entitled 'A Catalogue of Precambrian Palaeobiological remains from India' on the Archaean and Proterozoic palaeobiological evidences (stromatolites, microfossils, macrofossils and ichnofossils) published since 1990 from India.

Manoj Shukla (till 06.06.2006), **Rupendra Babu, V.K. Singh & Mukund Sharma**

Up-dated the Geological Clock for the Institute Museum (MS & VKS), and prepared two displays depicting Precambrian microbiota, one for Institute Museum and another for Science Day presentation (VKS & RB).

Mukund Sharma, V.K. Singh & Rupendra Babu

Recovered for the first time remarkable microscopic metazoan remains with low quantity of OWM both acritarch and cyanophycean remains from the phosphoritic chert intercalated in Tirohan Limestone (equivalent to Rohtas Limestone Formation of Semri Group) of the Chitrakoot Formation in Madhya Pradesh. The identified metazoan is bilaterally symmetrical, segmented, cryptic multicellular organisms, monoecious (hermaphrodite), usually cylindrical-elongated, coiled body somewhat flattened ventrally with prominent clitellum and setate (chaetae) like ornamented structures compared with modern earthworm named *Lumbricus terrestris*. This assemblage shows the juvenile/young worms, possible biomineralized of post embryonic development stage during the Pre-Ediacarn time.

Rupendra Babu & V.K. Singh

An atlas of spores and pollen from Triassic Succession on Indian Peninsula has been prepared from the published data available. This atlas provides comprehensive information about the palynofossils from the Triassic rock strata in different Mesozoic sedimentary basins of India. This includes the check-list of all the taxa recorded from the Triassic of India. Details of the genus with their type species, and the species instituted from India are dealt herein. Further, it includes the distribution of various species through Triassic, which enables the identification of a group of species for the palynozonation in the Triassic Sequence. These Groups further enhance their role and use in palynostratigraphy.

Archana Tripathi, Vijaya & Ram Awatar

Detailed morphographic study of two monosaccate pollen taxa– *Kamthisaccites* Srivastava & Jha 1986 and *Goubinispora* Tiwari & Rana 1981 has been done. Two new species, viz. *Kamthisaccites ringus* and *Goubinispora triassica* are identified from Triassic palynoflora recovered in subsurface strata of Mahuli-Mahersop area, south of the Singrauli Coalfield (Chhattisgarh). These two species are marker taxa for Middle to Late Triassic sequence.

Vijaya & Archana Tripathi

Palynological analyses of the Mesozoic sediments exposed along the tributaries of Mahanadi River near Jhala and Bansa villages, around Chandia have been carried out. Late Jurassic-Early Cretaceous palynoassemblages have been recovered from the above strata. Quantitative analysis and photo-documentation is in progress.

Ram Awatar & Madhav Kumar

Finalized a review paper entitled 'Early land plant developments: Global progress and Indian priorities'. Another paper entitled 'Permian-Triassic plant diversity in Tatapani-Ramkola Coalfield, Chhattisgarh' has also been finalized.

K.J. Singh

Triassic flora of Tiki Formation has been analysed for evolutionary and palaeoecological significance (with **Ram Awatar**). Antarctic plant evidences collected have been evaluated for palaeoecological significance (with **S.K. Bera**). Cretaceous green algae from the Nimar Sandstone Formation (Madhya Pradesh) have also been evaluated for palaeoecological and palaeogeographical inferences (with workers from Botany and Geology Departments, Lucknow University). Achievements of Institute have been compiled and exciting findings have been prominently displayed at CIMAP, Lucknow through a scientific presentation in the form of posters (with **D.C. Saini**).

Role of dissemination tools and awareness programmes to make Palaeontology relevant to present times is highlighted. Multidisciplinary ventures with expanding modes to arrive at socially compatible inferences are advocated. Significance of palynofossils in stratigraphy and ecology has also been brought out drawing evidences from the Cretaceous sequences. Holistic perspectives in Palaeobotany have been highlighted emphasizing use of fossil evidences for understanding evolution, ecology, palaeogeography and climate change.

A. Rajanikanth

Prepared two posters depicting on significance and utilization of fundamental organic petrological studies in coal bed methane exploration and in source rock evaluation in context to India (for display at the 2nd Global Conference-cum-Exhibition– India R&D 2006: Mind to Market, New Delhi). Finalized a paper entitled 'Coal Petrology– A shifting role from coal utilization to fossil fuels exploration'.

Alpana Singh & B.D. Singh

Finalized a catalogue of Cenozoic Tertiary plant megafossils from India, incorporating records between 1989 and 2005. Emendation and synonymy of taxa as given by authors in their latest publications is maintained. Geographical names have been used as per latest nomenclature and orthography. Anomalies in assigning different geological ages/

horizons for a taxa in different publications have also been rectified.

Rashmi Srivastava & J.S. Guleria

Finalized a manuscript entitled 'Existence of *Shorea robusta* (Sal) in the Himalayan foot hills of India since 5600 years BP, belonging to family Dipterocarpaceae' (with **Mahesh Prasad & E.G. Khare**). Finalized another manuscript entitled 'A fossil wood from Kamthi Formation of Tohegaon, Chandrapur District, and Maharashtra' (with **Rajni Tewari & A. Rajanikanth**). The wood *Araucarioxylon* belongs to the family Araucariaceae.

Anil Agarwal

Studied a few fossil leaf impressions collected from the Eocene of Tsokar, Ladakh by a team of Institutes' and WIHG (Dehradun) scientists. They have been described as *Palmacites tsokarensis* sp. nov. Their presence not only indicates that palms were abundant during the period, but also suggests that the area had not attained as much height as it has today.

R.C. Mehrotra

A large number of petrified wood pieces collected from southern part of Tripura have been identified. Presence of *Dipterocarpoxylon tertiarum*, *Glutoxylon burmense* and *Bauhinia deomalica* in this collection suggest that climate was warm-moist during late Miocene.

R.C. Mehrotra, A. Bhattacharyya & S.K. Shah

A fossil wood showing closest resemblance with the extant taxon, *Bauhinia malabarica* Roxb., of the family Fabaceae has been reported for the first time from the Lower Tertiary (Lower Miocene) sediments of the Tuipang area, Mizoram (with **Anil Agarwal & B.D. Mandaokar**). A fossil fruit compression showing close resemblance with the modern *Caesalpinia nuga* of the family Fabaceae has been recorded from the Baragolai Coalfield, Assam. Recovery of this fruit constitutes first record of a single seeded pod of a coastal legume and indicates presence of palaeoshore-line in the vicinity of the area referable to tropical warm and humid climate during Oligocene time (with **A. Ambwani & Anil Agarwal**). Fossil palm wood *Palmoxylon bhisiensis* sp. nov. of the family Arecaceae has also been described for the first time from the Lameta Formation near Bhisi village in Nagpur district (Maharashtra). The present palm wood possesses highly lacunar ground tissued which signifies an aquatic environment in the area (with **A. Ambwani & Devi Dutta**).

Morphotaxonomical study on the leaf impressions from Late Tertiary sediment of Mahuadanr valley, Jharkhand has been carried out. The qualitative and quantitative methods of comparison of morphological features between the fossil and extant taxa revealed the occurrence of some more new taxa, which are comparable to 12 species of 10 dicotyledonous families. On the basis of present assemblage as well as already known data the palaeoclimate and phytogeography of the area during the Late Tertiary has been deduced. The analysis of present distribution of all the modern comparable species of the fossils indicates that most of the taxa (about 43%) presently found to grow in the mixed deciduous forests of the Himalayan foot hills, central India, south India and adjoining area of the Mahuadanr valley, which suggests that mixed deciduous type of forest was flourishing in and around the fossil locality during the sedimentation. The presence of a good amount of taxa now a days in the vicinity of fossil locality indicates that same flora is continue till now suggesting that there is no any marked climatic change in the Mahaudanr area since Late Tertiary time (with **G.P. Srivastava & S.K. Singh**).

Mahesh Prasad

A catalogue, including all records of Tertiary fungi published after 1988 (up to 2005), has been prepared and finalized. The catalogue incorporates 85 genera and 172 species, excluding taxa that are nomina nuda or invalid combination or where no binomials are given. These include fungal spores, fragments of hyphae, sclerotia, conidiophores, setae, germlings and fructifications.

A review of the book entitled "Palynology and its Applications" by Shripad N. Agashe has been documented.

R.K. Saxena

A catalogue, including all records of spores and pollen from the Indian Tertiary sediments published after 1988 up to 2004, has been finalized. The catalogue contains records of 521 genera and 1172 species, excluding taxa that are nomina nuda or invalid combinations or where no binomials are given. The catalogue is expected to be useful in the study of Tertiary spores and pollen and in checking unwarranted introduction of new genera and species.

R.K. Saxena & G.K. Trivedi

Palynological analysis of Tertiary sediments from bore-hole BGG-3, Birbhum Coalfield (West Bengal) has been completed. Recovered palynofossils have revealed the presence of brackish environment during the early Eocene in the coalfield and existence of humid tropical climate. Preparation of a manuscript is under progress.

J.P. Mandal & Vijaya

A palynofloral assemblage has been recovered for the first time from the Fulra Limestone Formation exposed at the confluence of Fulra and Panandhro nalas in the W of Babia Hill, Kutch Basin. The recovered palynoflora consists of dinoflagellate cysts, fungal spores and ascostromata, pteridophytic spores and angiosperm pollen. Some of the important constituents of the palynofloral assemblage are– *Lygodiumsporites, Polypodiaceasporites, Polypodiisporites, Margocolporites, Tricolporopilites, Tricolporopollis, Graminidites, Aplanosporites, Phragmothyrites, Spiniferites, Operculodinium* and *Achmosphaera*. Two distinct palynozones have been recognized on the abundance and distribution of stratigraphically significant palynofossils in the succession. The present day distribution of the extant

counterparts of the palynotaxa indicates prevalence of tropical (warm-humid) climate during the deposition of the Fulra Limestone Formation in the studied area. Palynological data further suggest that the formation was mostly laid down in a shallow marine environment. The palynoflora has been compared with the Eocene palynofloral assemblages recorded from various sedimentary basins of India and abroad and has been assigned late Middle Eocene age for the Fulra Limestone Formation. The dating pattern is in agreement with the faunal age determination. A manuscript has been finalized on the aspect.

J.P. Mandal & Samir Sarkar

Palynological study on Vastan Lignites, Cambay Basin has been carried out and a rich palynological assemblage has been recovered. Some of the important palynotaxa are– *Phragmothyrites, Notothyrites, Inapertisporites, Frasnacritetrus), Dandotiaspora, Lygodiumsporites, Biretisporites, Lycopodiumsporites, Intrapunctisporis, Retipollenites, Cheilanthoidspora, Schizaeoisporites, Clavainaperturites, Palmidites, Liliacidites, Retimonosulcites, Proxapertites, Neocouperipollis, Perinofoveomonocolpites, Lakiapollis, Acanthotricolpites, Spinizonocolpites, Tribrevicolporites, Tricolporopollis, Tricolpites, Tricolporopilites, Dermatobrevicolporites, Lanagiopollis, Margocolporites, Barringtoniapollenites, Polygalacidites, Retistephanocolpites, Polybrevicolporites, Myrtacidites, Myricipites, Protecidites, Clavaperiporites, Liliacidites, Proxapertites, Neocouperipollis* and *Spinizonocolpites.* Qualitative and quantitative analyses of the spores and pollen recovered shows dominance of angiosperm pollen which is conspicuous feature of the assemblage. Dinoflagellate cysts and reworked Cretaceous elements pollen have also been recovered.

The palynomorphs in the assemblage have been compared with the pollen and spores of modern taxa and the distribution of the families represented by the fossil taxa suggests a tropical-subtropical (warm and humid) climate during the sedimentation. The presence of fungal remains and pteridophytic spores are also corroborates the above view. Palynomorphs belonging to low-land, freshwater swamp and water edge, mangrove and coastal floras have been identified. The presence of dinoflagellate cysts and mangrove elements in the palynoassemblage indicates influence of brackish water during deposition. On the basis of high frequency of *Nypa* and also good representation of *Barringtonia* pollen, it is inferred that the sediments were deposited in an area which was fringed by thick mangrove vegetation chiefly constituted by *Nypa*. A comparison of the present with the other Palaeogene assemblages of India reveals a close resemblance with the palynoflora of Naredi Formation (Early Eocene, Kutch) and Rajpardi Lignite (Gujarat). The studied sequence is dated as Early Eocene based on the palynomorphs.

M.R. Rao, (R.S. Rana) & Poonam Verma

All the published records of fossil organic walled dinoflagellate cysts genera, species and infraspecific taxa, described from various sedimentary basins of India during the last three decades, are placed at one place in the form of a Catalogue. The objective of this compilation is to facilitate the active researchers, engaged in palynological research, in deciphering correct stratigraphic ranges and basinal occurrences of dinoflagellate cysts in India and their proper use in future biostratigraphic analysis. The Catalogue includes a total number of 1643 entries. In terms of current names of fossil dinoflagellate, acritarch, and Prasinophyte taxa as recorded in Catalogue, there are 235 genera (out of which there are 225 organic walled dinoflagellate cyst genera, 9 acritarch genera and one prasinophyte genus) and 663 species.

Khowaja Ateequzzaman, Rahul Garg & N.C. Mehrotra

Three posters depicting significance of proxy pollen records for interpretation of past climate from wetland of Assam, central India and Antarctic subcontinent are prepared for the Conference and finalized the manuscripts.

S.K. Bera, S.K. Basumatary, D.C. Saini & A. Rajanikanth

Pollen analysed 20 forest humus, moss polsters and dry soil collected in a transect from within the forest across the open land in and around Rongrenggiri, Darugiri & Songsak Reserve Forests, East Garo Hills (Meghalaya). The palynological study although does not fully cohere with the present day vegetation set up, the face value evaluation of the palynoassemblage would be helpful to interpret the pollen/ vegetation relationship in order to trace past vegetation and climate in and around the study area. Finalized a paper entitled 'Phenology of important medicinal plants and various plant parts used by Bodo community of Goalpara district, Assam'. Preparation of another manuscript on pollen rain from the vegetation of tropical moist deciduous forest, East Garo Hill is in progress.

S.K. Basumatary & S.K. Bera

Pollen analysed a 2 m deep sediment profile from Demagiri, southern Mizoram, deciphering short-term climatic variability and coeval vegetation in the region during last millennium. Around 900 to 450 yrs BP mixed tropical forests comprising *Symplocos*, *Holoptelea*, *Lagerstroemia*, *Dalbergia*, etc. occurred in the region under warm and humid climate. Between 450 to 250 yrs BP the forests turned sparse in response to prevailing relatively less humid climate. The continued decline in the forest constituents suggests the reduction of monsoon precipitation.

M.S. Chauhan & B.D. Mandaokar

Finalized a paper entitled 'Fungal remains from the Late Tertiary sediments of Mahuadanr Valley, Latehar district, Jharkhand and their climatic significance'. The study of Late Tertiary fossiliferous deposit from Mahaudanr has brought out a rich fungal assemblage comprising 21 well established forms and 10 fungal remains of uncertain affinities of which

Tetraploa, *Alternaria Nigrospora*, *Microthryium*, Microthyriaceae, *Phragmothyrites*, *Cookeina*, *Multicellaesporites*, *Diplodia*, *Curvularia*, *Monoporisporites*, *Meliola*, etc. are very frequent. The rich and diverse fungal assemblage retrieved from the fossiliferous bed envisages that the region experienced a humid climate during the course of sediment accumulation.

S.K. Singh & M.S. Chauhan

Prepared 19 text-figures representing different morphoforms of fossil Bryophytic and Pteridophytic spores since early geologic time. Also prepared brief reports of International Bryological Symposium held in China in October, 2005.

Asha Gupta

Pollen/spores and Arcellaceans have been studied in soil samples collected in different seasons from inland lakes and coastal wetlands with an objective to prepare a modern analogue for use in palaeoecological studies. The methodology for the study of Arcellaceans in palynological slides is standardized to enable the precise study of ecological conditions through this proxy along with the floral indicators.

Anjum Farooqui

Prepared a poster showing the varied macerals and sub-macerals of vitrinite, inertinite and liptinite groups of macerals in Indian coal and lignite under normal and uv mode for the display.

Rakesh Saxena

Reported for the first time different nature of fossil fruits from Vastan Lignite mine, Surat (Gujarat), and detail studies is under progress in consultation with megafossil workers of the Institute. Continued work with National Geographic team, comprising scientists from Belgium, India and USA and finalized four papers on palaeontological aspect.

Hukam Singh

Director Dr. N.C. Mehrotra felicitating the new Governing Body Members

Collaborative Work

Recovered OWMs comprising acritarchs and cyanobacterial remains from the silicified carbonaceous/black shales associated with chert nodules in limestone of Buxa Group (belonging to Ranjit Valley of Sikkim, Lesser Himalaya). The acritarchs are both large sized simple and few ornamented sphaeromorphs (*Leiosphaeridia tenuissima* Eisneck, *Synsphaeridium* sp., *Lophosphaeridium* sp. and *Paracymatiosphaera annularis* Wang), and low amount of cyanobacterial remains representing solitary cells, group of sphaeroidal cells and thin sized trichomes taxa– *Myxococcoides minor* Schopf, *Soldadophycus major* Gaucher and *Siphonophycus robustum* (Schopf) Butterfield *et al.* The present assemblage tentatively indicates Terminal Neoproterozoic age for this window. Finalized a paper on Ediacaran Prototype Sponges from the Buxa Dolomite, Siang district, Northeast Lesser Himalaya on the recovered 3 types cryptic, endolithic, multicelled celluloid fossils from the dolomite, comparable with two genus of extant sponge viz. *Chalina* (Type A & Type B) and *Phyllospongia* (Type C) belonging to most primitive parazoa/eumetazoan (sponge) representing demospongiae.

Manoj Shukla (till 06.06.2006) & Rupendra Babu [& V.C. Tewari (WIHG, Dehradun)]

Recorded structurally complex and significant OWMs comprising prokaryotes and eukaryotes belonging to cyanobacterial remains and acritarchs from the shales and chert sediments belonging to Pachmunda Syncline exposed in Solan district, Himachal Lesser Himalaya. The cyanobacterial remains are solitary cells and group of the sphaeroidal cells with or without mucilaginous sheath including trichomes taxa (*Myxococcoides psilata, Palaeoanacystis vulgaris*, *Salome hubeiensis*, *Oscillatoriopsis* sp.). Large sized acanthomorphic taxa are– *Tianzhushania spinosa*, *Echinosphaeridium maximum*, *Ericiashaera rigida Goniosphaeridium cratum, Distosphaera speciosa,* and *Filisphaeridium* sp. with a few simple spharomorphic acritarch, viz. *Leiosphaeridia minuitssima*. The recovered assemblage indicates Terminal Neoproterozoic age for the Pachmunda Syncline and shows moderate deep water condition.

Manoj Shukla (till 06.06.2006) & Rupendra Babu [& V.K. Mathur & D.K. Srivastava (GSI, Northern Region, Lucknow)]

Field work has been undertaken to the Lesser Himalaya in Chakrata Hills where the Deoban Limestone Formation is well exposed. Samples have been collected for the investigations of carbonate formation of the Deoban area for understanding the palaeobiological regimes and genesis and development of carbonate precipitate patterns and also to document Carbonate microfacies. Studies on the palaeobiological remains of chert facies are in progress.

Mukund Sharma [& Meera Tiwari (WIHG, Dehradun)]

Field work has been done in the Bhima Basin. Geologists of the GSI accompanied to Gulbarga district of the Karnataka. Samples have been collected from Kolkur Formation of the Bhima Basin. Well-preserved assemblages of the carbonaceous megafossils and metazoans have been collected.

Mukund Sharma [& Sun Weiguo (Nanjing, China)]

Preliminary palynological study of subsurface (bore-holes TROD-1, TRBD-2 & TRBD-3) materials from Tatapani-Ramkola and surface and subsurface (bore-hole SKB-1) samples from Batuka Nala and Bhawani Nala of South Karanpura coalfields has been carried out.

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

Palynological dating of the rock samples from subsurface strata comprising Permian, Triassic and Jurassic sequences is being carried out. Preliminary microscopic studies have revealed that in Damodar Basin (bore-hole EBM-1, West Bokaro Coalfield) strata in between 58.65 and 353.30 m depths contains spores-pollen assemblage of Late Permian in age. In Birbhum Coalfield (WB), strata in between 249.90 and 337.50 m depth have yielded the assemblage equitable with *Murospora florida* Palynozone, which is latest Jurassic in age. Similarly, in bore-hole SMJS-2 in Singrauli Coalfield (Son Basin) sediments between 5.70 and 631.50 m depth indicate the existence of Early to Late Permian sequence by the frequent occurrences of radial monosaccate pollen at greater depths (631.50-532.60 m) and abundance of striate bisaccate pollen in the relatively upper part (353.85-170.40 m).

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

About 20 rock samples, representing the late Early Cretaceous sequence in Northern Japan, have been worked out for their spores-pollen content. The assemblage contains taxa like *Coptospora verrucosa, Cooksonites* spp, *Pilosisporites* spp and *Appendicisporites* spp, as characteristics of late Early Cretaceous palynoflora. Detailed study is in progress.

Vijaya [& T. Kozai (Naruto University of Education, Tokushima, Japan)]

Chemical processing of 36 samples from bore-hole HACK-4, Hasdo-Arand Coalfield (CG) has been completed. The qualitative and quantitative analyses show the Upper Barakar (41.35-61.60 m), Lower Barakar (68.60-170.33 m) and Talchir palynoflora. Early Permian age has been assigned to the above sediment. Results communicated to GSI.

Ram Awatar [under MOU between BSIP & GSI (Coal Wing)]

Compiled microconstituents and rank data of the coal samples (29) encountered in bore-hole TRBD-3 of Tatapani-Ramkola Coalfield. Observations under fluorescence mode have shown appreciably high amounts of hydrogen-rich macerals (perhydrous vitrinite + liptinites) in these coals.

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

Processed samples from bore-holes GVV-6 and GBA-6 of Godavari Coalfield for recovery of palynomorphs. Palynological report on quantitative and qualitative study of yielding samples has been communicated.

Neerja Jha [under MOU between BSIP & GSI (Coal Wing)]

Completed processing of samples from bore-holes MGP-4 (17 samples), MCP-7 (35 samples), MCP-8 (10 samples), MCP-9 (12 samples), MGP-11 (5 samples), MP-1 (5 samples), MP-2 (3 samples), MP-3 (8 samples), and MRN-2 (7 samples) for recovery of palynomorphs. Prepared 8-10 slides of each yielding sample. Carried out microscopic study (quantitative and qualitative analysis) of samples from bore-holes MCP-7, MGP-11, RAN-9 and recorded palyno-composition of each sample. Results communicated to SCCL.

Neerja Jha [& SCCL (Kothagudem, AP)]

Finalized the manuscript entitled 'Petrological evaluation of the coal seams from Gundala area, Godavari Valley Coalfield, Andhra Pradesh, India.

O.S. Sarate [& M. Basava Chary (SCCL, Kothagudem, AP)]

Finalized study on platyspermic seeds from upper portion of the Itararé Subgroup, 'Toca do Índio Ranch', Municipality of Cerquilho (SP). The assemblage comprises *Gangamopteris-Rubidgea-Stephanophyllites* association from the type-locality of Northeastern Paraná Basin. This flora is Early Permian (Asselian- Early Sakmarian) in age. The platyspermic seeds are assigned to the genera *Samaropsis* and *Cordaicarpus.* The assemblage is diversified and includes the taxa *Samaropsis dolianitii* Millan, *S. rigbyi* Millan, *S. tietensis* Millan, *S. cerquilhensis* (Millan) comb. nov., *S. moreirana* (White) Millan, and *S. goraiensis* Surange & Lele. Additionally, 3 new species, one belonging to the genus *Cordaicarpus* and 2 belonging to the genus *Samaropsis* are also recorded.

Rajni Tewari [& M.E.C. Bernardes-de-Oliveira, M.C.D.E. Castro-Fernandes & F. Ricardi-Branco (Brazil)]

The palynoflora recovered from the bulk macerates of samples from Fireclay Quarry of M/S Tata Refractories Limited near Talbast (Orissa) in Mahanadi Basin have been studied in detail. Lot of morphological variations has been noticed in the dominant genus *Murospora*, as well as in the genera *Impardecispora*, *Klukisporites* and *Ischyosporites.* The well representation of stratigraphically important sporomorphs– *Klukisporites scaberis, Impardecispora uralensis, Impardecispora appiverrucatar, Aequitriratites spinulosus, Aequitriradites verrucosus,* ?*Cooksonites* sp./?*Muriospora* sp., ?*Cibotiumsporites* sp. and ?*Cerebropollenites* have been noticed in the assemblage. Thus, the association of above mentioned palynomorphs in the present palynological assemblage from Talbast is definitely confirms the Lower Cretaceous age for it. Thus the Lower Cretaceous age connotation of Athgarh Formation on the basis of megafossil and megaspore evidences also gets support from palynological front.

B.N. Jana [& J.M. Hilton & G.J. Harrington (University of Birmingham, UK)]

Three wood samples from the late Quaternary sediments of Kerala have been identified. Two of them found to represent *Caryea arborea* and one *Calophyllum* woods respectively.

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

Plant megafossils from Lower Siwalik sediments of Koilabas and near by area has been carried out. Four taxa, viz. S*abisiwalica* sp. nov., *Mangifera someshwarica* Lakhanpal & Awasthi, *Bouea premacrocarpa* Antal & Awasthi, and *B. koilabasansis* have been recorded from Serianaka, Western Nepal. These are phytogeographically very important as their modern equivalents presently distributed in the Indo-Malayan region.

Mahesh Prasad [& P.P. Tripathi & H.D. Dwivedi (M.L.K.P.G.College, Balrampur)]

Monsoon intensification and Neogene-Quaternary Siwalik Biodiversity— processed 65 samples of Upper Siwalik sediments exposed at Gaggar River Section, Haryana and recorded an assemblage consisting of algal and fungal remains, pteridophytic spores, gymnosperms and angiosperms pollen. Some of the important palynotaxa are– *Lygodiumsporites, Lycopodiumsporites, Leptolepidites, Pinuspollenites, Lakiapollis, Compositoipollenites* and *Graminidites*. Data interpretation has been taken up and continued.

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

Continued studies on palynofacies and dinoflagellate cysts distribution pattern of late Quaternary succession encountered in shallow wells from K-G delta region. Documentation of vertical distribution patterns of dinocysts, pollen-spores, various organic matter constituents (charcoal, degraded brown, well preserved cuticles, amorphous) and algal components (*Botryococcus*, *Pediastrum*, cyanobacteria) have been done. A draft project report including interpretation of these parameters in deciphering fluctuating transgressive/ regressive phases and identification of various sequence components has been prepared.

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

Carried out palynological study of the subsurface Karpatian sediments (Early Miocene) encountered in bore-hole Nosislav-3 from the southern part of the Carpathian Foredeep in Moravia, Czech Republic. The recorded palynoflora mainly consists of pteridophytic spores, gymnospermous and angiospermous pollen and dinoflagellate cysts. The significant elements of the palynofloral assemblage are– *Leotriletes, Echinatisporis, Arecipites, Platcaryapollenites, Myricipites, Symplocoidites, Tricolporopollenite, Engelhardtioidites, Pinuspollenites, Tsugaepollenites, Achomosphaera, Spiniferites, Operculodinium, Lejeunacysta, Polysphaeridium, Diphyses,* etc. On the basis of the distributional pattern of palynofossils 3 distinct palynological zones have been established. The palynological data have been interpreted throwing light on its dating potential, identification of various depth levels and environment of deposition. Abundance of dinoflagellate cysts in the assemblage clearly indicate that the sediments were deposited in a near shore, coastal environment with lagoon or swampy conditions near by. Occurrences of the palynofossils belonging to the members of the families Schizeaceae, Cyatheaceae, Pteridaceae, Myricaceae, Fabaceae, etc. in the lower horizon point towards the prevalence of a warm (subtropical) to warm temperate climate during the deposition of Karpathian sediments in the present area. A manuscript on the aspect has been finalized.

Samir Sarkar (& Nela Dolacova (Masaryk University, Brno, Czech Republic)]

Carried out palynostratigraphical investigation of Neogene sediments of Andaman-Nicobar measured stratigraphic sections, viz. Northeast Coast Section & Wreck point Section (Henry Lawrence Island) and Meetha Nala Section (Havelock Island), Ritchiis Archipelago. The recovered palynofloral assemblage is mainly composed of angiosperm and gymnosperm pollen, pteridophytic spores and fungal spores and ascostromata. Preliminary data interpretation suggests an Early Miocene age to the assemblage. The palynoflora has been compared with modern equivalents and it indicates a subtropical humid climate with high degree of rainfall during the deposition of the sequence in the area of investigation. Detailed morphotaxonomic study of the recovered palynofossils is now being carried out.

Samir Sarkar (& V. Sharma (Delhi University, New Delhi)]

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)]

Siliceous dinoflagellates have been documented from upper 1m of a deep ocean core from Southern Ocean. The assemblage shows predominance of the genus *Actiniscus* through out the studied interval, which characteristically represents siliceous ooze with considerable amout of calcareous nannoplankton also. The study is in progress.

Jyotsana Rai & Rahul Garg [& Neloy Khare (NCAOR, Goa)]

Work on the study of calcareous algae from the Palaeocene-Eocene sequence of Shella Formation (Jaintia Group) from South Jaintia Hills is in progress. A manuscript entitled 'Calcareous green algae from the Umlatdoh Limestone belonging to Shella Formation (Jaintia Group), Meghalaya, India" has been finalized. Finalization of another manuscript on Eocene coralline algae from Prang Limestone (Shella Formation) of Jaintia Hills is in progress.

A.K. Ghosh [& Ajanta Sarma (G.C. College, Silchar, Assam)]

Work on the study of biota with special reference to green algae from the Shell Limestone (Nilkanth Formation) Mussourie Syncline, Lesser Himalaya has been finalized. A manuscript has been finalized on the aspect.

A.K. Ghosh [& V.K. Mathur, P.S. Misra & A.K. Kacker (GSI, Northern Region, Lucknow)]

Initiated processing of samples from two Onshore cores from Krishna delta for the recovery of pollen/spores assemblage.

Anjum Farooqui [& D. Rajasekhar Reddy (DSI, Visakhapatnam)]

Palynological study in 26 soil samples from two Off shore cores (Off Kerala) is being carried out. 12 samples have been analysed. Results show rich pollen/spores assemblage of estuarine and terrestrial ecosystem off shore under 40 m water depth in the shelf area.

Anjum Farooqui [& A.R. Nambiar (GSI, Southern Wing)]

Palynological studies in four shallow soil sections from Porbander has been completed and finalized. Results provide successional changes in pollen/spores and Arcellacean record corresponding to the change in pH of the aqueous soil solution since 2nd millennium BC. *Sesbania* plantation is evident during the Harappan period in the study area. Pollen assemblage is almost absent, whereas Arcellaceans are abundant. Under such conditions where vegetation is sparse to devoid the Arcellaceans or Thecamoebians serve excellent proxy data indicating palaeoecological conditions.

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

International project- *Holocene evolution of Chilka Lake, anthropogenic impact and pollution problems*: Lithofacies analysis, geochemical estimates, pollen assemblages and radiocarbon dates are being used to infer an evolutionary history for Late Quaternary vegetation succession and contemporary climatic changes through the analysis of 5.40 m deep Chilka lake's profile CHI 51 (Poz-8505-11,130 ±90 yrs. BP). The synthesis of vegetation dynamics of profile has clearly

portrayed the scenario of depositional environment and more particularly the land and sea level changes. The statistical analysis of data, preparation of pollen diagram and documentation of results are in progress. The details are as follows:

Depth (cm)	Radio-carbon dates	Sample numbers	Lithology	Vegetation composition	Sea level changes
0-60	-	1, 2, 3, 4	Light grey silt/clay	Degeneration of both core & peripheral mangroves	Regression of sea
60-210	1155 ±30 yrs. BP	5,6,7,8,9	Grey/black laminated silt	Proliferation of mangroves	Stabilization of sea
210-270	1480 ± 30 yrs BP	10, 11,12	Light grey silt/clay	Degeneration of core mangroves	Regression of sea
270-480	1790 ±35 yrs BP	13,14,15, 16,17	Dark grey silt	Degeneration of core mangroves with proliferati-on of peripheral mangroves and hinterland vegetation	Regression in tidal magnitude+ increase in fresh water discharge
480-540	11,130 ± 90 yrs BP	18,19,20, 21	Grey/black laminated silt	Proliferation of mangroves	Stabilization of sea

Ten samples from 4.0 m deep Chilka Lake profile CHI 1 (Poz-8501-12,960 ±130 yrs. BP) have also been palynologically analysed exhibiting poor assemblage of palynodebris. Biodegraded/corroded, drifted and reworked pollen grains have also been reported from most of the samples.

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

Palynological investigation on 8 bark samples, viz. *Terminalia myriocarpa*, *Dalbergia* sp, *Schima wallichii*, *Quercus spicata*, *Rhododendron arunachalense*, *Pinus roxburghii*, *P. wallichiana* and *Taxus baccata* from different forest locality of Lower Subansiri district adjoining sub-Himalayan belt of Arunachal Pradesh reflect good number of pollen/spores trapped in the bark surface. The use of bark as a pollen trap may open up new possibilities for vegetational reconstructions and human interference on vegetation as an addition to other conventional methods fail to generate result. A manuscript is finalized on the aspect.

S.K.Bera [& Subir Bera (Kolkata), Yi-Feng Yao & Cheng-Sen Li (China)]

Finalized a manuscript entitled 'Distribution of the Quaternary palaeolacustrine and dry lake beds in the Schirmacher Oasis, East Antarctica– A study based on field observations'.

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

Bio-investigations of 6 aerosol samples from Bikaner, Jhunjhunwala and Delhi, separated by a distance of 600 km in dust-storm hit region of N-NW India have shown the presence of pollen of trees, viz. *Prosopis* (*P. juliflora* & *P. cineraria*), *Acacia*, *Syzygium*, *Holoptelea*, *Cedrus* and shrubs (*Ziziphus*, *Ricinus*, *Ephedra*) and members of Oleaceae in variable frequencies. The concentration of pollen of trees and shrubs increases in windward direction just as the climate changes from hot arid to semi-arid. The higher frequencies of grasses (Poaceae), Chenopodiaceae/ Amaranthaceae, Brassicaceae, Caryophyllaceae, etc. could be the result of the very frequent presence of these herbs in the sampling areas and hence the higher production of pollen. In general, the similarity of the pollen and spore assemblage in the dust samples indicates a common source of dust in the region. The presence of pollen of the temperate species, viz. *Cedrus*, *Pinus*, *Betula*, etc. suggests a Himalayan connection to the present day dust in the region.

M.S. Chauhan & Anupam Sharma [& Sudesh Yadav (JNU, New Delhi)]

Carried out morphological investigation of palaeoethnobotanical remains from ancient multi-period (Black Slipped Ware, Painted Grey Ware and Northern Black Polished Ware, etc.) site Indor-Khera in District Bulandshahar (Uttar Pradesh). Preliminary investigation of botanical finds reveal well-preserved cultivated species of Jujube (*Ziziphus mauritiana* and *Z. oenoploea*) which dominate the other finds in almost every samples. Other finds are of cereals, like barley (*Hordeum vulgare*), dwarf wheat (*Triticum sphaeococcum*), pulses of urd (*Vigna mungo)* and grass-pea (*Lathyrus sativus*), seeds of silk-cotton fibre plant (*Salmalia malabarica*), etc. The finds typify the arid and dry conditions. Detailed study is in progress.

Chanchala Srivastava [& Jaya Menon (Dept. of History, AMU, Aligarh)]

Isotopic values of carbon and oxygen analyzed earlier from subsurface sediment from Tsokar lake, Ladakh and from dated tree ring sequence of *Abies pindrow* collected from Dokriani glacier (Uttrakhand) have been interpreted as a part of multi proxy data analysis for the understanding of climatic changes in the Himalayan region.

A. Bhattacharyya [& R. Ramesh (PRL, Ahmedabad)]

A manuscript based on palynological studies from more than 100 m long glacio-lacustrine sediments exposed at Lamayuru Ladakh has been finalized. The study shows continuation of prevailing semi-arid climate during the last glacial period with interruption of brief ameliorations of climate during 35,000 and 22,000 yrs BP. In addition to that subsurface sediments collected from varved clay deposit from Garbyang Quaternary section (30°5'30"N: 80°50'20"E) analyzed for pollen and sediments are found productive.

A. Bhattacharyya & P.S. Ranhotra [& B.S. Kotlia (Kumaon University, Nainital)]

Several parameters of environmental geomagnetic experiments analyzed from subsurface sediments collected from Gangotri, Dokriani of the western Himalaya have been interpreted as a part of multi proxy data based climate reconstruction from the Himalayan region.

A. Bhattacharyya & P.S. Ranhotra [& N. Basavaiah (Inst. of Geomagnetism, Mumbai)]

Mean vessel area (MVA) of early wood (EW) calculated earlier through image analysis from dated tree ring series of teak (*Tectona grandis* L.) from Parambikulam (PAR), Kerela has been analyzed further for the climatic reconstruction. Based on MVA as proxy data, northeast monsoon during October-November of this region has been reconstructed which extends from AD 1743-1986.

A. Bhattacharyya & S.K. Shah [& D. Eckstein (Inst. of Wood Biology, Hamburg, Germany)]

Based on tree ring data of south East Asia, analyses are progresses to understand the temporal teleconnections among three large-scale coupled processes— i) Asian land surface air temperatures, ii) Sea surface temperature (SST) anomalies in the Indian Ocean, and iii) Tropical Pacific SST anomalies associated with the El Niño-Southern Oscillation (ENSO) which play significant role in the variability of Asian monsoon.

A. Bhattacharyya & S.K. Shah [& E. Cook, B. Buckley & P.J. Krusic (Lamont Doherty Earth Observatory, New York)]

Radiocarbon analysis made from annual rings of a teak disc (*Tectona grandis*) collected from Hoshangabad (MP) in central India and compared with the published data of same aspect on teak from Thane (Maharashtra). Two short time series of D14C with low temporal resolution from these two sites have been compared to capture the bomb-peak of atmospheric radiocarbon variability. These time series cover time span of 1954-1977 and 1959-1980 for Hoshangabad and Thane respectively. The bomb-peaks in these places appear around 1963-64. The Hoshangabad tree records a peak $D^{14}C$ comparable to the peak value of Northern Hemisphere Zone-3. But the peak $D^{14}C$ at Thane is significantly less which probably due to the depletion by fossil fuel CO_2 emanating from the neighbouring industrial areas. This depletion of peak values has been used to estimate the local emission of fossil CO_2, which is about 14.6 ppmV.

S. Chakraborty, A. Bhattacharyya & S.K. Shah [& K. Dutta (Inst. of Physics, Bhubneswar) & M. Nigam (Univ. of Georgia, Athens) & E.A.G. Schuur (Univ. of Florida, USA)]

Scanning Electron Microscopic studies of 10 species of the genus *Rhododendron* (Ericaceae) collected from Sikkim Himalaya have shown micromorphological variations. Various characteristic features are noted.

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

Sponsored Projects' Works

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)

Sub-fossil wood samples collected from the peat deposits at Ziro valley, Lower Subansiri district, Arunachal Pradesh have been identified as *Pinus* sp. One floating chronology of 331 yrs of this species has been prepared based on tree ring width data along 23 radii of the 6 disc of this tree. Processing of other sub-fossil woods for the preparation of floating chronology are in progress. Besides, monthly precipitation for some months has been reconstructed based on ring-width chronology of different Pine spp. from different sites of Eastern Himalaya. These are October-May precipitation from *Pinus kesiya* from Shillong, March-May and January-May precipitation from *Pinus merkusii* from Mishmi Hills, and December-June precipitation based on *Pinus wallichiana* from Ziro valley.

For pollen analysis, subsurface sample dated in between mid Holocene to recent collected from Srinagar, Tripura have been macerated. Samples are found productive in spore and pollen contents. Some of the identified pollen grains are– *Potamogeton, Mitragyne, Madhuca, Syzygium, Loranthus, Lagerstroemia, Symplocos, Terminalia, Pinus, Nymphoides, Typha, Impatians, Croton, Polygala, Shorea, Ceratopteris, Baringotonia, Aegle* and several taxa belonging to families viz., Poaceae, Cyperaceae, Palmae, Malvaceae, Asteraceae, Euphorbiaceae, Polygonaceae and Labiatae.

A. Bhattacharyya & S.K. Shah

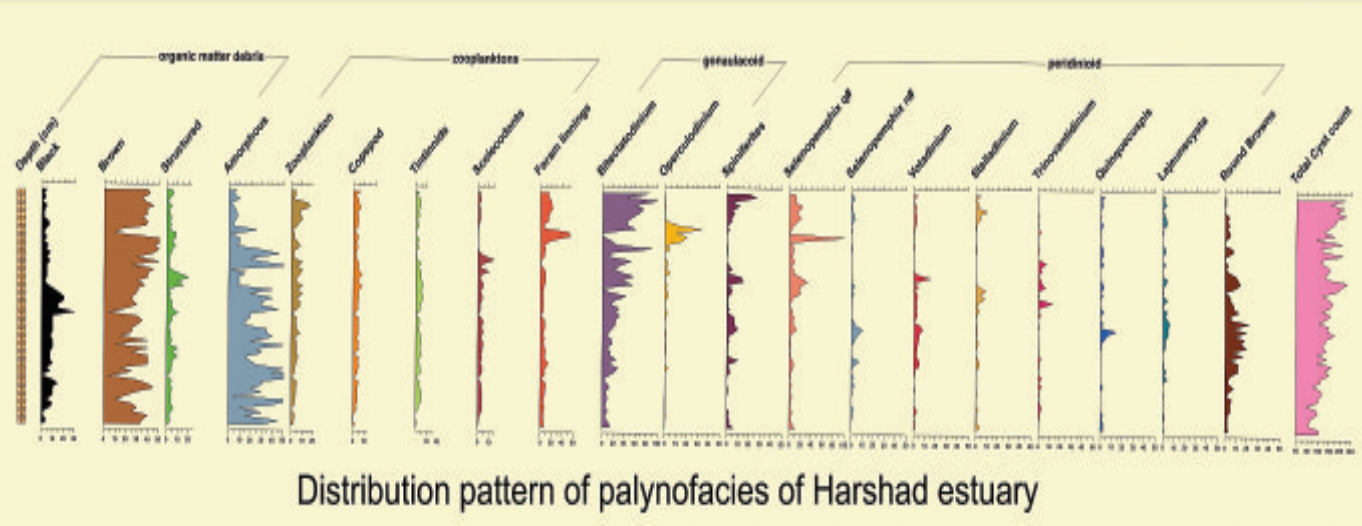
Carbon isotopic analysis made from subsurface sediments collected from Ziro Valley (Eastern Himalaya), and Gangotri, Dokriani (Western Himalaya) has been interpreted as a part of multi proxy data based climate reconstruction from the diversified climatic region of the Himalayas. Finalization of manuscripts is under progress.

A. Bhattacharyya, S.K. Shah & P.S. Ranhotra [& 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)

Palynofacies and Dinocyst distribution studies in Harshad Estuary— With a view to monitor paleomonsoonal fluctuations, palynofacies and dinoflagellate cyst distribution pattern have been studied in Harshad estuary that lies in the northwestern part of coastal Saurashtra. Six sediment cores have been collected from various parts (proximal-distal) of this estuary. The cores were X-ray radiographed to screen small lithological details/ variations, and were closely sampled at 1 cm interval to monitor decadal scale climatic fluctuations. The sediments are rich in dinocyst content and show fluctuations in Gonyaulacoid and Peridinoid forms at specific levels intervals. Association of Protoperidinoid dinocyst *Bitectatodinium sp.* of Gonyaulacoid dinocyst along with terrestrial organic matter is noted at various clayey, silty clay horizons, indicating SW monsoonal activity. However, low dominance of Protoperidinoid dinocyst along with abundant charcoal and degraded organic matter in the silt dominated sediment layers provides evidence of low SW monsoonal activity. The detail decadal scale paleomonsoonal variability is expected after Pb^2 dating of sediment core.

Vandana Prasad & Vartika Singh



Distribution pattern of palynofacies of Harshad estuary

Documentation of Quaternary nannofossils has been done in few selected levels of estuarine sediments of Harshad estuary. The assemblage contains flood abundance of *Gephyrocapsa oceanica, Emiliania huxleyi, Helicosphaera carteri var. wallichii* and subordinate *H. kamptnerii.* The assemblage contains reworked late Cretaceous *(Watznaeuria barnesae, Micula decussata, Arkhangelskiella cymbiformis, Aspidolithus parcus, Rhagodiscus splendens, Cribrosphaerella ehrenbergii, Orastrum campanensis, Braarudosphaera bigelowii, Eprolithus floralis, Biscutum constans, Coronocyclus nitescens, Markalius inversus*) and Palaeocene-Palaeogene *(Calcidiscus macinteirei, Coccolithus pelagicus, Cribrocentrum reticulatum, Cyclicargolithus floridanus, Coccolithus doronicoides, Cyclococcolithus luminis, Discoaster saipanensis, D. barbadiensis, D. multiradiatus*) and calcareous dinoflagellates represented by *Thoracosphaera albertosiana, T. operculata, T. pelagica* and *T. saxea*. Possibility of a section containing late Cretaceous and Palaeogene age nannofossils in close vicinity is inferred a reason for these reworked species in a coastal marine set up.

Jyotsana Rai, Vandana Prasad & Vartika Singh

A combined study of Palynology, Phytoliths studies on Wadhawana Lacustrine sediments, Dhadhar River Basin Mainland Gujarat— The studies have been pursued with a view to monitor high resolution paleoclimatic interpretation of Holocene age (samples have been done at 3 cm interval). The study in 3.70 m sedimentary soil section shows total 5 phases from bottom to top (past to present) with the help of pollen/ spores, fresh water algae and Arcellaceans/testate amoebae and phytoliths. Phase-I shows high percentage of pollen count along with the fresh water algae confined to shallow limnic ecosystem. Fresh water arcellaceans which are sapropels among the algae and aquatic angiosperms dominate in this phase. Arboreal pollen were a few in number dominated by pollen grains of Sapotaceae. Presence of winter season grass phytoliths and high percentage of pollen grains of *Chrozophora* (an herb) that crops up during winters along the streams/rivers suggest the strengthened winter monsoon during phase I. Phase-II is barren and Phase-III again shows the limnic ecology with dominance of *Chara.* The end of this phase shows occurrence of *Casuraina* pollen, suggesting the onset of anthropogenic activity in the area. This period was supported by moderate warm and humid climate that prevailed for a longer period to allow the sustenance of arboreal plants. Phase-IV is again barren followed by a short Phase-V indicating the strengthened SW monsoon in the recent years and shows large proportion of summer season grasses that proliferates during summer monsoon.

It is inferred that Phase I, III and V correspond to warm and humid climate punctuated by phases II and IV corresponding to dry and arid climate. Throughout the section shallow, limnic ecology is recorded. The ecological conditions fluctuated from lacustrine to fluvio-lacustrine and the climatic phases show rhythmic cyclicity of events exhibiting almost equal span of time. Phase V indicates the strengthening of monsoon in the recent years which shows resemblance with the Phase I in the past.

Anjum Farooqui, 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)

Continued palynological studies from Cambay Shale, Vastan Lignite Mine, Gujarat. The studied sequence (Early Eocene) of this formation is located in a lignite mine and is situated at about 60 km NE of Surat. The Cambay Shale in the area is 20-145 m thick but sample collection for the present study is limited to a 26 m thick sequence which is chiefly made up of clay stone (with or without shell layers), lignite, shale and calcareous clay. Terrestrial as well as marine palynofossils have been recorded from several fossiliferous layers of the section. The assemblage is marked with overall dominance of angiosperm pollen, whereas pteridophytic spores are characteristically low in frequency. Presence of dinoflagellate cysts is noticed in the middle part of the sequence. Based on the palynofloral composition, it is inferred that deposition of the studied sequence took place in fluctuating conditions ranging from lacustrine, swampy and marshy to deltaic environment.

Palynological studies allow division of Vastan sequence into 3 zones. The Lower Zone, which is represented by about 5.5 m thick sediments, is rich in coastal and tropical rainforest elements. Most of the forms recorded from this part are related with the families Arecaceae (Palmae), Bombacaceae and Alangiaceae. The Middle Zone, represented by 10 m thick sediments, shows characteristically impoverished palynological assemblage and has distinctly low concentration of organic matter indicating prevalence of drier conditions in vicinity of the depocentre. The central part of this zone is marked with presence of dinocysts indicating marine incursions. Continuance of shallow marine deposits is noticed almost up to the top of the studied sequence. The Upper Zone, represented by about 10.5 m thick sequence, shows a mixture of marine and terrestrial palynofossils. Within this zone a horizon of 2 m thick clay stone shows very high frequency of algal filaments, non-structured organic matter and monotypic assemblage of *Operculodinium* spp. The top part of this zone contains good amount of Bombacaceous pollen and structured organic matter but is devoid of dinocysts. Most of the forms present in the assemblage indicate tropical to subtropical coastal regime of deposition.

S.K.M. Tripathi & Divya Srivastava

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

To analyze climatic changes vis-à-vis glacial fluctuations of the Trans-Himalayan region, palynological investigation has been undertaken from subsurface sediments collected from three sediment profiles which were dug in the proglacial lake bed close to Durung Drung glacier (4,100-4400 m). Exploratory results show that there is a good representation of pollen grains of both arboreal and non-arboreal plants in all the profiles. As

a whole in these pollen-spectra non-arboreal taxa are more abundant than the arboreal. This suggests that the site is above tree line through out as it is today. However temporal variation of climatically sensitive pollen taxa reflects changes in vegetation vis-à-vis climate above tree line zone. Detailed palynological studies of these profiles to observe the change of palynoflora through time are under progress.

A. Bhattacharyya & Jyoti Sharma

Several parameters of environmental geomagnetic experiments, viz. magnetic susceptibility, induced remnant magnetization, Anhysteretic remanent magnetization, SIRM, S-ratio, etc. have been generated from subsurface sediments collected from the glacier. These will provide an additional parameter for palaeoclimatic reconstruction. Interpretation and correlation of the data is in progress.

A. Bhattacharyya & Jyoti Sharma [& N. Basavaiah (Inst. of Geomagnetism, Mumbai)]

Several subsurface sediments collected from glacio lacustrine sediments of the glacier, which cover major time span of later part of last glaciations to recent have been dated. These dates are 29,980 ±3,920 yrs BP, 13,812 ±187 yrs BP, 12,616 ±37 yrs BP, 6,632 ± 87 yrs BP, and modern.

A. Bhattacharyya & Jyoti Sharma [& K. Dutta (Inst. of Physics, Bhubaneswar)]

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

The Satopanth and Bhagirathi Kharak Glacier areas have been explored for the potential lichen species (mainly sp. of *Rhizocarpon geographicum* L, DC) for lichenometric studies. It has been observed that the area from Badrinath to Mana village is being used for the farming by the local people and boulders etc. are being removed and boundaries are made of small stones which were covered with the lichen species of *Xanthoria elegans, R. geographicum, Dimelaena oreina* (Ach.) Norman, *Lecanora muralis* and few other species. It has also been observed that upto Mana village the dominating species is *Xanthoria elegans.* However, from Mana to the snout of the glacier, dominance of *R. geographicum* is seen showing a clear cut demarcation. Several lichen thallium of *R. geographicum* have been identified and marked at seven places from Badrinath to Vasudahra Fall at an interval of 1 km approx. The marked lichen thalli have been numbered and measured with the help of vernier caliper to draw the growth curve. These thalli have been left untouched in natural condition for further growth to access the growth rate per year in the region. Soil samples (26) have also been collected at an interval of 10 cm from two trenches of 1.5 m and 1m each, which are digged at a distance of 4 and 4.5 km from Mana village near Vasudhara Falls. The palynological analysis and C^{14} dating is being carried out.

Shantanu Chatterjee

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)

Initiated palynological analyses of samples from a trial trench (KC) dug on the outwash plain of the Chaurabari Glacier. Studies reveal that the lower part of the trench (samples KC-1 to KC-5) is characterized by the overall dominance of arboreal taxa, mainly represented by *Cedrus, Abies, Pinus, Betula, Alnus* and *Rhododendron*. The middle part of the trench (samples KC-6 to KC-11) shows a decrease in the frequency of arboreal taxa and a corresponding increase in the non-arboreals. The dominant elements include Brassicaceae, Rosaceae, Ranunculaceae, Tubuliflorae, Liguliflorae, Saxifragaceae and Poaceae. Ferns and *Potamogeton* also show a decreasing trend than the earlier zone. The upper part of the trench (samples KC-12 to KC-16) is characterized by a change in the overall vegetational pattern. The arboreal taxa show a gradual increase upwards in the sequence, with maximum values at the top.

Ratan Kar

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* have been collected from Kinnaur, Himachal Pradesh. Samples collected from Purbani area are being cross dated using standard dendroclimatological technique. Ring-widths of successfully dated samples are measured and prepared tree ring chronologies. The mean ring-width chronology of *Cedrus deodara* extends back to AD 1257. The present ring-width chronology shows potential of developing millennium long ring-width chronology of this species from the region. Around 1100 yrs long (AD 919-2005) ring-width chronology has been developed from tree cores of *Pinus gerardiana.* This is the longest chronology so far developed from the western Himalayan region. Cross correlation analysis indicated very strong correlation among these chronologies. Such strong correlation has been used to develop precipitation reconstruction using both the species together growing at the same site.

Jayendra Singh (till 15.02.2007)

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)

Undertook field work to central Narmada Valley to study and collect various profile samples from Quaternary sediments exposed at Hathnora and adjoining areas. The profile samples are collected from Dhansi, Surajkund and Baneta Formations and also from swampy lake at Kusumelli Dam for palynological investigation. Pollen analyzed 75 samples of sediment profile from Khariaghat, Baneta areas (Baneta Formation), Dhansi (Dhansi Formation) and Kusumelli Dam. The preliminary pollen

analysis of sediment profile of Kusumelli Dam shows an assemblage of algal and fungal remains, pteridophytic spores and angiosperm pollen. Angiosperm pollen pertains to Alangiaceae, Asteraceae, Polygalaceae, Rutaceae, Cyperaceae, Chenopodiaceae, Sapindaceae, Rubiaceae, *Terminalia* and *Artemisia*. Pteridophytic spores are represented by *Selaginella* and trilete/ monolete spores. Pollen analysis of remaining profiles is in progress.

M.R. Rao & Poonam Verma

Project— Quaternary sedimentary records of Baroda Window, Mainland Gujarat: A multidisciplinary approach (Sponsored by DST, New Delhi, No. SR/S4/ES-21/ Baroda Window/P1/ 2005)

Based on the field observation and literature survey, it is clear that extensive Quaternary fluvial deposition took place in palaeo rifts of Mainland Gujarat, which were formed by northward drifting Indian Plate. These deposits were further modified by various geological processes viz. neotectonics, palaeoclimate and sea level changes. Today the Quaternary sediments are nicely exposed as incised cliffs formed by rivers draining in the Mainland Gujarat. The entire Quaternary sequence (incised valley, entrenched meanders, huge ravines, uplifted terraces etc) preserves a history of continental (fluvial and Aeolian) and marine deposition of ~125 ka. Marine sediments, indicative of transgress ional phase, is succeeded by sediments deposited through ephemeral rivers under semi arid to sub-humid climate regime with period of intense pedogenesis. The pedoginized horizons are capped by aeolian sediments, which indicate influence of the Thar dessert. The postglacial tectonic uplift had triggered the erosion rate resulting into formation of 30-40m deep incised fluvial valleys. These fluvial valleys provided the site for both marine and fluvial aggradations, which occur as raised valley fill terraces. Five Quaternary deposit sections have been selected along the Mahi and Narmada River Basin. Samples are processed for geochemical, isotopic, magnetic and palynofacies studies. Effort is being made to generate data on these aspects to develop a better understanding on Quaternary records.

Anupam Sharma, S. Chakraborty, Vandana Prasad, Binita Phartiyal & Kamlesh Kumar [& 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)

The carbon isotopic analysis of a sediment profile consisting of peat and peaty clay from south Bengal Basin in India has been carried out to study the past precipitation pattern. The record spans about 7000 yr since early mid-Holocene. Two distinct layers of peat were identified ca. 7300 ±200 cal yr and 3600 ±150 cal yr ago. The carbon isotopic composition of the organic matter preserved in the peat layers shows episodic negative excursion during these periods, indicating the arrival of humid phases. However, these diminutions are superimposed by a long term increasing trend in ä^{13}C that indicates a progressive reduction in monsoon precipitation. The long term trend in the carbon isotopes of the sediment organic matter in these sample and that in the oxygen isotopes of foraminifera in a marine sediment core from the north Bay of Bengal show similar behaviour. This probably indicates the carbon isotopes in terrestrial sediments and the oxygen isotopes in marine sediment in this region responded to the monsoon precipitation during the Holocene.

S. Chakraborty

Project— Development of high-resolution long-term tree-ring proxy climate records from eastern Himalayan region, India (Sponsored by DST, New Delhi, No. ES/48/ICRP/005/2005)

Field trip has been undertaken to collect tree-ring samples from Arunachal Pradesh and Sikkim.

R.R. Yadav & Gaurav Srivastava

Project— Late Holocene climate records from the Himalayan region: high-altitude tree ring and pollen proxy records (Sponsored by DST, New Delhi, No. SR/S4/ES-181/2005)

Work yet to be started.

R.R. Yadav, K.G. Misra & A.K. Yadava

Project— Preparation of a treatise of microfossils and their role in understanding evolutionary Precambrian palaeobiology and biostratigraphy (Sponsored by DST, New Delhi, No. INT/ILTP/ B-2.56/2006)

Published literature on Precambrian Palaeobiology has been scanned, 132 genera and 460 species have been selected from the available literature for incorporation in the proposed treatise. Russian counterpart (VNS) visited the institute during October-November 2006. During his visit a number of palaentological plates have been made and a research paper entitled "Mesoproterozoic Silicified Microbiotas of Russia and India-Characteristics and Contrasts" has been finalized.

Mukund Sharma & Yogmaya Shukla [& V.N. Sergeev (GINRAS, Moscow, Russia)]

Project— Late Quaternary vegetational and climatic oscillations as deduced from radiocarbon dates and palynodata of older alluvium sediments on the south bank of the Brahmaputra plains (Tinsukia & Dibrugarh districts) in east Assam, Northeast India Sponsored by DST, New Delhi, No. SR/S4/ES-21/ Brahmaputra-I/2005 (P-8) 15.03.2007)

Sanction order has been received for implementation of the research project.

S.K. Bera

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Director Dr. N.C. Mehrotra felicitating Shri Rasik Ravindra, Director, NCAOR, Goa

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Consultancy/Technical Assistance Rendered

The consultancy services were provided to the following Individuals/Institutions for **Radiocarbon Dating** of a variety of samples:

Deccan College, Pune (2 samples)

Agharkar Research Institute, Pune (9 samples)

Prof. N.J. Pawar, Pune University, Pune (1 sample)

Center for Earth Science Studies, Trivandrum, Kerala (9 samples)

Dr. P.D. Padmalal, Center for Earth Science Studies, Trivandrum (1 sample)

Dr. Biju Longinor, UGCT, Kerala (2 samples)

Dr. K.M. Nair, VM Foundation Trust, Trivandrum (7 samples)

Director, Geological Survey of India, Kochi, Kerala (2 samples)

Director (Geology), Geological Survey of India, Hyderabad (6 samples)

National Bureau of Soil Survey & Land Use Planning, Nagpur (12 samples)

Delhi University, New Delhi (6 samples)

Archaeological Survey of India, New Delhi (2 samples)

Archaeological Survey of India, Patna (6 samples)

Director, UP State Archaeology, Lucknow (6 samples)

Banaras Hindu University, Varanasi (2 samples)

Dr. K.S. Saraswat, Lucknow (1 sample)

Dr. Supriya Chakraborty, BSIP DST Project (3 samples)

Dr. J.S. Kharakwal, Institute of Rajasthan Studies, Udaipur (5 samples)

Executive Director & Project Officer, DMMC, Govt. Uttarakhand, Dehradun (2 samples)

SEM Unit has developed techniques, which includes fixation, post fixation and critical point drying of biological specimens (living cells/ tissues). Recently, the unit has developed techniques to investigate nano-particles, nano-films, polymers, semi-conducting material, resins and sample from pharmaceuticals. Drugs effect on the microbiological samples has also been introduced. Works have been carried out for ultra structural morphology and micro-analysis of samples received from certain in-house projects as well as from external agencies. Investigators have also availed facilities for morphological investigation of their samples (fossil/living) and distribution of trace elements at nano level using EDS techniques. Scientific expertise pertaining to the various techniques adapted for sample preparation as well as interpretation of data at sub-cellular level has been offered to the outside investigators. The scientists/ scholars of following Agencies/ Organisations/ Universities have availed the use of Institute facilities and expertise:

Botany Department, Lucknow University, Lucknow (18 Botanical samples)

Physics Department, Lucknow University, Lucknow (53 Nanoparticle/powder samples)

Zoology Department, Lucknow University, Lucknow (34 Zoological samples)

Central Institute of Medicinal and Aromatic Plants, Lucknow (2 Botanical samples)

National Botanical Research Institute, Lucknow (19 Botanical & 4 Fly ash samples)

KG Dental University, Lucknow (42 Dental samples)

Central Institute for Plastic Engineering & Technology, Lucknow (4 Polymer & 7 Resin samples)

Babu Banarsi Das National Institute of Technology & Management, Lucknow (12 Pharmaceutical & 1 Nanoparticle samples)

Botany Department, Gurukul Kangri University, Haridwar (6 Botanical samples)

G.B.Pant University of Agricultural & Technology, Garampani, Nainital (5 Botanical samples)

Sant Gadge Baba Amravati University, Amravati (17 Botanical & 6 Zoological samples)

Jawaharlal Nehru University, New Delhi (2 Wood & 6 Microbiological samples)

Department of Chemical Engineering, BHU, Varanasi (1 Dental sample)

Department of Material Science, BHU, Varanasi (5 Semi-conducting material samples)

Institute of Pharmacy, Bundelkhand University, Jhansi (12 Pharmaceutical & 3 Polymer samples)

Rajeev Gandhi Prodhyogiki Vishwavidhyalaya, Bhopal (8 Pharmaceutical & 1 Polymer samples)

H.S. Gour University, Sagar (1 Polymer sample)

Central Fuel Research Institute, Dhanbad (30 Coal samples)

Central Mining Research Institute, Dhanbad (1 Coal sample)

Library Unit has provided training to the two apprentice trainees– Miss Ragini Tripathi & Miss Preeti from the Board of Apprenticeship Training (Northern Region), Kanpur.

Electronic Data Processing Unit has provided one month computer practical training to 2 students of Rajkia Mahila Polytechnic, Lucknow studying for Diploma in Computer Science.

A.K. Srivastava provided suggestions, guidance and technical expertise to Jharkhand Government for the preparation of detail project report for the establishment of Birbal Sahni Memorial Fossil Park and Museum in Sahebganj district of Rajmahal Hills.

J.S. Guleria & Rashmi Srivastava rendered expert opinion and technical assistance to Mr. Kiran Desai (Programme Director), Centre for Environmental Education, Ahmedabad and his team in connection with Ghughua National Fossil Park (Madhya Pradesh).

Samir Sarkar provided palynological training to Ms. Bhagyapati, a research scholar from Geology Department of Delhi University.

S.K.M. Tripathi provided scientific assistance for palynological studies to a Ph.D. student- Mr. Shanker Lal Nama from Geology Department, JNV University, Jodhpur. Special help was rendered in identification of palynofossils and formulation of one chapter in his thesis dealing with palynological studies.

B.D. Singh and **Alpana Singh** provided scientific assistance in observation of coal samples under Scanning Electron Microscope to two scientists– Dr. (Mrs) Nandita Chaudhary and Dr. A.K. Singh of Central Fuel Research Institute, Dhanbad.

Rupendra Babu provided the methodology and literatures related to Precambrian Palaeobiology to Dr. Vandana Samanta, Reader in Geology, Banaras Hindu University, Varanasi.

Jyotsana Rai imparted training for 2 weeks to Ms. G. Shanmugavalli of Department of Geology, Periyar University, Salem for carrying out M.Sc. dissertation on 'Cretaceous Nannofossils' (Albian, Cenomanian, Turonian) of Tiruchirapalli, South India.

M.S. Chauhan imparted training to Mr. Lokesh Chandra, a research scholar of G.F., P.G. College, Shahjahanpur (Rohilkhand University) regarding the preparation of reference pollen slides and pollen morphological studies of some modern plants occurring around Shahjahanpur (UP).

A. Bhattacharyya supervised two Ph.D. thesis entitled "Vegetational and Climatic changes in the Himalayan and trans-Himalayan region since Late Pleistocene" of Mr. P.S. Ranhotra, and "Analysis of Climatic changes in Northeast Himalaya and its comparison with Western Himalaya during Late Quaternary" of Mr. S.K. Shah, under DST sponsored projects. Also provided scientific assistance for the M.Sc. Dissertation entitled "Palaeoclimate records from the river terraces around Marguerite, Assam" of Ms. Valentine Brahma, Gauhati University, and Guwahati.

Rakesh Saxena studied 40 coal samples received from Central Mining Research Institute, Dhanbad and prepared and communicated a report containing detailed analysis of maceral, reflectance and cleat patterns.

Organised a 10-days 'Advanced Coal Petrological Training Programme' on the invitation of ONGC, Kolkata and provided the training to 4 Officials at Regional Laboratory, CBM-BPM Basin, CIT Road, Kolkata during August-September, 2006. Prepared an up to date module for the study of coal and lignite petrology for the participants. It consists of varied methodologies of Collection, Preparation and Processing of samples; Microscopic techniques both under normal and UV light in incident mode; Characterization of macerals; Quantitative and Qualitative distribution of varied maceral in time and space; Preparation of Compositional models for interpretative purposes; Reflectance studies of coal/lignites; and the necessary precautions to be observed at the time of reflectance measurements.

Conducted 5-days 'Training Course in Coal Petrology' for 3 Officials at Vizag Steel Plant, Visakhapatnam during October, 2006. Prepared a training module for the officials, which comprises various methods of Collection, Preparation and Processing of samples for Steel Industry; Microscopic techniques for the study of varied types of coal under normal and UV light in incident mode; Typical assessment and characterization of varied macerals of vitrinite, inertinite and liptinite groups; Delineation of oxidized and non-oxidized vitrinite; Identification of fluorescing inertinites; Liptinite and their behaviour pattern; Mineral matter and its typification; Reflectance measurements and their behavioural pattern in time and space; Special emphasis was given on the blend coals; Preparation of various compositional models and their interpretative values.

Papers presented at Conference/Symposia/Meetings

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Bajpai S C. Energy in Building, *National Seminar on Non-Conventional Renewable Energy Sources*, Dr Hari Singh Gour University, Sagar, Madhya Pradesh, January, 2007.

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Shah SK & Bhattacharyya A – Tree growth analysis based on several pine species of the north-east Himalaya. *7th Int. Conf. Dendrochronology, Cultural Diversity & Environmental Variability.* Beijing, China, June 2006.

Shah SK, Bhattacharyya A & Chaudhary V – Temporal variation of precipitation during recent past in the northeast Himalaya based on tree-ring proxy record. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Sharma A, Phartiyal B & Ram-Awatar – Weathering of rocks in Trans-Himalayan region and its effect of fertility in lower reaches. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Sharma M – Astropalaeobiology: Exploring early life and Beyond. *DST Brainstorming Session Palaeontol. Res. in India-Future Directions*, Jammu, October 2006.

Sharma M, Sinha D & Guhey R – Stromatolites of Jagadalpur Formation, Indravati Group, Chhattisgarh, India. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Shukla M, Sharma M, Babu R, Mathur VK & Srivastava DK – Ediacaran microbiota from Baliana and Krol Groups, Lesser Himalaya, India. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Singh A & Singh BD – Progenitors of hydrocarbons in Indian coals and lignites and their significance. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Singh BD & Singh A – Characterization of Indian coals and lignite as assessed under fluorescence mode. *Nat. Conf. Frontier Areas in Geol. & Techn. Aspects of Fossil Fuel & Mineral Resources*, ISM Dhanbad, November 2006.

Singh KJ – Permian-Triassic plant diversity in Tatapani-Ramkola Coalfield, Chhattisgarh, India. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Singh RS & Kar R 2006. Palynology of the Late Cretaceous Deccan Intertrappean beds of Rangapur, Andhra Pradesh, India. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany and Allied Sciences*, BSIP, Lucknow, November 2006.

Singh SK & Chauhan MS – Fungal remains from the Late Tertiary sediments of Mahuadanr Valley, Latehar District, Jharkhand and their climatic significance. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Singh VK – New evidences of carbonaceous Metaphyte fossils from the Maihar-Nagod area (MP), Bhander Group, Vindhyan Supergroup, India. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Srivastava AK – Pteridospermic frond from the Lower Gondwana of India. *Diamond Jubilee Int .Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Srivastava AK – Morphological diversity in Glossopterid leaves. *Diamond Jubilee Int .Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Srivastava C – Millets in ancient agricultural economy in Indian sub-continent and their biogeographical implications. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Srivastava D & Tripathi SKM – Palynological study on the Early Eocene sequence of Vastan Lignite Mine, Gujarat, India. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Srivastava R – Evolutionary trends in the Cretaceous-Tertiary dicotyledonous woods of India and their ecological/ functional aspects. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Tewari R – Permian megafloristics of Wardha-Godavari Basin, India: A synopsis. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Thakur B, Prasad V & Garg R – Diatoms from marine sediments as indicators of monsoon related run off in eastern Arabian Sea. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Tripathi SKM & Srivastava D – Palaeoenvironmental significance of floral and faunal assemblages from Early Palaeogene sequences of western India. *Climate & Biota of Early Palaeogene*, Bilbao, Spain, June 2006.

Tripathi SKM & Srivastava D. Characteristic palynofloral assemblages from Western Rajasthan. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Trivedi GK – Palynology of the Rewak Formation (Late Eocene) exposed along Siju-Baghmara Road, South Garo Hills, Meghalaya, India. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Vijaya & Tripathi A – New key species from the Middle to Late Triassic succession of India. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Yadav RR, Singh J, Dubey B & Misra KG – Climate records from tree rings: Indian scenario. *Diamond Jubilee Int. Conf. Changing Scenario in Palaeobotany & Allied Subjects*, BSIP, Lucknow, November 2006.

Deputation/Training/Study/Visit in India/Abroad

Director

N.C. Mehrotra

Participated in a National Meet 'Indian Ocean Tsunami: Its impact assessment and Lessons for future' held at Anna University, Chennai on June 05, 2006.

N.C. Mehrotra, Rahul Garg, S.K.M. Tripathi, B.D. Singh & S.K. Singh

Participated (with Institute's exhibit) in the 2nd Global Conference-cum-Exhibition on 'India R&D 2006– Mind to Market' organized by Federation of Indian Chambers of Commerce and Industry (FICCI) in partnership with Departments of S&T and Industry Policy and Promotion, and CSIR held at Vigyan Bhawan, New Delhi during December 04-06, 2006. Director (NCM) also attended the Conference deliberations.

N.C. Mehrotra & Rahul Garg

Participated in the R&D Round Table Seminar on 'Potential areas of Academia-Industry Interaction' organized by Petrotech Society and held at New Delhi on March 20, 2007.

Scientists

S.K.Bera

Participated as Resource Person in the UGC sponsored Refresher Course in Life Science (Thrust Area: Exploring the vistas in life science), organized at Department of Botany, University of Calcutta, Kolkata during February 2007.

A. Bhattacharyya

Participated in the 9th Meeting of the Programme Advisory and Monitoring Committee on 'Himalayan Glaciology' held at SASE, Chandigarh during November 13-14, 2006, and presented a project proposal on "Analysis of temporal variation of climate vis-à-vis glacial fluctuations in the NE and NW Himalayas based on multi proxy records: Tree ring, pollen and isotopic data".

A. Bhattacharyya & Anupam Sharma

Attended the pre-induction Training Programme at Auli during September 15-26, 2006 in connection with the 26th Indian Scientific Expedition to Antarctica. Later, participated in the Expedition as a member of the summer team during November 2006-April 06, 2007, and collected samples (subsurface sediments, moss layer, algae and water from different lakes) for palaeoclimatic analyses from two major sites of Indian Antarctic expedition, viz. Schirmacher Oasis and Larseman Hills. Subsurface sediments are collected either through sediment borer from glacio-lacustrine deposits or clearing upper surface of these exposed lacustrine sections along hill slopes for analyses of multi proxy data. Besides, water samples from several lakes and some plant materials have also been collected.

Supriya Chakraborty

Participated in a DST sponsored 'Filed Workshop on Quaternary Carbonate Deposits of Gujarat' around the coastal areas of Saurashtra during December 5-10, 2006 organized by the Department of Geology, University of Baroda. Also visited PRL, Ahmedabad during December 11-20, 2006 for carrying out mass spectrometric analysis of sediment organic matter. Visited Geer Foundation in Gandhinagar during March 6-12, 2007 to initiate a collaborative project on coral palaeoclimatology.

Rahul Garg

Visited Directorate General of Hydrocarbons, New Delhi for discussion and finalization of project proposal on 'National Centre for Applied Palynology and Stratigraphy for exploration of Fossil Fuels' during May 18-19, 2006.

Visited National Centre for Antarctic and Ocean Research (NCAOR), Goa to act as a Subject Expert of the Antarctica Research Programme under 'Earth Science and Glaciology' theme presented during June 29-30, 2006.

Participated in the 'Training Programme for Vigilance Officers' organized by DST at Goa and visited National Institute of Oceanography and NCAOR for discussions with scientists on mutual collaborative projects during October 09-13, 2006.

Attended 1st Meeting of the National Working Group of International Geological Correlation Programme (IGCP)-522 held at GSI Complex (Southern Region), Hyderabad on October 30, 2006.

A.K. Ghosh

Deputed to Ten Days Exposure (from May 27-June 07, 2006) to Scientific Labs/ Institutions in Taiwan and Singapore under "National Programme for Training of Scientists and Technologies in Government Sector" sponsored by Department of Science and Technology, Government of India.

Deputed to visit Germany for 3 months (on and from 28.03.2007) to work as a Visiting Scientist in the Institute of Geosciences, University of Tubingen as a nominated scientist of INSA-DFG bilateral exchange programme.

Asha Gupta

Attended Indian Art History Congress–2006 held at State Museum, Lucknow during December 15-17, 2006.

B.N. Jana

Visited The School of Geography, Earth and Environmental Sciences of the University of Birmingham, Birmingham (UK) for 3 months under INSA-Royal Society Exchange of Scientists Programme during June 11-September 12, 2006, and worked with Dr. Jason Hilton on the Jurassic-Cretaceous materials of India and Britain.

Madhav Kumar & Jyotsana Rai

Attended Proficiency Course on 'Modern Practices in Petroleum Exploration' organized at the Institute of Drilling Technology, Oil and Natural Gas Corporation during September 18-23, 2006. The course was organized jointly by Petrotech Society, New Delhi and ONGC, Dehradun.

R.C. Mehrotra

Attended DST sponsored Programme on 'Intellectual Property Rights and World Trade Organization Related Issues' conducted at Academic Staff College of India, Hyderabad during December 11-15, 2006.

C.M. Nautiyal

Attended National Workshop for Development of Module to Communicate "Physics in Daily Life and Physics for Consumer" held at Institute of Engineers, Guwahati and organized by NCSTC-Network catalysed and supported by NCSTC (DST), New Delhi during June 13-15, 2006. Also attended two meetings in connection with preparation of radio programme under Year of Planet Earth at Vigyan Prasar, Noida on September 13th and October 07, 2006.

A. Rajanikanth & D.C. Saini

Participated in Symposium on 'Excitements in Plant Sciences UPASTA' held at Central Institute of Medicinal and Aromatic Plants, Lucknow on February 28, 2007, and prominently displayed Institute scientists research findings through a scientific presentation in the form of posters.

Ram Awatar & Madhav Kumar

Deputed to display plant fossil and archaeobotanical specimens in State Level Science and Technology Exhibition at Deoria organized by Council of Science and Technology (UP) from April 12-14, 2006. BSIP exhibit awarded with 3rd prize (Medal & Citation) by the Hon'ble S&T State Minister Sri Durga Prasad Misra.

Rakesh Saxena

Deputed to impart the training on Coal Petrology to ONGC official at CBM-BPM Basin Office, Kolkata during August 21-September 01, 2006. Also deputed to impart the training to officials of Vizag Steel Plant, Visakhapatnam during October 09-14, 2006.

Jyoti Sharma & Kamlesh Kumar

Attended the 6th Course on 'Application of Remote Sensing and Geographic Information Systems for Mineral Exploration' organized at GSI Training Institute, Bandlaguda, Hyderabad under the NNRMS Programme during January 22-April 06, 2007.

Alpana Singh

Participated in Coal Bed Methane Development Programme-2006 (CBM Short Courses) organized by the Total CBM Solutions (India) at New Delhi on December 13-14, 2006. The Short Course-I *Coal bed methane exploration strategies: Hydrogeologic controls critical for exploration, development and reservoir assessment* was related to CBM life cycle and conducted by Andrew R. Scott – world renowned CBM Expert from USA. He 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. Jack C. Pashin of Geological Survey Alabama overviewed the development of CBM production in USA.

Alpana Singh & B.D. Singh

Visited Central Fuel Research Institute, Dhanbad on November 04, 2006. Had discussions with concerned scientists on coal and lignite petrographic data mainly generated at both the institutions. Also explored the possibilities for collaborative data accumulation on physico-chemical parameters of Indian lignites/coals, besides coal petrography.

B.D. Singh

Attended one day Workshop for 'Public Information Officers appointed under Right to Information Act-2005' organized by Sant Mastan Educational Welfare Society in collaboration with Mumbai Study Circle, Mumbai and held at Hotel Arif Castles, Lucknow on July 15, 2006.

Participated in the Training Programme on 'Contract Management and Arbitration for Scientists and Technologists' under the scheme NPST Working in the Government Sector, sponsored by DST (Govt. of India) and organized at the Administrative Staff College of India, Hyderabad during August 21-25, 2006.

Participated in Training Workshop on 'Implementation of Right to Information Act-2005' organized by Good Governance Forum of Lucknow Management Association and held at Hotel Taj Residency, Lucknow on September 01, 2006.

Attended Workshop on 'The Right to Information Act-2005– Obligations and Strategies' organized by Industrial Management Academy at Hotel Ambassador (Sujan Singh Marg), New Delhi during October 09-10, 2006.

A.K. Srivastava & B.D. Singh

Visited Ranchi for attending the meeting (on August 03, 2006) of Coordination Committee in the Office of Principal Secretary, Science and Technology & Revenue, Jharkhand Government in connection with the establishment of Birbal Sahni Memorial Fossil Park and Science Museum in the State.

Archana Tripathi

Attended DST sponsored Training Programme on 'Negotiating Strategies in Work Environment' conducted at Academic Staff College of India, Hyderabad during June 19-30, 2006.

Attended the WOS-A 2nd Group Monitoring Workshop in Earth and Atmospheric Sciences cum 3rd Meeting of the Subject Expert Committee held at Chennai during December 17-18, 2006.

S.K.M. Tripathi & S.K. Shah

Attended 18th Group Monitoring Meeting of DST & Young Scientist Award Programme held at Jammu University, Jammu during December 14-17, 2006 in connection to the review of ongoing sponsored project.

Vijaya, Hukam Singh & Viswajeet Thakur

Attended a R&D Academia Industry Seminar organized by Petrotech Society at New Delhi during January 16-18, 2007.

R.R. Yadav

Attended 8th Meeting of the Programme Advisory Committee on Earth Sciences for presenting the research proposal, held at Delhi University, Delhi during June 30-July 01, 2006.

Deputation to Conferences/Symposia/Seminars/Workshops

Director

N.C. Mehrotra, S.K. Bera & Amalava Bhattacharyya

Seminar on Antarctic Science: Indian Contributions in Global Perspectives held at NCAOR, Goa from May 25-26, 2006.

N.C. Mehrotra, Rahul Garg, R.C. Mehrotra, A. Rajanikanth, Mukund Sharma, Vandana Prasad & Anjum Farooqui

1st In-House Science Meet of the Autonomous Institutions under DST held at Jawaharlal Nehru Centre for Advance Scientific Research, Bangalore from September 23-24, 2006.

N.C. Mehrotra, A. Rajanikanth & A.K. Ghosh

- *94th Session of Indian Science Congress Association* held at Annamalai University, Annamalai Nagar, Chidambaram (TN) from January 03-07, 2007.

N.C. Mehrotra, J.S. Guleria & R.C. Mehrotra

- *Sino-India International Conference on Biodiversity and Environmental Changes in the Himalayas* held at Sanya, Hainan Province, China from March 28-April 01, 2007.

Scientists

Amalava Bhattacharyya

7th International Conference on Dendrochronology, Cultural Diversity and Environmental Variability held at Beijing, China from June 11-17, 2006.

Anjum Farooqui, B. Sekar, Divya Srivastava, Jyoti Sharma & Poonam Verma

Brainstorming Session & Field Workshop on *Geoarchaeology and Human Response to Landscape evolution* held at Anna University, Chennai from October 13-15, 2006.

Rahul Garg, S.K. Bera & Amalava Bhattacharyya

National Workshop on Emerging Areas of Scientific Investigations during XXVI Indian Antarctic Expedition held at NCAOR, Goa from June 29-30, 2006.

Madhav Kumar & Neeru Prakash

7th European Palaeobotany-Palynology Conference held at Prague, Czech Republic from September 6-11, 2006.

C.M. Nautiyal

European Science Open Forum- 2006 held at Deutches Museum, Munich, Germany from July 15-21, 2006.

Vandana Prasad

International Conference Climate and Biota of the Early Palaeogene held at Bilbao, Spain from June 12-20, 2006.

2nd Indo-US Frontier of Science (FOS) Symposium held at the NAS, Beckham Centre, Irvin, USA from January 16-23, 2007.

M.R. Rao & A. Rajanikanth

Workshop Integrated Stratigraphy and Geochronology of Cretaceous Sediments held at Anna University, Chennai on December 6, 2006.

23rd Annual Convention of Indian Association of Sedimentologists & National Seminar on Environmental and Economic Significance of Sedimentary Basins of India held at Anna University, Chennai from December 7-9, 2006.

Mukund Sharma

National Seminar on Precambrian Life: Indian Scenario held at Durgapur Govt. College, Durgapur (WB) from August 23-24, 2006.

Alpana Singh & B.D. Singh

National Conference on Frontier Areas in Geological and Technological Aspects of Fossil Fuel and Mineral Resources (GTFM-2006) held at Indian School of Mines, Dhanbad from November 2-4, 2006.

R.R. Yadav & A. Bhattacharyya

Indo-German Bilateral Symposium on Palaeoclimate Studies— Himalaya: Modern and Past Climates (HIMPAC) held at INSA, New Delhi during October 24-27, 2006.

R.R. Yadav, A. Rajanikanth, Mukund Sharma & Vandana Prasad

Brainstorming Session on Paleontological Research in India-Future Directions held at University of Jammu, Jammu from October 9-10, 2006.

All the Scientific Staff

Diamond Jubilee International Conference on Changing Scenario in Palaeobotany and Allied Subjects held at BSIP, Lucknow from November 15-17, 2006.

Administration

S.C. Bajpai

Participated in the Brainstorming Session on 'The Indian Coasts: Planning and Management' sponsored by DST and organized at Centre for Studies on Bay of Bengal, Andhra University, Visakhapatnam during May 22-23, 2006.

Attended the International Conference on 'Challenges and Strategies for Sustainable Energy, Efficiency and Environment' held at UP Technical University, Lucknow during June 10-11, 2006.

Attended the National Seminar on 'Non-Conventional Renewable Energy Sources' held at H.S. Gour University, Sagar (MP) during January 22-23, 2007.

Attended Panel Discussion, Bhartendu Natya Akademi, Lucknow during January 16, 2007.

Lectures Delivered

Director

N.C. Mehrotra

- *Hydrocarbon Exploration in Petroliferous Basins of India– Palynological Perspectives* (Remote Sensing Day Lecture) at Remote Sensing Centre, Lucknow (August 12, 2006).
- *Significance of High Impact Palynology in Hydrocarbon Exploration* (Inaugural Lecture) at ONGC, Kolkata (August 21, 2006).
- *Application of Palynology and Organic Petrology in Fossil Fuels Exploration* (Diamond Jubilee Lecture) at Central Fuel Research Institute, Dhanbad (August 24, 2006).
- *Birbal Sahni Institute of Palaeobotany: Expertise and Potentials* at the DST In-house Science Meet, Jawaharlal Nehru Center for Advanced Studies, Bangalore (September 2006).
- *Antarctica: Scientific Challenges and Opportunity* at the Special Symposium on Antarctica, 94th Indian Science Congress Association, Chidambaram (January 06, 2007).
- *Hydrocarbon Exploration in Indian Petroliferous and Frontier Basins: High-impact Palynological Studies* (Inaugural Presidential Lecture) at Sino-India International Conference, Sanya, Hainan, China (March 29, 2007).

A.K. Arya

- *Basics of Geology and its Application for Civil Engineers* (3 lectures) at Department of Civil Engineering, Institute of Engineering and Technology, Lucknow (March 28-30, 2007).

S.K. Bera

- *Antarctic research: Biological perspectives* at Botany Department, Calcutta University, Kolkata (February 6, 2007).

A. Bhattacharyya

- *Dendrochronology & Palynology* (series of lectures) at UGC sponsored Refresher Course, Gauhati University, Guwahati (June 1-3, 2006).

Supriya Chakraborty

- *Atmospheric Radiocarbon Variability recorded in Teak Tree from Peninsular India: Implications to Atmospheric Transport* at Physical Research Laboratory, Ahmedabad (December 19, 2006).

Anjum Farooqui

- *Quaternary Mangroves and its Response to Climate and Sea Level Changes* at the DST In-house Science Meet, Jawaharlal Nehru Center for Advanced Studies, Bangalore (September 2006).

Rahul Garg

- *Biotic Extinction and Climatic Crisis in the Marine Realm: Evidence from Fossil Phytoplankton* at the DST In-house Science Meet, Jawaharlal Nehru Center for Advanced Studies, Bangalore (September 2006)

B.N. Jana

- *The Mesozoic Fossil Flora of Kachchh, Gujarat, India* at the Department of Earth and Environmental Sciences, University of Birmingham, Birmingham, UK.

R.C. Mehrotra

- *Cenophytic Panorama of India: Plant Pathways and Palaeoclimate* at the DST In-house Science Meet, Jawaharlal Nehru Center for Advanced Studies, Bangalore (September 2006)

C.M. Nautiyal

- *Communicating Science in Hindi through audio media*. Workshop at BSIP by Paribhashik Shabdavali Ayog. (May 18, 2006).
- *Bhookamp* for AIR (Uttarayan), Lucknow/ Nazibabad (Recorded on 22.9.2006)
- Two lectures on Science Communication at Andhra University, Visakhapatnam (September 23-26, 2006) catalysed and supported by NCSTC (DST)
- *Anybody Listening There? Life in the Universe* (Guest Lecture) at Instruments Research and Development Establishment, Dehradun on Science Day (February 28, 2007).

Vandana Prasad

- *Palaeobotanical studies lead to Conceptual Change in Evolutionary Biology: Dinosaur Coprolites and the early Evolution of Grasses and Grazers* at the DST In-house Science Meet, Jawaharlal Nehru Center for Advanced Studies, Bangalore (September 2006)

A. Rajanikanth

- *Holistic perspectives in Palaeobotany* at the DST In-house Science Meet, Jawaharlal Nehru Center for Advanced Studies, Bangalore (September 2006)
- *Perspectives in Cretaceous Palynology* at Department of Geology, Anna University, Chennai (December 2006)

- *Excitements in Palaeobotany* at the Symposium on Excitements in Plant Sciences UPASTA, CIMAP, Lucknow (February 28, 2007)

Mukund Sharma

- *Stromatolites's studies in India: An overview* (Key-note Address) at the National Seminar on Precambrian Life: Indian Scenario, Department of Geology, Durgapur Government College, Durgapur, W.B.(August 23, 2006).
- *Exploring Early Life: Current Endeavours and New Directions* at the DST In-house Science Meet, Jawaharlal Nehru Center for Advanced Studies, Bangalore (September 2006)

Lectures by outside scientists in the Institute

Prof. Gerta Keller, Dept. of Geosciences, Princeton University, Princeton, New Jersey, USA

- *The Chicxulub Debate: The KT Mass Extinction– Impacts, Volcanism and Climate Change* (December 18, 2006)

Prof. Kuniteru Matsumaru, Dept. of Geology, Faculty of Education, Saitama, Japan

- *Cretaceous Foraminifera from Kashmir* (January 09, 2007)

Prof. Rajiv Sinha, Dept. of Civil Engineering, Indian Institute of Technology, Kanpur

- *River Interlinking and its Impact on Earth Systems* (at Geological Society of India– Northern India Chapter Meeting; July 17, 2006)

A view of Geological Society of India, Northern India Chapter Meeting held on July 17, 2006 at BSIP

Recognition

N.C. Mehrotra

- Conferred 'Birbal Sahni Birth Centenary Award-2006' by Hon'ble Prime Minister of India at 94th Session of Indian Science Congress Association (Chidambaram).
- Awarded 'Prof. S.N. Bhalla Gold Medal-2006' by the Palaeontological Society of India (Lucknow).

- Convened a Symposium of *Knowledge Partners on International Year of Planet Earth– Indian initiatives* at '94th Indian Science Congress Association' held at Annamalai University, Annamalainagar, Chidambaram (Tamil Nadu) in January 2007.
- Chaired Technical Session *Geological Sciences* at the 'Seminar on Antarctic Science: Indian Contributions in Global Perspectives' held at NCAOR, Goa in May 2006.
- Nominated as one of the Presidents, Sino-India International Conference 'Biodiversity and Environmental Changes in the Himalayas' held at Sanya City, China in March-April 2007.

Scientists

Anil Agarwal

- Awarded the 'INSA Exchange Programme Fellowship' for visiting Czech Republic in 2007-08 (for one month).

Anil Agarwal & Mahesh Prasad

- Awarded 'Certificate and Team Medal' for collaborative integrated team work in the Institute.

S.K. Bera

- Resource Person, UGC sponsored Refresher Course in Life Science (Thrust Area: Exploring the vistas in life science), Academic Staff College, University of Calcutta, Kolkata (held in February 2007).

A. Bhattacharyya

- Invited as Resource Person to deliver lectures and interact with the participants under UGC sponsored Refresher Course in Geological Sciences (Theme: Quaternary Geology), at Gauhati University, Guwahati (held in June 2006).

Rahul Garg

- Subject (Earth Sciences) Expert at National Workshop on Scientific Investigations during 26th Indian Antarctic Expedition held at NCAOR, Goa in July 2006.

Asha Khandelwal

- Elected Fellow of the Indian Aerobiological Society.

C.M. Nautiyal

- Co-chaired a Session each at the Workshops on 'Science Communication' and on 'Innovative Experiments in Physics' held respectively at Andhra University (Visakhapatnam) and at Army Public School, Lucknow.

Vandana Prasad

Awarded 'Diamond Jubilee Medal-2006 & Citation' for publishing papers of high quality in Refereed Journals during last two years (preceding the year of award).

Jyotsana Rai & Supriya Chakraborty

- Awarded the 'INSA Exchange Programme Fellowship' for visiting United Kingdom in 2007-08 (each for 3 months).

A. Rajanikanth

- Chaired a Technical Session at the '23rd Annual Convention of Indian Association of Sedimentologists & National Seminar on Environmental and Economic Significance of Sedimentary Basins of India' held at Anna University, Chennai during December 2006.
- Guest Speaker, DST Workshop on 'Integrated Stratigraphy and Geochronology of Cretaceous Sediments' held at Anna University, Chennai during December 2006.

M.R. Rao

- Chaired a Technical Session at the '23rd Annual Convention of Indian Association of Sedimentologists & National Seminar on Environmental and Economic Significance of Sedimentary Basins of India' held at Chennai during December 2006.

Alpana Singh

- Awarded the 'INSA Exchange Programme Fellowship' for visiting Poland in 2007-08 (for 3 months) under international bilateral exchange programme.

B.D. Singh

- Co-chaired Technical Session-III *Fossil Fuel Systems–II (Coal Bed Methane)* at the 'National Conference on Frontier Areas in Geological and Technological Aspects of Fossil Fuel and Mineral Resources (GTFM-2006)' held at Indian School of Mines, Dhanbad in November 2006.

Archana Tripathi

- Awarded 'Scientific Output Medal' for the best piece of research work done in 2006 (Scientist-E, F & G categories).

G.K. Trivedi

Elected Fellow of the Indian Botanical Society.

Others

S.K. Shah

- Selected to present work entitled "*Temporal variation of precipitation during recent past in the northeast Himalaya based on tree-ring proxy record*" in Young Scientists Award Program of Earth Science Section, DST (New Delhi) at the University of Jammu, Jammu during December, 2006 and received II prize for presentation.

Dhoom Singh & M. Pillai

- Jointly awarded 'Efficient Administrative Staff Medal-2006' of BSIP.

M.S. Rana & Rameshwar Prasad Pal

- Awarded 'BSIP Employee Medals-2006' for working diligently and efficiently with extra efforts.

Representation in Committees/Boards

Director

N.C. Mehrotra

- President, The Palaeobotanical Society of India, Lucknow (since January 2007).
- Chief Editor, *The Palaeobotanist.*
- Chairman, Organizing Committees, Diamond Jubilee International Conference *Changing Scenario in Palaeobotany and Allied Subjects*, BSIP, Lucknow (November 2006).
- Member, Indo-French Technical Association, New Delhi.
- Member & Indian Correspondent for Newsletter, American Association of Stratigraphic Palynologists.
- Member, Governing Body, Wadia Institute of Himalayan Geology, Dehradun.
- Member, Governing Body, National Centre for Antarctic and Ocean Research, Goa.
- Member, Local Advisory Council, Regional Science Centre, Lucknow (Ministry of Culture).

Scientists

Rupendra Babu

- Corresponding Member, International Working Group-IGCP Project-493: The rise and fall of Vendian Biota.

Usha Bajpai

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

Jayasri Banerji

- Editor, *The Palaeobotanist.*
- Vice President, The Palaeobotanical Society, Lucknow (till December 2006).

S.K. Bera

- Councilor, Executive Council, The Palaeobotanical Society, Lucknow (since January 2007).
- Reviewer (Invited), Research paper (No. PALBO1791R2-2006), *Rev. Palaeobot. Palynol.*

Amalava Bhattacharyya

- Member, Organizing Committee, Diamond Jubilee International Conference *Changing Scenario in Palaeobotany and Allied Subjects*, BSIP, Lucknow (November 2006).

Anjum Farooqui

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

Rahul Garg

- Convener, XXI Indian Colloquium on Micropalaeontology and Stratigraphy, Lucknow.
- Vice President, The Palaeobotanical Society, Lucknow (since January 2007).
- Member, Editorial Board, *Journal of the Palaeontological Society of India*.
- Convener, Research Planning and Coordination Cell, BSIP.
- Co-ordinator, Joint Research Committee (BSIP-NIO).
- Member, National Working Group, IGCP-522.

A.K. Ghosh

- Member, Managing Committee, A. P. Sen Memorial Girls' P.G. College, Lucknow.

J.S. Guleria

- Chief Editor, The Palaeobotanical Society & *Geophytology* (since January 2007).
- Member, Executive Committee, Lucknow University's Botany Department Alumni Association.
- Secretary, Organizing Committees, Diamond Jubilee International Conference *Changing Scenario in Palaeobotany and Allied Subjects*, BSIP, Lucknow (November 2006).

Asha Gupta

- Member, Executive Committee, Society for Plant Research.
- Member, Executive Committee, International Council for Biodeterioration of Cultural Property.

Asha Khandelwal

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

Madhav Kumar

- Councilor, Executive Council, The Palaeobotanical Society, Lucknow (since January 2007).

J.P. Mandal

- Joint Editor, *The Palaeobotanist*.

R.C. Mehrotra

- Joint-Secretary, Organizing Committees, Diamond Jubilee International Conference *Changing Scenario in Palaeobotany and Allied Subjects*, BSIP, Lucknow (November 2006).
- Councilor, Executive Council, The Palaeobotanical Society, Lucknow (since January 2007).

C.M. Nautiyal

- Member, Local Organising Committee, Workshop-cum-Symposium of Materials Research Society of India at Lucknow (March 2007).
- Advisor, National Children's Science Congress-UP (2006).
- Member, CST-Committee for Satellite-based Distance Education Centre in the Field of S&T (supported by ISRO, CST, Vigyan Prasar).
- Member, Selection Committee for Education and Technical Assistants at Regional Science Centre Lucknow.
- Member, Jury, Science Elocution Contest at Regional Science Centre, Lucknow.
- Member, Jury for the National level fair 'IRIS' held at IIT, Delhi.

Mahesh Prasad

- Member, Executive Council, The Palaeobotanical Society (till December 2006).
- Vice President, BSIP Employee Co-operative Credit and Thrift Society, Lko.

Jyotsana Rai

- Member, National Working Group, IGCP-506: Marine and Non-marine Jurassic- Global Correlation and Major Geological Events.

A. Rajanikanth

- Joint Editor, BSIP Annual Report.
- Member, International Working Group IGCP Project- 506.
- Member, International Organization of Palaeobotany (India Chapter), Kolkata
- Reporteur, 94th Indian Science Congress Association, Chidambaram (January 2007)

Ram Awatar

- Councilor, Executive Council, The Palaeobotanical Society, Lucknow (till December 2006).

D.C. Saini

- State Nodal officer for UP (Nominated), Society of Ethnobotanists, NBRI, Lucknow.
- Joint Secretary, The Palaeobotanical Society, Lucknow (since January 2007).
- Member, Sub-Committee, Ethnobotany of State Biodiversity Board, UP.

Mukund Sharma

- Corresponding Member, International Working Group-IGCP Project-493, CC, NZ.
- Member, National Working Group IGCP-509.
- Joint Editor, Miscellaneous Publications, BSIP.
- Member, Organizing Committee, Diamond Jubilee International Conference *Changing Scenario in Palaeobotany and Allied Subjects*, BSIP, Lucknow (November 2006).
- Judge, City Level Science Fair, Regional Science Centre, Lucknow.
- Member, Institutional Animal Ethics Committee of ITRC, Lucknow

R.K. Saxena

- Secretary, The Palaeobotanical Society, Lucknow (till December 2006).
- Treasurer, The Palaeobotanical Society, Lucknow (since January 2007).
- Member, Editorial Board, *Geophytology*.
- Secretary and Member Editorial Board, Indian Society of Geoscientists.

B.D. Singh

- Associate Member, International Committee for Coal and Organic Petrology (ICCP).
- Member, Paper Setter Pannel (for M.Tech.), Indian School of Mines, Dhanbad.
- Member, Research Planning and Coordination Cell, BSIP.
- Member, Coordination Committee for the establishment of Birbal Sahni Memorial Fossil Park and Museum, Dept. S&T, Govt. of Jharkhand, Ranchi.

A.K. Srivastava

- Secretary, The Palaeobotanical Society of India, Lucknow (since January 2007).
- Chief Editor, The Palaeobotanical Society & *Geophytology* (till December 2006).
- Member, Editorial Board and Treasurer, Indian Society of Geoscientists.
- 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).

- Member, Coordination Committee for the establishment of Birbal Sahni Memorial Fossil Park and Museum, Dept. S&T, Govt. of Jharkhand, Ranchi

Rashmi Srivastava

- Councilor, Executive Council, The Palaeobotanical Society, Lucknow (since January 2007).

Rajni Tewari

- Editor, *Geophytology* (since January 2007).

Archana Tripathi

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

S.K.M. Tripathi

- Councilor, Executive Council, The Palaeobotanical Society, Lucknow (since January 2007).

G.K. Trivedi

- Expert, Research Degree Committees/Boards (Science Faculty), Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot (MP).

Units

Publication

Journal— *The Palaeobotanist*

The journal Volume 55(1-3) was published with state of the art printing technology. Research papers for the Volume 56(1) are being processed.

Annual Report

Bilingual (English/Hindi) Annual Report—2005-2006 was published with a new page design incorporating Institute's activities like Research, Conference participation, Awards, Research papers/abstracts published/accepted, Foundation/ Founders' Day celebrations, reports of different Units, annual accounts and related aspects with relevant graphics and photographs.

BSIP Newsletter

BSIP Newsletter 2006 (No. 9) was published with information on important activities of the Institute including participation in exhibitions, conferences, new additions to library, memorial lectures, National Science Day celebrations, important research finds, science meet reports and related information along with relevant images. Hindi activities including Pakhwara celebration, articles, Hindi Essay, etc. were also incorporated in this Newsletter.

BSIP Vision

A Vision document "Vision 2020" was published. The document provides different faces of Palaeobotany and ever expanding wide spectrum of palaeobotanical researches. The areas of focus in coming years emerging out of synergy with colleagues in the Institute and outside are elaborated in the document.

Catalogues— Seven Catalogues were published covering Indian aspects on Precambrian Palaeobiological remains, Spores-pollen from Triassic Sequences, Cenozoic (Tertiary) Plant Megafossils, Tertiary Spores-pollen, Tertiary Fungi, Dinoflagellate Cysts, and Medicinal Plants of BSIP Garden.

Handouts— Brief biographical profiles and extract of themes of lecture of eminent speakers delivered on the occasion of Foundation Day (10th September) and Founders' Day (on 14th November) were published. Similar handout was also compiled and printed for the speaker of the 2nd Diamond Jubilee Lecture delivered on November 14, 2006.

First Day Cover— A First Day Cover of the Institute and its Founder Prof. Birbal Sahni, FRS was designed and was published by the Department of Post and Telegraph on the occasion of Diamond Jubilee (1946-2006) of the Institute. It was released on Founders' Day (14th November) by Mrs. Neelam Srivastava, Post Master General, and UP Circle, Lucknow.

Souvenir— A Souvenir for Diamond Jubilee International Conference (November 15-17) was published containing information on Institute History, Founder, Messages, Reminiscences, List of Participants, Advertisements and Images of past events celebrated in the Institute since its inception on September 10, 1946.

Abstract Volume— An Abstract Volume (188 pages) for the Diamond Jubilee International Conference on *Changing Scenario in Palaeobotany and Allied Subjects* organized by the Institute during November 15-17, 2006 was published with information on Abstract contents, Internal Committees and Author Index.

Programme Schedule— A programme schedule of Diamond Jubilee International Conference (November 15-17) was published containing schedule of paper/poster presentation and theme lectures.

Invitation Cards— Invitation cards for different occasion's viz., Foundation Day, Founder's Day and Diamond Jubilee International Conference, Cultural Evenings & Sponsored Dinners were printed.

New Year's Card— Greeting Cards for the year 2007 were brought out depicting Institute's building.

Sale of Institute Publication

This year the publication of the Institute netted an income of Rs. 1,39,347.

Publications Released

Library

Library is committed to serve to its users efficiently.

The current holdings of library are as under:

Particulars	Additions during 2006-07	Total
Books	63	5,664
Journals (bound volumes)	2174	14826
Reprints	2148	39,421
Reference Books	08	336
Hindi Books	12	2887
Ph.D. Thesis	-	91
Reports	-	46
Maps & Atlases	-	61
Microfilm/ Fisches	-	294
CD	-	72

Currently the library is receiving 172 journals (98 through subscription and 74 through exchange). There are 154 registered card holders using the library facilities.

Exchange Facility

Institutions on exchange list	63
Individuals on exchange list	147
Journals received on exchange basis	75
Reprints sent out in exchange	1142
Reprints of research papers purchased for exchange	26

Automation

This year library has updated its existing software Libya for unlimited entries. Data entry work is in progress. Some of the journals are available online to users.

Other Facilities

Current Awareness Service— To keep the readers aware with the latest arrivals in the library "Current Awareness Service" is carried out bi-monthly.

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.

The following Institutions/Organizations availed the library facilities:

- Department of Botany, Annamalai University, Tamil Nadu
- Department of Geology, Govt. Science College, Raipur
- Department of Botany, J.N.V. University, Jodhpur
- Hawaii University, Galion
- Geological Institute of Russian Academy of Sciences, Moscow
- Departments of Botany, Geology and Ancient Indian History & Archaeology, Lucknow University, Lucknow

Museum

Institute's Museum continued to play a significant role in popularizing the science of Palaeobotany amongst the students and common man. Efforts were also made to make the museum display more elaborative, effective and educative. Two electronic display systems– the touch-screen monitor and plasma TV, were added to the museum. Significant information and data related with different aspects of palaeobotanical researches were fed into these systems. Many new panels providing detailed information about origin of Universe, evolution of life and the application of hydrocarbon exploration were added to the museum. Special attention was paid for the proper display of scientific works and achievements of the Institute's scientists.

Work on Inventory of the type and figured specimens are under progress. 280 unexamined slides of microfossils and some liverworts deposited in the museum by late Dr. Manoj Shukla were classified, numbered and added to the Repository of museum. These slides are from nearly all horizons of Palaeozoic Era and belong to different countries, viz. Australia, Canada, China, Czech Republic, UK and India.

Research materials collected by the scientists of the Institute from 149 localities of the country under different projects, DST sponsored projects and collaborative researches were deposited in the Museum. Details of additions to the type and figured specimens/slides are as follows:

Holdings

Particulars Type	Addition during 2005-2006	Total
Type and figured specimens	61	6,679
Type and figured slides	120	12,740
Negatives of above	293	17,504

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

Project	Specimens	Samples
Project– 1	26	239
Project– 2	-	386
Project– 3	364	10
Project– 5	-	13
Project– 6	196	217
Project– 7	-	76
Project– 8	-	80
Project– 10	36	364
Project– 11	-	129
Project– 12	25	-
Project– 14	-	01

Samples deposited under Sponsored/ Collaborative Projects:

DST Sponsored (SR/S4/ES-129/2004)	-	72 samples
National Geographic Project (7938-05)	-	212 samples
CSIR Pool Scientist Project	-	26 samples
DST Sponsored (SR/S4/ES-138/05)	-	324 samples
BSIP and GSI Collaborative	-	275 samples
DST (SR/S4/ES-21/Baroda window/PI)	-	232 samples
DST Sponsored (SR/S4/ES/15/02)	-	128 samples
DST Sponsored (SR/S4/ES/171/05)	-	30 samples
Received from Iran (Collaborative)	-	10 samples

Fossil specimens gifted within the country to the following centers:

- Department of Botany, Gauhati University, Guwahati (Assam)
- Department of Botany, Shivaji Science College, Nagpur (Maharashtra)
- Department of Botany, J.N.V. University, Jodhpur (Rajasthan)
- Government Inter College, Kaladhungi, Nainital (Uttarakhand)

Institutional Visitors

- Forest Range Officers Training Institute, Kanpur (UP)
- Cotton College, Guwahati (Assam)
- J.B. College, Jorhat (Assam)
- Department of Botany, Krishna Mahavidyalaya, Satara (Maharashtra)
- Department of Botany, Smt. K.W. College, Sangli (Maharashtra)
- Mother Haleema Sr. Secondary School, Bhadohi (UP)
- A.B.R.P.G. College, Anapara, Sonebhadra (UP)
- Department of Botany, J.N. Vyas University, Jodhpur (Rajasthan)
- Department of Botany, University of North Bengal, Darjeeling (WB)
- Regency Public School, Sitapur (UP)
- Bright Land Inter College, Triveni Nagar, Sitapur Road, Lucknow
- D.I.E.T. Nishatganj, Lucknow
- St. Ann's Inter College, LDA Colony, Kanpur Road, Lucknow
- Happy World Girl's Inter College, Lucknow
- I.E.T., Lucknow

Herbarium

About 300 plant specimens from North Anuppur Forest Division in MP were identified, mounted on herbarium sheets and registered. About 75 samples of fruits and seeds were also processed and identified. All the plant materials were incorporated in their respective families and sections. Digitized inventory of Herbarium pollen slides (4,000), plant specimens (500), wood blocks and wood slides (50) was prepared, providing botanical name of the each species their family, place of collection, accession number and date of preparation (if available).

Holdings

Particulars	Addition during 2005-2006	Total
Herbarium		
Plant specimens	300	22,871
Leaf specimens	-	973
Laminated mounts of venation pattern	-	66
Xylarium		
Wood blocks	-	4,153
Wood discs	-	68
Wood cores	500	6,832
Wood slides	-	4,180
Palm slides (stem, leaf, petiole, root.)	-	3,195
Sporothek		
Polleniferous materials	-	3,016
Pollen slides	-	12,237
Carpothek		
Fruits & seeds	75	4,496
Museum Samples		
Medicinal & food plant	-	91

Visitors

- Prof. D.L. Dilcher. University of Florida, U.S.A.
- Prof. Cheng-Sen Li, Institute of Botany, Chinese Academy of Sciences, Beijing, China
- Dr. Yao, Institute of Botany, Chinese Academy of Sciences, Beijing, China
- Dr. R.C. Srivastava, Joint Director, Botanical Survey of India, Itanagar, Arunachal Pradesh
- Dr. V.D. Kapgate, Department of Botany, J.M. Patel College, Bhandara, Maharashtra
- Forest Guards (Trainees) of Forestry Training Institute, Kanpur, U.P.
- Teachers Attending Refresher Course, Academic Staff College, Lucknow University, Lucknow

Electronic Data Processing

Internet connection with Radio link facility from Software Technology Park of India, Lucknow has been upgraded from 256 Kbps to 1 MBPS 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 87 Computers are connected with the LAN. E-Mail accounts for scientists and various units/sections have been opened through Mail Server on Institute Domain Name (BSIP.RES.IN).

An Anti Virus Program F-Prot has been renewed with 50 user license to protect the system from viruses and worms. This year Institute has procured 42 Compaq P-IV System with UPS and Laser Printers and one colour Laser Printer, 5 Scanner, one Tablet PC and two Sun Servers.

Institute's web site (http://www.bsip.res.in) is running on the Institute's Server. Computer Section is maintaining the day to day updation.

Payroll, Form16 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 391 samples were cut and about 1539 slides were prepared. In addition, 332 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.

Reservations and Concessions

The Institute is following General Reservation Orders of the Government of India as applicable to Autonomous Bodies and 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.

Status of Official Language

The institute continues to strive to attain the targets under Official Language policy. The Quarterly and Annual Reports to DST and Half Yearly Reports to NARAKAS are regularly sent. Apart from promoting the use of Hindi in official work, a number of special activities are organized throughout the year.

With support from the Scientific and Technical Terminology Commission, Institute organized a Seminar on *Scientific Writing and Technical Terminology in Hindi* during May 17- 19, 2006. The Chairperson of the Commission Prof. Vijay Kumar and Scientific Officer Dr. Ram Krishna Misra also came for the Seminar. In addition, several Workshops on use of Hindi softwares were organized. The Chief Wildlife Warden (UP), Sri Mohd. Ahsan, IFS delivered 2 lectures in a Workshop at the institute on 26th February, 2006. In one he elaborated on the reference to environment and its depiction in the Hindi poetry and in the other deliberated on wild life.

Institute was represented in the meetings of NARAKAS on 21st August, 2006 and 26th February, 2007. Dr. NC Mehrotra, Director and Dr. CM Nautiyal, Member- Secretary, Rajbhasha Karyanvayan Samiti attended the 23rd and 24th meetings of the Joint Advisory Committee for Official Language at New Delhi on May 20th and December 16th, 2006. NARAKAS presented Certificates of Appreciation to the Institute for organizing Hindi Workshops.

Hindi Fortnight

Hindi fortnight was celebrated during September 10th-25th and inaugurated on September 10, 2006. The fortnight was inaugurated by Dr. Jauhari Lal, Former Director (HRD), ONGC and Secretary General and CEO, Petrotech Society, New Delhi by giving a lecture on *Future of Science in the Age of Information Technology*. Several competitions were held for enthusiastic participants.

In the course of fortnight, there were 91 entries in various competitions. 'Spot the Error' competition was organized on 14th September which was joined in by 21 staff members. Four participants joined in computer typing on 18th, while 4 three-member teams competed in the Quiz. There were 41 names entered as names for the BSIP Newsletter. Two other competitions, viz. summary and review of some Hindi book available in the library and a Speech Competition on "Safety of Human Race Lies in Conserving Environment' were also organized. The prizes were distributed on the Founder's Day function of the Institute.

The results of various competitions were as follows:

Book- Summary & Review:

I. Mr. Avinesh K. Srivastava, II. Dr. Chanchala Srivastava

Name for BSIP Newsletter:

I. Mr. T.K. Mandal

Poetry

I. Dr. Alpana Singh, II. Dr. Jyotsana Rai, III. Mr. Prem Prakash

Spot the Error

I. Mr. Deepak Pandey, II. Dr. R.K. Saxena & Mr. T.K. Mandal, III. Dr. Jyotsana Rai, Mr. A.K. Arya & Ms. Poonam Verma

Typing

I. Mr. Deepak Pandey, II. Ms. Sudha Kureel, III. Mr. Ajay K. Srivastava

Quiz

I. Dr. R.K. Saxena, Mr. Amit K Ghosh, Ms. Kavita Kumar II. Mr. A.K. Arya, Mr. T.K. Mandal, Mr. D.K. Pal, III. Mr. Veeru K. Singh, Mr. Deepak Pandey, Ms. Anupam Jain

Speech

I. Mr. Madhvendra Singh, II. Mrs. V. Nirmala, III. Mr. K.C. Chandola

Hindi Protsahan Puraskar

To encourage the use of Hindi in official work, 9 persons were awarded cash prizes as follows during the valedictory function of the Diamond Jubilee Celebration:

I. Dr. Jayasri Banerji & Dr. S.K.M. Tripathi

II. Dr. Alpana Singh, Mrs. V. Nirmala & Mr. Madhukar Arvind

III. Dr. Chanchala Srivastava, Mr. M.S. Rana, Mr. D.K. Pal, Ms. Sudha Kureel & Mr. Rajesh Awasthi

Inspection

Sri Nilambar Pandey, Joint Director (Official Language), DST visited the Institute on inspection on August 30, 2006. He visited section, interacted with committee members and offered valuable suggestions for improvement.

Miscellaneous

Arrangements for making of 20 more computers bi-lingual have been made through software procurement. Various forms and formats have also been made bi-lingual. Besides, abstracts of the research papers were prepared in Hindi for the Institute's Journal '*The Palaeobotanist*' and published. The Annual Report-2005-06 is published in Hindi also. The contents of Newsletter of Institute are in Hindi and English both.

The Institute, thus, is continuously engaged in promoting the use of the official language.

Deputation to Workshops

S.C. Bajpai

Attended *Hindi Me Takniki Lekhan Tatha Paribhasik Shabdavali*, Commission for Scientific and Technical Technology, Government of India, Birbal Sahni Institute of Palaeobotany, Lucknow, May 17-19, 2006.

C.M. Nautiyal

Coordinated the Workshop at BSIP organized by Paribhashik Shabdavali Ayog during May 17-19, 2006

Rashmi Srivastava, P.S. Katiyar, I.J.S. Bedi, Ashok Kumar & Mishri Lal

Attended the various sessions of 'Samuhik Hindi Karyashala' organized by NARAKAS and held at CDRI, Lucknow during June 26-27, 2006.

D.C. Saini, Ashok Kumar, Ajay K. Srivastava & Chitra Chatterjee

Attended the various sessions of 'Rajbasha Karyashala' organized by NARAKAS and held at CDRI, Lucknow during December 27-28, 2006.

Staff

Director

Dr. Naresh C. Mehrotra

Scientists

Scientist 'F'

Dr (Ms) Jayasri Banerji
Dr Rahul Garg
Dr Ramesh K. Saxena
Dr Manoj Shukla (expired on 06.06.2006)
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 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 'B'

Mr Ajay K. Arya
Mr Sadhan K. Basumatary
Dr Srikanta Murthy
Dr Hukam Singh
Mr Veeru K. Singh
Mr Biswajeet Thakur

Scientist 'A'

Dr (Mrs) Binita Phartiyal
Dr Anil K. Pokharia

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

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 (expired on 17.12.2006)
Mr S.R. Yadav (retired w.e.f. 30.09.2006)

Technical Assistant 'D'

Mr Syed R. Ali
Mr D.S. Bisht
Mr Sumit Bisht
Mr D.K. Pal
Mr S. Suresh K. Pillai
Mr Dhirendra Sharma
Mr Madhavendra Singh (resigned w.e.f. 28.02.2007)
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

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

Administrative Personnel

Registrar: Mr Suresh C. Bajpai

Accounts Officer: Mr Dipak K. Dutta

Private Secretary: Mrs M. Jagath Janani

Section Officer

Mr I.J.S. Bedi

Mr R.K. Kapoor

Mrs V. Nirmala

Accountant: Sri Dhoom Singh (Officiating)

Stenographer: Sri Murukan Pillai

Assistant

Mrs Ruchita Bose

Mrs Usha Chandra (expired on 31.03.2007)

Mr Hari Lal

Mrs Swapna Mazumdar (Officiating)

Mr K.P. Singh (Officiating)

Mr Koshy Thomas (Officiating)

Mrs Pennamma Thomas

Hindi Translator: Mr Ashok Kumar

Upper Division Clerk

Ms Chitra Chatterjee (Officiating)

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

Mr N.U. Kannan

Lower Division Clerk

Mr Akhil Antal (resigned w.e.f. 31.01.2007)

Ms Sudha Kureel

Ms Manisha Tharu

Driver

Mr Nafis Ahmed ('IV')

Mr D.K. Mishra ('II')

Mr M.M. Mishra ('II')

Mr V.P. Singh ('II')

Mr P.K. Mishra ('I')

Class 'D' Personnel

Attendant 'IV' (Technical)

Sri K.C. Chandola

Attendant 'III'

Sri Kesho Ram

Sri Haradhan Mahanti

Smt. Munni

Sri Prem Chandra

Sri Ram Deen

Sri Ram Kishan

Sri Ram Singh

Sri Shree Ram

Attendant 'II'

Sri K.K. Bajpai

Smt. Maya Devi

Sri Hari Kishan

Sri Dhan B. Kunwar

Sri Kailash Nath

Sri Mani Lal Pal

Sri Ram Dheeraj

Sri Ram Ujagar

Sri Mohammad Shakil

Sri Bam Singh

Sri Kedar N.Yadav

Attendant 'I'

Sri R.K. Awasthi

Smt. Beena

Sri Deepak Kumar

Sri Vishwanath S. Gaikwad

Sri Inder Kumar

Sri Subhash C. Mishra

Km. Nandani

Smt. Ram Kali

Sri Ramesh Kumar

Sri Ravi Shanker

Mali

Sri Rameshwar Prasad Pal ('III')

Sri Ram Chander ('I')

Sri Ram Kewal ('I')

Sri Mathura Prasad ('I')

Appointments

Mr. Parminder Singh Ranhotra, Birbal Sahni Research Associate w.e.f. 29.03.2007 (FN)

Mr. Santosh Kumar Shah, Birbal Sahni Research Associate w.e.f. 29.03.2007 (FN)

Miss Anumeha Shukla, Birbal Sahni Research Scholar w.e.f. 30.03.2007 (FN)

Mr. Krishna Gopal Mishra, Senior Research Fellow w.e.f. 15.01.2007 (FN)

Mrs. Poonam Verma, Junior Research Fellow w.e.f. 15.05.2006 (AN)

Mr. Kamlesh Kumar, Junior Research Fellow w.e.f. 16.06.2006 (FN)

Miss Yogmaya Shukla, Junior Research Fellow w.e.f. 21.07.2006 (FN)

Mr. Gaurav Srivastava, Junior Research Fellow w.e.f. 15.01.2007 (FN)

Mr. Akhilesh Kumar Yadav, Junior Research Fellow w.e.f. 15.01.2007 (FN)

Mr. Saheb Lal Yadav, Laboratory Assistant w.e.f. 15.01.2007 (FN)

Sponsored Project Personnel

Dr Shantanu Chatterjee, CSIR SRA

Dr Ratan Kar, CSIR SRA

Dr Jayendra Singh, PI (resigned w.e.f. 15.02.2007)

Mr S.K. Shah, SRF (resigned w.e.f. 28.03.2007)

Ms Jyoti Sharma, JRF

Ms Divya Srivastava, JRF

Ms Vartika Singh, JRF

Mr Jagdish Prasad, Field/Lab Assistant

Ms Abha, Technical Assistant (tenure expired w.e.f. 30.06.2006)

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