



Annual Report

2010-2011



Birbal Sahni Institute of Palaeobotany, Lucknow

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

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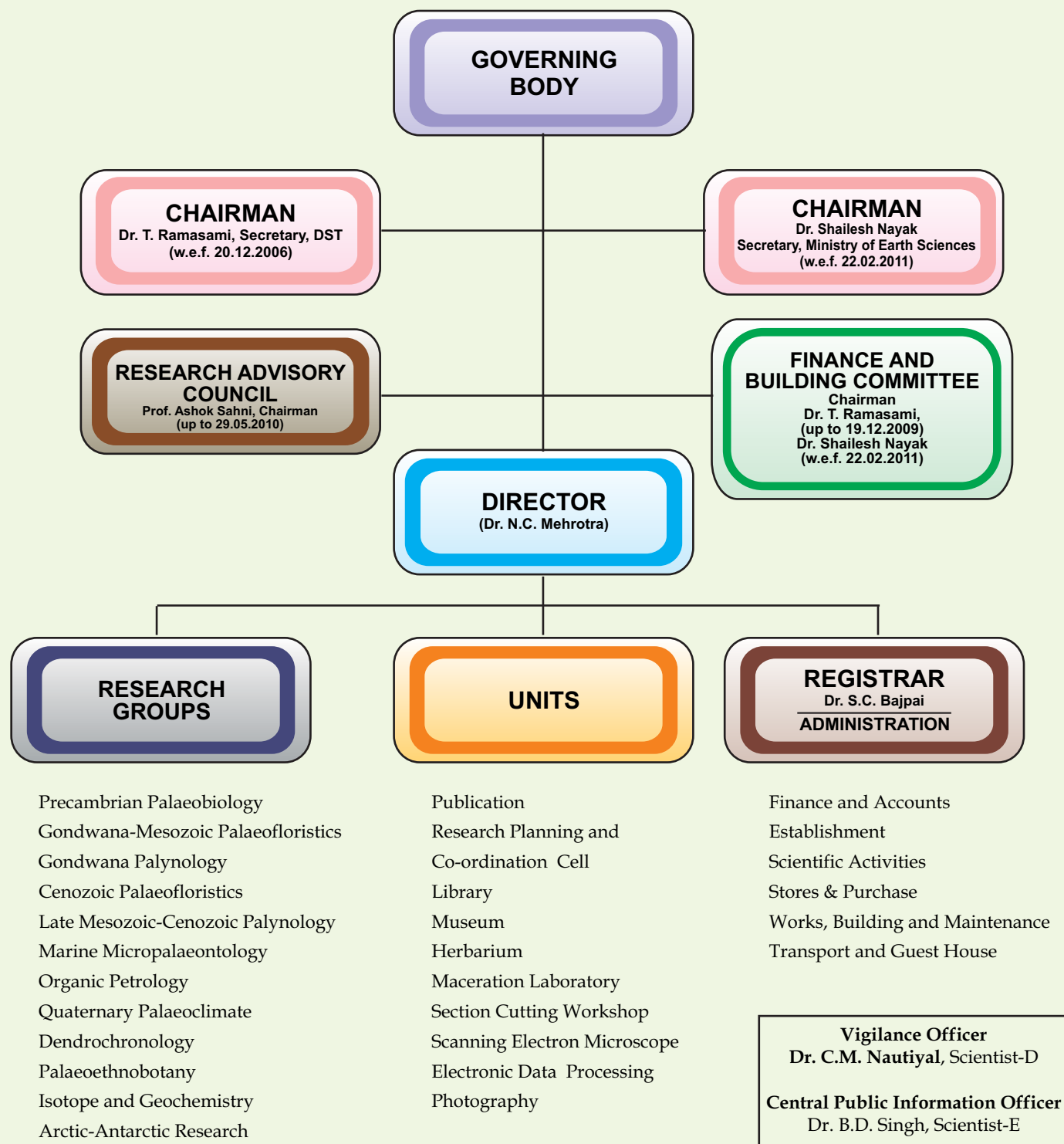
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N.C. Mehrotra

Naresh C. Mehrotra
Director

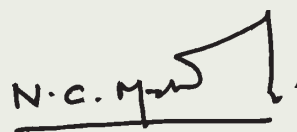
Organization Structure

Department of Science & Technology Autonomous Institute



Foreword

The Birbal Sahni Institute of Palaeobotany, Lucknow is a nodal centre for palaeobotanical researches and bears a long heritage of excellence in plant fossil research. It has carved a niche on international sphere through scientific collaborations and by following a multidisciplinary research approach through the active involvement of youth supported by a blend of senior expertise. The research activities during the year 2010-11 form an integrated part of XI Five Year Plan thrust areas and inputs from the 14 research projects culminated in the form of significant research database. The progress is visible in the form of research papers; outreach and publication activities participated by scientific, technical and administrative personnel. The institute operates as an autonomous institute under the Department of Science and Technology, Govt. of India and guided by the collective wisdom of eminent members of Governing Body and Research Advisory Council and made worthwhile contribution to Earth System Sciences. This document is a collective endeavour of RPCC/Publication/Museum/associated units and the information included reflect our commitment to multifaceted development of Palaeobotany.



(N.C. Mehrotra)

Director



Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences, Govt. of India &
Chairman, Governing Body of the Birbal Sahni Institute of Palaeobotany, Lucknow

Research Highlights

The Birbal Sahni Institute of Palaeobotany (BSIP), an autonomous institute under the Department of Science and Technology, is carrying out researches with a commitment to ensure growth in fundamental and applied aspects of Palaeobotany and allied Earth System Sciences, especially focusing on past plant life and palaeoclimate. The palaeobotanical researches are being conducted right from Archaean to Recent geological sequences (3200 Ma to 400 AD), applying an integrated and multidisciplinary approach. Continuing the XI Five Year Plan targets, 14 research projects for the year 2010-2011 have been organized under the umbrella of six identified Thrust Areas:

1. Early life, atmosphere and oceans: Evidences from Indian Craton (Bio-Geosphere interactions in the Precambrian);
2. Fossil land plant communities: Morpho-structure, Evolution, Systematics with applications to Biostratigraphy and Palaeoecology (Plant evolution, Anatomy, Taxonomy and Stratigraphy);
3. Integrative Micropalaeontology, Biopetrology and Organic facies: Relevance to fossil fuel characterization and exploration (Integrated approach to realizing economic potential in prospective basins);
4. Multi-proxy parameters for Quaternary palaeoclimate reconstructions, vegetation dynamics, relative sea level changes and anthropogenic influence (Integrated approach to climate change, modeling and sustainable ecosystems);
5. Polar and Major Planetary Events (Polar research and record of events such as Tsunami, Earthquakes and Volcanism); and
6. Frontiers in Palaeobotanical Research (Reconnaissance Projects to aid in development of future research direction).

Some of the important outcome of scientific research during the year is as under:

- Studied trace fossils from Marwar Supergroup provides definitive evidence of the Cambrian succession for hitherto suggestive Precambrian-Cambrian sequence in peninsular India. The Precambrian-Cambrian boundary, therefore, should lie in still older part of the sequence either in the Nagaur Formation or in Bilara Group (in Rajasthan Basin).
- Recorded palaeobiological assemblage from Singhora Group, Chhattisgarh Basin indicates a fairly well-preserved biota (algal remains) of multicellular tissue forming thalli, bilateral symmetry and erect growth comparable to carbonaceous films of eukaryotic remains known from Canada, USA and China.
- Plant fossils investigated from various Gondwana successions of Satpura, South Rewa, Mahanadi, Pranhita-Godavari and some other basins have helped in interpreting floristic evolution and palaeoecology of the regions.
- Study of plant fossils from coal-bearing sequence of Satpura Gondwana Basin suggest that in all probability flora of Karharbari Formation continued to exist in lower part of Barakar Formation. Thus, there is need to recognize the physical presence of Karharbari Formation in Lower Gondwana coalfields of India.
- Recovery of angiospermous floral elements and associated floral components from East Coast revealed new insights in plant evolution during Cretaceous times in the Indian sub-continent.
- Analysed palynomorph assemblages from various coal-bearing Gondwana sequences of Singrauli, Sohagpur, Ib-River, Tatapani-Ramkola, Birbhum, East Bokaro, and Godavari valley coalfields for biostratigraphic dating and correlations.
- Recovered an early to late Jurassic age palyno-assemblage which is indicative of non-marine Jurassic sequence in India, so far not recorded from South Rewa Basin.

- Plant remains (wood, leaves and fruit) investigated from various Palaeogene beds of Gujarat, Rajasthan, MP, Manipur, Assam, Himachal Pradesh, Uttarakhand, etc. have helped in interpreting floristics, palaeoecology, and phytogeography of the regions. Additionally, palynoflora from various Tertiary sequences of Kachchh, Rajasthan, north-east and central India, Cauvery Basin, Andaman, etc. investigated for stratigraphic zonation and correlation
- The occurrence of some Southeast Asian elements in the fossil flora of Assam indicates that an exchange of floral elements took place between India and Southeast Asia during the Miocene period.
- Recorded assemblage of dicotyledonous woods from the Deccan Intertrappean sediments of MP that signifies tropical climate with plenty of rainfall during the period of deposition.
- Recorded 5 angiospermous taxa from lower Siwalik sediments of Nahan area (HP) that presently occur in tropical evergreen and moist deciduous forests of NE and South India which receive higher rainfall; suggesting that changes in climate must have taken place after middle Miocene.
- Discovered mites (Acarina) from the Palaeogene sediments of Kutch, Gujarat and highlighted their significance in deducing palaeoenvironment.
- Considering the stratigraphical record of palynofossils in Indian Palaeogene strata, the investigated Nagaur sequence (Marh Formation, Rajasthan) is dated as early Eocene.
- Recorded angiospermous pollen (Family Arecaceae) for the first time from the late Albian Grey Shale of Dalmiapuram Formation (Kallakudi Mine-II, Tamil Nadu).
- Recognized two broad vegetation types based on the characteristics of palynoflora recovered from the Tirap colliery in Upper Assam Basin – i) plants associated with a mangrove habitat, and ii) freshwater inter-fluvial swamps, lakes and ponds.
- Dinocyst / palynofacies assemblages from Mahadek Formation, Cherrapunji area (Cretaceous-Palaeocene) shows specific levels of well-preserved cyanobacteria followed by dinocyst dominated horizons indicative of fluctuating tidal flat and shallow inner neritic depositional conditions.
- Reported first record of bennetitalean fossil flower represented by *Williamsonia* sp. along with Carpolithes (seed), from the upper part of the Callovo-Oxfordian of Washtawa Formation (Nara Shale Member) of Kachchh Basin.
- The record of high latitude cold water nannofossil forms with warm water taxa and nannoliths indicate mixing of warm and cold water currents in Jaisalmer Basin during late Cretaceous time situated at mid latitudes (ca. 30°S). Presence of certain taxa indicates mixing of taxa from Austral Province current.
- Recorded coralline red algae and halimedacean green algae, based on thin section analysis, from the Limestone unit of Hut Bay (Little Andaman) belonging to Middle Miocene age.
- Evaluated certain Gondwana coals from Godavari valley and Tertiary lignites from Cauvery and Cambay basins for their macerals and rank characterization in relation to economic suitability, besides depositional patterns.
- Interpreted the Quaternary pollen record to understand the evolution of mangrove vegetation in relation to sea-level and concurrent climatic fluctuations around the Chilka Lake (Mahanadi Delta).
- Reconstructed vegetation through palynology of core samples from Vizanagram (north of Visakhapatnam) shows vegetational change from moist deciduous lowland forest community to dry deciduous forest during Holocene.
- Studied distribution of diatom, dinoflagellate cysts, nannoplankton and cyanobacteria in the oxygen minimum zone OMZ (~150-1200 m) recovered from sediments of Arabian Sea; showing negative correlation with the diatoms, dinoflagellate cysts and nannoplankton with OMZ. Luxuriant growth of cyanobacteria in the OMZ transect is a significant phenomenon.

- Pollen analyses of sediment cores/samples from Betul and Sehore districts (MP), unfolded the short-term climatic variability and vegetation shifts during the late Holocene.
- Recovered one 28 ka BP vegetation and climatic record from Dikhou river section, Sibsagar district (Assam); indicating the existence of scattered tropical semi-evergreen forest under cool and dry to warm and humid climatic regime.
- Analysed tree-ring samples of *Cedrus deodara* from six sites of Garhwal Himalaya and prepared their chronology, ranging between 272 and 594 years.
- Added more palaeo-ethnobotanical finds from ancient Ahichchhatra, District Bareilly (UP); revealing advanced agricultural practices in this region of Ganga Plains during Chalcolithic and Early Historic times.
- Based on the geomorphological studies of the Spiti valley, and an attempt has been made to access the areas in terms of its neotectonic instability of this basin that feeds one of the very important rivers of India i.e., the Sutlej.
- Described large former glacial lakes and their sediments from the Schirmacher Oasis region of Antarctica. The water bodies were present during the late Quaternary (~13-3 ka BP) and have reduced in size by negative water balance.
- Studied mineral/ environmental magnetic analyses in the dry lacustrine/ sediment fills of the Schirmacher Oasis indicates 6 phases of climatic fluctuation between 13-3 ka BP.
- Studied sediment samples from the fresh water lakes, near scientific bases and those which are away from direct human influence, of Larsemann Hills and Schirmacher Oasis to visualise the change in assemblage of palynomorphs.
- Participated in India's Arctic Programme for field related studies. The main emphasis was on the analysis of modern palynological analogs with reference to the dispersal, transportation and subsequent deposition of local and extra-local palynomorphs in the sediments of Ny-Alesund (Svalbard).
- Detailed studies of the Ny-Alesund trench sediments have revealed significant data regarding the late Quaternary climate and sea level changes, which were regional in nature.
- Observed morphology and comparative anatomy of least to high thermally altered plant fragments (charred spores-pollen & organic matter derived from wood and leaf pieces) preserved in carbonaceous shales of Lashly Formation (Middle to late Triassic) of Allan Hills, South Victoria Land (SVL), Antarctica; demonstrating the evidences of effect of fire on vegetation during Middle to late Triassic.
- Visualized preponderance of reworked miospores of Gondwanic (late Permian and early Triassic) affinity in the Oligo-Miocene sediments of Tarumsa Formation of Kargil Molasse Group.

Multidisciplinary and multi-institutional research activities with Institutions in India and abroad have been continued in several spheres. International collaborations with Institute of Botany, Chinese Academy of Sciences, Beijing; University of Texas, USA; and Institute of Geosciences, University of São Paulo and Guarulhos, Brazil have helped to expand scientific knowledge. Initiated a scientific programme which is aimed to assimilate the valuable palaeobotanical data available at BSIP with international experts of different disciplines. Their further examination and interpretation in global perspective will result into world class research. Under the programme, following two eminent experts visited the institute– Prof. Martin J. Head (of Canada), and Prof. Valentin Krassilov (of Israel).

The collective research efforts have resulted in 102 published papers, 85 scientific abstracts, one book, and 16 reports/articles, besides 51 research papers accepted for publication. Two scientists were deputed abroad (Poland) under inter-academy exchange programme of INSA. Two scientists participated in the Indian Expedition to Arctic. Two scientists visited Brazil and one scientist visited Japan on invitation, and another seven scientists were deputed for attending various conferences abroad (in Canada, China, Finland and Japan). Thirty-two scientists and five research scholars were deputed to attend different national and international conferences held in the country. Concerned scientists

were also deputed to attend the Indo-Brazilian Symposium on *Glimpses of Gondwana Research* organized at BSIP. Forty-eight research papers were presented in these scientific meetings at different centers of India and abroad. A training programme on Late Cenozoic Dinoflagellate Cysts was also organized at the institute, imparted by Prof. M.J. Head.

The visits of honourable Minister for Science & Technology, Gov.India, Shri Pawan Kumar Bansal and His Excellency Governor, Uttar Pradesh Shri B.L. Joshi helped us keeping our morale high and visits by other eminent personalities enhanced our scientific zeal



Dr. N.C. Mehrotra welcoming Hon'ble Union Minister for Science & Technology, Shri Pawan Kumar Bansal



Dr. N.C. Mehrotra welcoming His Excellency Governor of Uttar Pradesh Shri B.L. Joshi

Governing Body

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(w.e.f. 22.02.2011)

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(w.e.f. 30.05.2007 to 29.05.2010)

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Finance and Building Committee

Chairman (Ex-officio)

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Birbal Sahni Institute of Palaeobotany

Non-Member Secretary (Ex-officio)

Dr. S.C. Bajpai
Registrar
Birbal Sahni Institute of Palaeobotany

Foundation Day

The Institute celebrated its 64th Foundation Day on September 10, 2010. On this occasion Dr. Harsh K. Gupta, Panikkar Professor, National Geophysical Research Institute, Hyderabad delivered '14th Jubilee Commemoration Lecture on the topic *Gas Hydrates: Indian Scenario*.

His Excellency Governor of Uttar Pradesh Shri B.L. Joshi presided over the function, who admired the multi-disciplinary growth of the Institute. Many guests and scientists from outside the Institute attended the function.



Interactive Science Meet

In the forenoon of Foundation Day an *Interactive Science Meet* was organized for earth science students

and inquisitive questions by students were attended by Dr. H.K. Gupta, an Eminent Earth Scientist.



Founders' Day

The Institute celebrated its Founder- Prof. Birbal Sahni 119th birth anniversary on November 14, 2010. On November 14- the Founders' 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 following Memorial Lecture was organized:

Dr. O.N Bhargava, Formerly Director, Geological

Survey of India delivered the '40th Birbal Sahni Memorial Lecture on the topic- *Early Palaeozoic Palaeogeography, Basin Configuration, Palaeoclimate and Tectonics in the Indian Plate*.

Prof. MP Singh, former Pro- Vice Chancellor of the University of Lucknow presided over the function. Many guests and scientists from outside the Institute and several conclave delegates attended the occasion.



Sir Albert Charles Seward Memorial Lecture

Dr. T. Ramasami, Secretary, DST New Delhi and Chairman, Governing Body of the Institute delivered the '56th Sir Albert Charles Seward Memorial Lecture' entitled- *Science of Managing Creative People in*

Climate related Research on December 18, 2010. Several guests and scientists from outside the Institute attended the occasion.



Diamond Jubilee Lecture

Shri N.K. Verma, General Manager, Frontier Basins, Oil and Natural Gas Corporation, Dehradun delivered the '5th Diamond Jubilee Lecture' on the theme *Exploration Technology in Frontier Basins* on February 28, 2011.



Indo-Brazilian Symposium & Field Workshop

An Indo-Brazilian Symposium on *Glimpses of Gondwana Research* was organized by BSIP on November 24, 2010. The symposium was divided into two technical sessions and covered some very interesting topics-

Palaeobiodiversity including mega- and microflora of different Gondwana sedimentary basins of India and Brazil,

The History of Palaeobotanical researches in the Brazilian Gondwana,

Palynomorphs of Gondwanic affinities from Kargil,

Insect-plant relationship of Gondwana and Post Gondwana,

Position of India in Gondwana reconstruction, and

Palaeobotanical researches in Brazilian Gondwana and Mesozoic Cretaceous algae from NE Brazil.

In all there were 13 presentations including two keynote addresses on "Floral successions of Carboniferous-Permian Interval from Brazil and their comparison with India" by Prof. Roberto Iannuzzi, Coordinator of the Research Centre of Gondwana, Institute of Geosciences, Department of Palaeontology and Stratigraphy, Porto Alegre, and "Palaeofloristics of Permian sediments of Satpura Basin, India" by Prof. Subir Bera, Head, Department of Botany, Calcutta University, Kolkata. Additionally, a Special Lecture on Stromatolites from Brazil, by Dr. Narendra Srivastava of Natal, Brazil was also delivered. The Symposium provided an insight to the palaeobotanical studies being carried out in Brazil and India.

Field Workshop

A Field workshop was organized during November 25-29, 2010 in Eastern India to visit Sundaban Delta and plant fossil localities in Damodar Valley Basin. Five scientists from the Institute (N.C. Mehrotra, A.K.

Srivastava, Neerja Jha, Rajni Tewari and A.K. Ghosh) and five Brazilian delegates (Mary EC Bernardes de Oliveira, Judite Garcia, Roberto Iannuzzi, Narendra Srivastava and Isa Mendes) participated in the Field Workshop.

The Sundarban Delta Complex, having geo-genetic link to the tectonic Bengal Basin, geographically extends over the eastern India and Bangladesh. It is characterized by prolific growth of rich and diversified mangrove vegetation and forms an integral down drift coastal part of the Bengal Delta Complex that overlies huge thickness of Tertiary marine sediments of the actively subsiding Bengal Basin. The Sundarban Delta Complex and its surroundings have a dynamic physiographical and geomorphological evolutionary history. The region, being a part of the Bengal Basin, represents coalesced multi-generation deltas that have prograded in phases during the positive interglacial eustatic sea level changes occurred during the Plio-Pleistocene time towards the Bay of Bengal leaving behind distinctive multilevel delta surfaces, terraces, palaeochannels and palaeoshorelines and migrating the successive coastline towards southern sea. The Sundarbans represents the mangrove-vegetated Recent-Holocene down drift coastal part of the Bengal Delta Complex.

In the Damodar Valley Basin, Raniganj Coalfield in Asansol and Raniganj area is one of the most significant for the Permian coal reserves of India under Eastern Coalfields Limited. All the delegates visited two outcrops in the Open Cast Mines- Sonpur Bajari and Kanstroria, those belong to Seam No. R-VI (Kenda Seam) and Benbad Seam of the Raniganj Formation. Plant megafossils (*Glossopteris angustifolia*, *G. retusa*, *Schizoneura gondwanensis*, Equisetalean axes, scale leaves and *Vertebraria*) and palynological samples were collected by the visiting team as study material from these areas.



Training Programme- Late Cenozoic Dinoflagellate Cysts

A training programme on Late Cenozoic dinoflagellate cysts, with emphasis on Quaternary dinoflagellates was organized at the Institute during February 15-26, 2011. The training was imparted by Dr. Martin J. Head, Professor and Chair, Department of Earth Sciences, Brock University, St. Catharines, Canada. The programme began on 15th February with a general lecture to all the BSIP scientists, entitled 'Deciphering paleoceanographic changes in the North Atlantic during the Pliocene and Early Pleistocene using a new proxy combining dinoflagellate cysts and foraminiferal geochemistry'.



Though, dinoflagellate cysts are used regularly for palaeoclimatic and paleoceanographic reconstructions, our country lacks specialists in this field. Therefore, it was thought pertinent to train youngsters in this important and upcoming field of marine palaeoclimate research. The training programme provided an opportunity to 13 young scientists (Ratan Kar, S.K. Shah, P.S. Ranhotra, Pauline Sabina K., Anju Saxena, Vartika Singh and Anjali Trivedi) and Ph.D. students (Shilpa Singh, M.F. Quamar, Sandhya Sharma, Swati Dixit, Jyoti Srivastava and Suman Sarkar) to study the biology of dinoflagellates, the morphologic analysis of their cysts and their ecological and stratigraphic utility.

Formal lectures were held in the mornings, and afternoons were used both for practical exercises in cyst morphology and microscopic studies. Special emphasis was placed on precision in morphological observation, and the critical appraisal of paleoclimate reconstruction. All microscope slides shown to the participants were from the published studies, and handouts of the respective

publications were given to help the participants. The participants were also provided PDFs of all the lectures for their future reference. This was followed by a short field excursion to the coastal regions of Goa during February 20-23, 2011 in which two scientists (Ratan Kara and Vartika Singh) and two research scholars (Shilpa Singh and Swati Dixit) participated.

The visit to Goa included lectures at the National Centre for Antarctic and Ocean Research and at the National Institute of Oceanography by Prof. Martin J. Head. Fruitful discussions with scientists at NCAOR and NIO were also held for future collaboration on climate change research between BSIP, Brock University and the above national oceanographic institutions. Both short-term and long-term collaborative projects were discussed, with a number of cores being identified as ideal for dinoflagellate cyst analysis. The study of Quaternary dinoflagellate cysts is completely new to India, and BSIP, with its long history of palynological research is the rightful place to initiate such studies for further strengthening its capabilities in the area of paleoclimate research.

Distinguished Visitors

- | | |
|--|---|
| Shri B.L. Joshi, Hon'ble Governor of Uttar Pradesh, Lucknow | Prof. V.A. Krassilov, Institute of Evolution, University of Haifa, Haifa, Israel |
| Shri Pawan Kumar Bansal, Hon'ble Minister of Science & Technology, Govt. of India, New Delhi | Shri P.P. Srivastava, Member, North Eastern Council, Shillong, Meghalaya |
| Dr. T. Ramasami, Secretary, Department of Science & Technology, Govt. of India, New Delhi | Shri N.K. Verma, GM, Frontier Basins, ONGC, Dehradun |
| Dr. Harsh K. Gupta, Panikkar Professor, National Geophysical Research Institute, Hyderabad | Prof. Patricia Vickers-Rich, Monash University, Melbourne, Australia |
| Dr. O.N. Bhargava, Former Director, Geological Survey of India | Prof. Walter Mike Hall, Monash University, Melbourne, Australia |
| Shri I.J. Singh, Joint Secretary (Adm.), DST, Govt. of India, New Delhi | Dr. Stephen McLoughlin, Sr. Curator, Swedish Museum of Natural History, Stockholm, Sweden |
| Dr. G Harigopal, Advisor, DST, Govt. of India, New Delhi | Dr. K.P. Navneeth Kumaran, Scientist-F, Agharkar Research Institute, Pune, India |
| Dr. Suman K. Agrawal, Director (AI), DST, Govt. of India, New Delhi | Dr. Tapas Chakravarty, Botanical Survey of India, Howrah |
| Prof. Ram Sagar, Director, Aryabhatta Research Institute of Observational Sciences, Nainital | Dr. R.N. Kharwar, Associate Professor, Department of Botany, BHU, Varanasi |
| Dr. Sankar Chatterjee, Curator of Paleontology, Texas Tech University, Lubbock, Texas (USA) | Dr. C.M. Joy, Associate Professor, S.H. College Thevara, Kochi |
| Prof. Martin J. Head, Chair of Earth Sciences, Brock University, St. Catharines, Canada | Prof. Md. Muzammil, Lucknow University, Lucknow |



Research

Thrust areas and Projects

Thrust Area: EARLY LIFE, ATMOSPHERE AND OCEANS: EVIDENCES FROM INDIAN CRATON (Bio-Geosphere interactions in the Precambrian)

Precambrian Palaeobiology Group

Project 1.1: Palaeobiology of the Neoproterozoic Marwar Supergroup and the Bhander Group of Vindhyan Supergroup: biostratigraphical correlation

An assemblage of the trace-fossils has been collected from the siliciclastic sequence of Nagaur Formation of the Marwar Supergroup exposed in the Dulmera area of Bikaner, Rajasthan. The trace-fossils include (in order of abundance) *Cruziana*, *Rusophycus*, *Palaeophycus*, *Dimorphicnus*, *Monomorphicnus*, *Planolites*, *Bergaueria* and varied arthropod scratch marks. Detailed study shows that this assemblage is undoubtedly the Cambrian in age and more likely to be Cambrian Series 2 (younger than about 525-520 Ma) than Terreneuvian. The study provides definitive evidence of the Cambrian succession for hitherto suggestive Precambrian-Cambrian sequence in peninsular India. The Precambrian-Cambrian boundary, therefore, should lie in still older part of the sequence either in the Nagaur Formation or in Bilara Group. Fresh investigations of the siliciclastic sequence of the Sonia Sandstone of the Jodhpur Group have shown the presence of cluster of circular structures on the top surface of the bedding plane. Mode of preservation of fossil assemblage of Sonia Sandstone suggests that these remains are closer to plant affinity and likely to be algal balls. Well-preserved specimens of *Marsonia* from Sonia Sandstone exposed in Artiyan Kalan locality of Jodhpur, Rajasthan are of enigmatic nature. At present the fossil assemblage of Marwar Supergroup shows that entire sequence range from Ediacara-Early Cambrian in age. Lithostratigraphic and biostratigraphic correlations of the Marwar

Supergroup of Rajasthan, the Salt range of Pakistan and the Haqf Group of Oman suggest about an existence of a larger super-basin incorporating these three sedimentary sequences.

On maceration, black shales occurring as lenticular pockets in the Sirbu Shale of Bhander Group, exposed in Maihar area, have yielded a rich assemblage of acritarchs. Abundance of smooth walled acritarchs suggests their Mesoproterozoic-Neoproterozoic age affinity. Absence of any traces of distinct Ediacaran biotic elements in the Bhander Group sediments negates the possibility of any correlation and continuity between the Vindhyan and Marwar Supergroups sediments. Studies indicate that the Marwar Supergroup, once known as Trans-Aravalli Vindhyan, is now well established as a distinct lithostratigraphic as well as biostratigraphic unit.

Extensive collection of trace fossils have been made during the field work in the Marwar Supergroup successions exposed in Rajasthan. Samples from Bilara Group have been collected for microfossils studies in thin section and maceration studies. Another field-visit was undertaken with Mr. Udai Bhan of University of Petroleum & Energy Studies, Dehradun for collection of samples for his Ph.D. problem. Systematic samples were collected from Upper Vindhyan sections exposed in Maihar area in Satna District of Madhya Pradesh, central India.

Mukund Sharma

Project 1.2: Tracing the palaeobiological entities from the eastern part of Chhattisgarh Basin with geologic implications

Studied biotic communities from the samples belonging to Singhora and Raipur groups of Chhattisgarh Supergroup collected from the outcrops exposed in Mahasamund and Raigarh districts. Structurally, three/two dimensional, cellularly preserved microbiota

comprising prokaryotes and eukaryotes have been observed in petrographic thin sections of bedded black silicified chert nodules, lenses occurred at different levels of limestone/dolomite series of Saradih Dolomite (= Chandi Formation) of Raipur Group exposed in and around Saradih

Village situated on the left bank of Mahanadi River of Raigarh district. The assemblage represents well-preserved population of cyanobacterial remains along with low amount of sphaeromorphic and acanthomorphic acritarchs. The cyanobacterial remains represent solitary and colonies of sphaeroidal cells and unbranched trichomes both septate/aseptate with/without mucilaginous sheath resembles with the extant forms belonging to Cyanophyta. The recovered acritarchs are sphaeromorphs (simple and ornamented in nature) followed by very few acanthomorphs (spinated) belonging to Sphaeromorphida and Sphaerohystrichomorphida subgroups.

Recorded and studied morphologically distinct type of varied shaped epilithic megascopic tapic carbonaceous film preserved on the shale samples collected from the Saraipali Formation of Singhora Group exposed in Pahari Nala section near Pardhyapali village of Sarangarh area in Raigarh, and Chhuipali Formation of Singhora Group

exposed near Baghdwari village south east of Saraipali township in Mahasamund districts. The assemblage indicates a fairly well-preserved biotic realm of multicellular tissue forming thalli, bilateral symmetry and erect growth are the main characteristic features. The morphologies are akin to Phaeophyta, Chlorophyta and Rhodophyta groups of algae. The morphological characteristics of the fossils can be compared with known carbonaceous films of eukaryotic remains known from the Knob Lake Group, Canada; Michigane and the Negaunee Iron Formation, Michigan USA; and the Changcheng Group, China.

The studies of recorded biotic communities from both the formations of Singhora Group shows an evolutionary trend ranges from Latest Orosirian to Calymmian and the Saradih Dolomite Formation of Raipur Group ranges Cryogenian age in ascending order and two types of environmental setting for these deposits.

Rupendra Babu & V.K. Singh

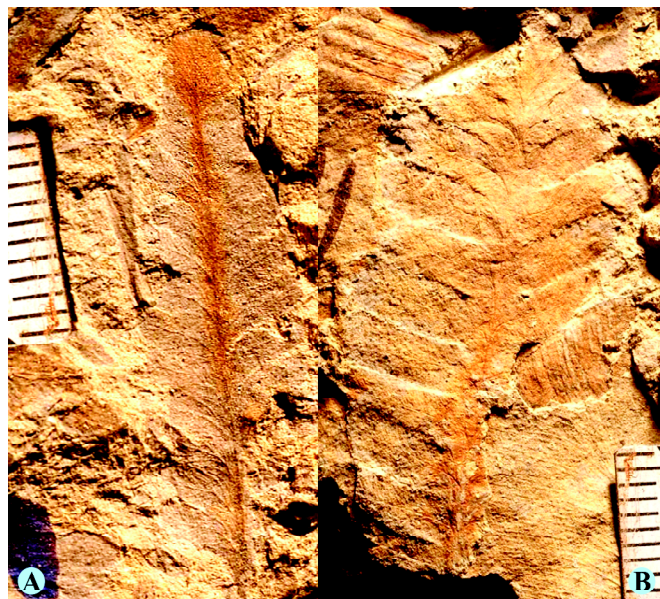
Thrust Area:

FOSSIL LAND PLANT COMMUNITIES: MORPHO-STRUCTURE, EVOLUTION, SYSTEMATICS WITH APPLICATIONS TO BIOSTRATIGRAPHY AND PALAEOECOLOGY (Plant evolution, anatomy, taxonomy and stratigraphy)

Gondwana-Mesozoic Palaeofloristics Group

Project 2.1: Palaeobotanical investigation of Satpura Gondwana Basin to analyze the floristic succession, evolutionary perspective, biostratigraphy and palaeoenvironment.

The plant fossils from coal-bearing Barakar Formation of Pench Valley, Kanhan Valley, Pathakhara and Mohpani coalfields, and non-coaliferous beds of Bijori Formation have been collected from 34 opencast, underground mines, road and river cutting sections. Systematic description, identification and comparison of the flora with the well known assemblages of different formations and areas of Lower Gondwana are examined and compiled in the form of Ph. D. thesis. The fossils of Barakar Formation are represented by 80 species belonging to 25 genera, viz. *Cyclodendron* (1 sp), *Phyllothea* (1 sp), *Lelstotheca* (1 sp), *Botrychiopsis* (1 sp), *Neomariopteris* (1 sp), *Euryphyllum* (1 s.), *Gangamopteris* (17 spp), *Glossopteris* (22 spp), *Rhabdotaenia* (2 spp), *Arberia* (1 sp), *Ottokaria* (2 spp), *Arberiella* (1 sp), *Pantolepis* (1 sp), *Penchiolepis* (2 spp), *Surangelepis* (2 spp), *Utkaliolepis* (1 sp), *Cheirophyllum* (1 sp), *Cordaitea* (1 sp), *Noeggerathiopsis* (3 sp), *Buriadia* (1 sp), *Alatocarpus* (1 sp), *Carpolithus* (2 spp), *Cordaicarpus* (5 spp),



Neomariopteris sp. (A) and *Santhalea bansoloiensis* (B) from the Bijori formation exposed near Tamia village, Chindwara district, Madhya Pradesh

Samaropsis (7 spp), *Vertebraria* (1 sp), and number of equisetalean and simple axes. The plant fossil assemblages of the coalfields show their comparison with the flora of Karharbari Formation of Giridih, Auranga, Deogarh, Daltonganj and South Rewa Gondwana Basin in having the association of *Gangamopteris*, *Glossopteris*, *Noeggerathiopsis*, *Buriadia*, and characteristic presence of *Botrychiopsis* along with *Arberia* and *Ottokaria*-type glossopterid fructification. The assemblages are also related with the flora of Lower Barakar Formation of Raniganj, South Karanpura, Palasthali and Ib-River coalfields. The study suggests that in all likeness flora of Karharbari Formation continued to exist in lower part of Barakar Formation. Thus, present palaeobotanical investigation indicates the possibility of Karharbari equivalent bed in the Lower Barakar sequence and there is need to recognize the physical presence of Karharbari Formation in Lower Gondwana coalfields of India.

The flora of Bijori Formation is dominated by glossopterid remains and limited presence of pteridophytes, e.g. *Santhalea bansloiensis*, *Neomariopteris* sp., *Trizygia speciosa* and 20 species of *Glossopteris*, viz. *Glossopteris angustifolia*, *G. leptoneura*, *G. tenuifolia*, *G. surangei*, *G. kamthiensis*, *G. utkalensis*, *G. intermedia*, *G. longicaulis*, *G. stricta*, *G. bosei*, *G. intermittens*, *G. stenoneura*, *G. gopadensis*, *G. taeniopteroides*, *G. retifera*, *G. conspicua*, *G. tortuosa*, *G. browniana*, *G. communis*, *G. indica*, *Vertebraria indica*, dispersed seeds of *Cordaicarpus*-type and equisetalean axes with or without nodes and internodes. The assemblages of Bijori Formation are comparable with the plant fossils of non-coaliferous horizons of Kamthi and Pachwara formations of Late Permian, and present investigation indicates that there was a change in the *Glossopteris* flora after the coaliferous phase of Raniganj Formation during upper part of Permian.

A.K. Srivastava (superannuated w.e.f. 31.01.2011) & Deepa Agnihotri

Sedimentological features in relation with the plant fossil preservation are examined in the coal-bearing sequence of Mohpani Coalfield. The preservation of fossils with finer details of venation pattern indicates the slow rate of deposition, however fragmentary and worn

out fossil remains indicate occasional turbulence during fossilization.

A.K. Srivastava (superannuated w.e.f. 31.01.2011) & Anju Saxena

Plant fossil assemblage from Mohpani Coalfield has been studied in detail pertaining to morphotaxonomy and depositional environment. The plant fossil assemblage is represented by 4 species of *Gangamopteris*, viz. *G. angustifolia*, *G. cyclopteroides*, *G. karharbarensis* and *G. major*; 3 species of *Glossopteris* namely *G. communis*, *G. indica* and *G. stenoneura*; and *Cordaicarpus zeilleri*. The study indicates the dominance of *Gangamopteris*-leaves in comparison to *Glossopteris* and presence of seeds; as such flora is comparable with the Lower Barakar flora, however absence of *Noeggerathiopsis* leaves make it distinct. It has been discussed that the flora of Mohpani is comparable with the plant fossils of lower Barakar Formation.

A.K. Srivastava (superannuated w.e.f. 31.01.2011), Anju Saxena & Deepa Agnihotri

Cordaitalean leaves represented by the species of *Noeggerathiopsis*, *Cordaites* and *Cheirophyllum* recovered from the mines of Rawanwara area of Pench valley Coalfield have been investigated in detail. The study indicates that the leaves of *Cheirophyllum* in having spatulate-obtuse shape and parallel running dichotomizing thick and thin veins compare with the leaves of *Cordaites*, but differ in possessing furcated or lacerate apical margin and presence of median groove. *Cordaites*-leaves discovered in the flora are found to be different from earlier leaves known from the Lower Gondwana beds of India in their large size and thick/stout parallel veins. *Noeggerathiopsis*-leaves are typical in having parallel running dichotomizing veins, but they have been categorized under 3 morphotypes, due to the varied thickness of veins in different parts of leaves. The morphological features of seeds recovered from the flora indicate the presence of apical horn comparable with the dispersed seed of *Cornucarpus* Surange & Lele. A new species *Samaropsis penchii* is instituted for large sized, pear shaped seed having distinct pedicel. The work has been compiled in the form of a Ph.D. Thesis.

A.K. Srivastava (superannuated w.e.f. 31.01.2011) & S.S.K. Pillai

Project 2.3: Morphotaxonomy, floristics, biostratigraphy and palaeoecological studies in Hasdev and Chirimiri areas (Son-Mahanadi Basin)

Seventy-five megafossil specimens from the Rajnagar and Kurasia collieries of Hasdev and Chirimiri areas, Korea district, Chhattisgarh are cleared, identified and studied. Twenty of them are photographed. The identified taxa include *Gangamopteris cyclopteroides*, *Gangamopteris* sp, *Noeggerathiopsis hislopai*,

Euryphyllum sp. *Ottokaria* sp. *Alatocarpus indicus*, equisetalean stems, stem twigs, and six species of *Glossopteris*, viz. *G. spatulata*, *G. barakarensis*, *G. arberi*, *G. browniana*, *G. communis* and *G. indica*.

K.J. Singh

Project 2.4: Palaeofloral diversity, biostratigraphy and palaeoecological study during Mesozoic in South Rewa Basin, Madhya Pradesh

The morphotaxonomic study of plant fossils collected from Chandia, Patparha, Barambaba areas has been undertaken to document and analyze the plant fossil assemblage. The blackish grey shale embodies well-preserved and diversified megafloral assemblage comprises number of species of conifers, e.g. *Elatocladus*, *Brachyphyllum*, *Pagiophyllum*, *Araucarites*, *Podozamites*, and pteridophytes- *Todites*, *Weichselia*, *Gleichenia* and *Phlebopteris*. Branched or unbranched twigs of *Gleichenia* are commonly found in the sedimentary deposits. The flora as such is dominated by conifers and pteridophytes, whereas cycads are so far not been reported. While comparing and correlating with various Early Cretaceous palaeofloral assemblages of India this has been observed that it is coeval with the

flora of Dhrangadra and Himmatnagar formations where too flora is dominated by conifers and pteridophytes. The present flora also resembles to some extent with Gangapur floral assemblage of Andhra Pradesh. However, the broad-leaved bennettitalean remains are prevalent in quite good number in Gangapur Formation.

The recovered palaeofloral assemblage shows close affinity with floristic assemblage zone-10 Sukh-Dev (1987), which is characterized by occurrence of *Weichselia*, *Onychiopsis*, proliferation of *Gleichenia*, *Araucaria*, *Allocladus*, *Brachyphyllum* and *Pagiophyllum* and lack of cycadophytes and pteridosperms.

Neeru Prakash

Project 2.5: Palaeofloristical analysis of Mesozoic sedimentary succession of western India

Compiled the megafloral assemblage, consisting of fossil algal mats, *Thallites*, *Coniopteris*, *Onychiopsis*,

Brachyphyllum, etc., recovered from the *Isoetites*-rich locality near Than (Gujarat).

B.N. Jana (superannuated w.e.f. 30.06.2009)

Project 2.6: Integrated Palaeobiology of East Coast Cretaceous

Recovery of angiosperm floral elements and associated floral components helped to note new insights in plant evolution during Cretaceous times in the Indian sub-continent. New finds of living fossil *Ginkgo* leaves suggests growth of deciduous trees near the deposition basin. Inferred palaeoenvironment of deposition based on evidences collected and other related markers.

Detailed out floristic variations in Cretaceous Flora of Krishna Godavari Basin. New wood data from the Raghavapuram Formation is significant to understand Cretaceous floral evolution. Also undertook field work in Krishna-Godavari Basin and collected fossil specimens and sediment samples.

A. Rajanikanth



Living Fossil *Ginkgo biloba* leaves from the Raghavapuram Formation, Krishna Godavari Basin



Project 2.7: Investigation of carbonified/ fusainised plant mesofossils recovered through bulk maceration of Late Triassic and Tertiary sediments of India and comparative studies on selected modern taxa

Cuticle isolated from plant compressions on hand specimens collected from the Nidhpuri plant-bearing bed

has been described and compiled.

Usha Bajpai (superannuated w.e.f. 31.05.2010)

Gondwana Palynology Group

Project 3.1: Palynostratigraphy and evolution of palynoflora through the Palaeozoic and Mesozoic sequence in Rajmahal Basin

Compiled the palynological data generated from coal-bearing horizon encountered in 10 bore-holes of the Rajmahal Basin. The study evidenced definite Late

Permian age for part of coal-bearing strata in the basin, along with the coal seams of Early Permian Barakar Formation.

Archana Tripathi (superannuated w.e.f. 31.07.2009)

Project 3.2: Palynostratigraphy of Late Palaeozoic and Mesozoic sequence in Singrauli and Tatapani-Ramkola coalfields and adjacent areas in Madhya Pradesh

The relative changes observed in the palyno-compositions from the Singrauli Coalfield have led to the recognition of 10 palynozones; representing from the earliest Permian in the Talchir Formation to that latest Late Triassic in the Parsora Formation. This palynological data is obtained from the wider parts in the Singrauli Gondwana Basin that includes– Moher sub-basin (bore-holes SSM-1 & 2), Main sub-basin (bore-holes SMJS-2, 3 & SMBS-1). The progressively changing palyno-compositions in the transgressing lithofacies support the deposition of lithosequences with the hiatuses of varied magnitude in this extended Permian and Triassic time interval.

**Vijaya & Archana Tripathi
(superannuated w.e.f. 31.07.2009)**

The palynostratigraphic data obtained from Tatapani-Ramkola Coalfield are based from the explored borecores (TRBD-2, TRBD-3 and TROD-1). The Permian strata worked out is about 1174.00 m thick and comprises from base to top Talchir, Barakar and Barren Measures formations. The palynological content enables delimitation of 5 palynological assemblages— i)

Scheuringipollenites barakarensis, ii) *Faunipollenites varius*, iii) *Gondisporites raniganjensis*, iv) *Densipollenites magnicarpus*, and v) *Krempipollenites indicus* in ascending order from the subsurface rock strata. The lithologically identified strata Talchir Formation in bore-cores TRBD-2 and TRBD-3 is palynologically dated as late Early Permian in having the *Scheuringipollenites barakarensis* and the *Faunipollenites varius* palynozones. Subsequently, the part of Barakar strata in these bore-cores corroborates with Barakar Formation. In bore-core TRBD-3, the Barren Measures rocks do not match with the palynological dates, and are affiliated with the palynoflora in the Ranjganj Formation. In TROD-1, the strata identified as Barakar Formation is dated as Late Permian in having *Gondisporites raniganjensis* palynozones, while that of Barren Measures Formation is palynologically dated as Early Triassic. Thus, the palynology has helped in the precise dating of the Lower Gondwana succession of Odari and Bartikhurd blocks in this coalfield.

**Vijaya, Archana Tripathi
(superannuated w.e.f. 31.07.2009) & Srikanta Murthy**

Project 3.3: Palynostratigraphy and palaeoclimatic studies on Gondwana sediments of Sohagpur and Mand Raigarh coalfields

Quantitative analysis of ~1300 m thick strata of bore-hole SNB-1 has revealed the dominance of non-striate disaccate pollen *Falcisporites*, *Klausipollenites*,

Nidipollenites and *Satsangisaccites* followed by cavate, cingulate and zonate forms. On the basis of marker palynotaxa 2 assemblages have been identified—

Satsangisaccites tharipatharensis and *Rimaesporites potonieii* zone, showing Middle to Late Triassic age of the strata. A large number of spore tetrads have also been recorded between 909.00-1075.15 m depth in this bore-hole, suggesting a warm humid climate during Triassic Period in the basin. Besides, well-preserved dinoflagellates cysts have been recorded in sample SNB-1/61 at 787.50 m depth, showing existence of marine transgression in this western part of the South Rewa Basin. Palynological analysis of bore-hole JNN-1 (Parsora Formation) has revealed dominance of non-striate bisaccate pollen in association with cavate, cingulated and zonate spores. Two palynozones have been identified within the Parsora Formation- (*Enzonasporites ignacii*- *Minutosaccus crenulatus* and *Rimaesporites potonieii*- *Samaropollenites speciosus* zones) suggesting Late Triassic age of the formation. In addition, undertook field work for the collection of outcrop samples from Sohagpur (MP) and Mand-Raigarh (Chhattisgarh) coalfields for palynological studies.

Palynological analysis of the Mesozoic sediments exposed along the tributaries of Mahanadi River around the Jhala village has yielded *Klausipollenites schaubergeri*, *Falcisporites minutosaccus*, *Densoisporites mesozoicus*, *Alisporites landianus*, *Striatopodocarpites decorus* and *Satsangisaccites triassicus* in the basal part of strata. Besides, occurrence of *Podocarpidites grandis*, *Callilasporites microvelatus*, *C. turbatus*, *C. barragaonensis*, *C. jaisalmeriensis*, *C. segmentatus*, *C. dampieri*, *C. triletus*, *C. monoalaspurus*, *C. microvelatus*, *C. lenticularis*, *Classopollis minor*, *Callialasporites. Dampieri*, *C. turbatus* *Araucaricites ghunarensis*, *Microcachrydites antarcticus*, *Podosporites rarus*, *Alisporites grandis* and *Murospora florida* in the younger strata an Early to Late Jurassic age has been assigned to the assemblage. This is the first record of non-marine Jurassic sequence in India, so far not recorded from South Rewa Basin.

RamAwatar

Project 3.4: Morphotaxonomy, floristics evolution, biostratigraphy and palaeoenvironmental studies of Ib-River Coalfield (Orissa)

Recovered two palynoassemblages from surface samples collected from Naupura and Banjari nala sections from Lilahari Nala section (Kuraloi block-A). The Palynoassemblage-I is at 496 to 301 m recorded from bore-hole IBK-A2 with the dominance of *Faunipollenites* and subdominance of *Scheuringipollenites* along with the presence of *Striapollenites*, *Verticipollenites*, *Rhizomaspora*, *Cyclogranisporites*, *Ibisporites*, *Cyclobaculispora*, *Ephedripites*, etc. Hence the assemblage shows the affinities with upper Barakar Palynoflora indicating late early Permian age. The palynoassemblage-II recovered from surface samples (Banjari village) has the dominance of *Striatopodocarpites* and subdominance of *Faunipollites* in the presence of *Diastrates*, *Distrimonosaccites*, *Cyclogranisporites*, *Microbaculispora*, *Parasaccites*, *Ephedripites*, *Inaperturopollenites*, *Callumspora*, *Densipollenites magnicarpus*, *Rhizomophora*,

Verticipollenites, *Navelesporites*, *Striatites*, *Striamonosaccites*, *Diastrimonosaccites*, *Leiotrilete*, *Lophotriletes*, etc. The appearance of *Arcuatipollenites*, *Densoisporites*, *Lundbladispore*, etc. in the presence of *D. magnicarpus* shows the younger affinities to late Permian equal to upper Raniganj palynoflora indicating late Permian age. Similar palynoassemblage has also been recovered from the bore-hole IBSK-I, OIOC-74, and Chaturdharanala section.

The studies on collected samples from bore-holes IBKN-5 and IBKN-6 are continued. The recovered flora shows the affinity with upper Barakar age and Late Permian age. Besides, the Raniganj sediments may be overlain by Middle to Late Triassic sediments. Additionally, visited Ib-Himgir Basin Coalfield, District Jharsuguda and Sundargarh and collected sub-surface and surface samples for the palynological work.

K.L. Meena

Project 3.5: Palynostratigraphy and patterns of evolution in palynoflora in Damodar Basin

Palynological assemblage zones recovered from the Permian and Mesozoic succession encountered in two bore-holes BRM-2 and BGG-3 of Birbhum Coalfield have been discussed herein for their age. Four palynoassemblage zones are identified in the Barakar

Formation (271.45-527.50 m; BRM-2) of the Late Permian age. Dubrajpur Formation (315.00-334.90 m; BGG-3 and 237.75-271.45 m; BRM-2) has yielded *Contignisporites cooksoniae* and *Cicatricosisporites australiensis* palynozones, which are suggestive of Middle

Jurassic and earliest Cretaceous (Berriasian) age. The overlying Infratrappean (214.90-237.75 m) and the Intertrappean (154.50-156.90 m) sediments of the Rajmahal Formation in bore-hole BRM-2 contain *Foraminisporis wonthaggiensis* palynozone that dates Valanginian to Hautervian in age, while in bore-hole BGG-3, between 174.60-242.60 m, has proved devoid of spore-pollen.

Vijaya & Srikanta Murthy

Palynological study, done in approx. 400.06 m thick strata, has revealed that in general the palynomorphs are associated with lumps of organic matter and plant tissues. Fair occurrences of striate and non-striate bisaccate pollen are observed within 13.40-419.00 m depth. Relative abundance of *Striatopodocarpites-Densipollenites* within 13.40- 96.30 m depth, equates these strata with

the Raniganj Formation of latest Late Permian. Underlying to this, at 166.60-287.90 m depth, fair presence of *Densipollenites* along with *Striatopodocarpites* correlates these strata with the Barren Measures Formation of early Late Permian age. The oldest part (332.60-419.00 m) in the sequence has yielded an abundance of the striate (*Faunipollenites*) and nonstriate bisaccate (*Scheuringipollenites*) pollen taxa, that infers to the Barakar Formation of late Early Permian. The FAD's of *Arcuatipollenites pellucidus*, *A. ovatus*, *Lundbladispora microconata* and *Kamthisaccites* sp. in between 13.40-92.00 m depth enhance the end Permian level. Occurrences of diversified plant debris at the interval depths are suggestive of wet and dry conditions during the sedimentation. Also visited East Bokaro Coalfield and collected rock samples for palynological study.

Srikanta Murthy

Cenozoic Palaeofloristics Group

Project 4.1: Tertiary floristics of Rajasthan and Gujarat

A number of petrified woods and fossil leaves collected from various Cenozoic localities of Rajasthan and Gujarat have been identified. Two fossil woods from Deccan Intertrappean sediments of Gujarat are found their close resemblance with the modern genera *Polyalthia* and *Duabanga* belonging to the families Annonaceae and Sonneratiaceae, respectively. Apart from this, some more fossil woods from Tertiaries of districts Kuchchh, Bharuch, Rajpardi and Bhavnagar are also identified as *Shorea*, *Hopea*, *Amoora*, *Chisocheton*, *Gluta*, *Afzelia-Intsia*, *Millettia-Pongamia*, *Terminalia* and *Ficus*, etc. representing families, viz. Dipterocarpaceae, Meliaceae, Anacardiaceae, Leguminosae, Combretaceae and Moraceae. Besides fossil woods, some fossil leaves of *Semecarpus*, *Artocarpus*, etc. have also been identified.

In addition, an interesting fruit wing of genus *Shorea* from Miocene sediments of district Kachchh is also identified.

Similarly, some fossil woods and leaves from districts Jaisalmer, Bikaner and Barmer of Rajasthan are also identified. Fossil woods belonging to following genera: *Araucaria*, *Podocarpus*, *Diospyros*, *Dipterocarpus*, *Sterculia*, *Eantandrophragma*, *Brachystegia*, *Erythrophloeum*, *Millettia*, *Terminalia* are identified. Besides these woods, some fossil leaves belonging to the genus *Kleinhovia*, *Glochidion*, *Artocarpus* are identified. Based on the work, a Ph.D. Thesis entitled 'Cenozoic Flora of North-Western Peninsular India' has been documented.

J.S. Guleria (superannuated w.e.f. 30.06.2010) &
Anumeha Shukla

Project 4.2: Floristics (Megafossil) of Deccan Intertrappean beds of India

Anatomical details of well-preserved dicotyledonous woods resembling extant genera, viz. *Dracontomelon* Bl. (syn. *Dracontomelum* Bl.) of the family Anacardiaceae, *Elaeocarpus* Linn. of the Elaeocarpaceae, *Euphoria* Comm. ex Juss. - *Otonephalium* Radlak of the Sapindaceae have been described from the Deccan Intertrappean sediments of Ghansor, Seoni district (MP). The assemblage indicates

occurrence of thick tropical vegetation at the time of deposition. The genera are presently found in natural association and are distributed in tropical wet-evergreen forests of Western Ghats, Tamil Nadu, Sri Lanka, Assam, Sikkim, Bangla Desh and Myanmar etc. Their presence signifies that the climate was tropical with plenty of rainfall during the period of deposition.

Rashmi Srivastava

Project 4.3: Cenozoic floral changes in northeast India vis-à-vis movement of the Indian Plate

Finalized a manuscript based on about 35 fossil wood pieces which have been collected from the Tipam Sandstone Formation of North Lakhimpur and Dhimaji districts of Assam. The assemblage indicates a warm and humid climate in the region during the deposition of the sediments. The occurrence of some Southeast Asian elements in the fossil flora indicates that an exchange of floral elements took place between India and Southeast

Asia during the Miocene. Another manuscript based on leaf and fruit impressions from the Laisong Formation of Manipur (Eocene –Late Oligocene) is also finalized. In addition, a number of leaves and a few fruits are collected from the Upper Palaeocene sediments of Cherrapunji, Meghalaya and Middle-Late Miocene sediments of Subankhata, Assam.

R.C. Mehrotra

Project 4.4: Tertiary floristics of South India

Compiled data on plant megafossils (carbonized woods, petrified woods, leaves, fruits, seeds) recovered from Neyveli (Tamil Nadu), Ratnagiri (Maharashtra),

Bahur Basin (Pondicherry), and Cochin, Cannanore, Payangadi and Warkala (Kerala).

Anil Agarwal (superannuated w.e.f. 31.07.2009)

Project 4.5: Study on Tertiary plant megafossils of north-west Himalaya

Fossil leaf impression having resemblance with *Ficus* is recorded for the first time from the Early Miocene sediments of Kasauli-Kalka road section, Himachal Pradesh. Characteristic venation pattern of the leaf suggests its close affinity with *Ficus racemosa* L. (= *F. glomerata* Roxb.). The presence of *Ficus* in the area indicates a warm and humid climate in the region during the deposition of the sediments in contrast to the present day cooler and less humid climate. The paper is finalized (with Gaurav Srivastava & R.C. Mehrotra).

J.S. Guleria (superannuated w.e.f. 30.06.2010) &
Rashmi Srivastava

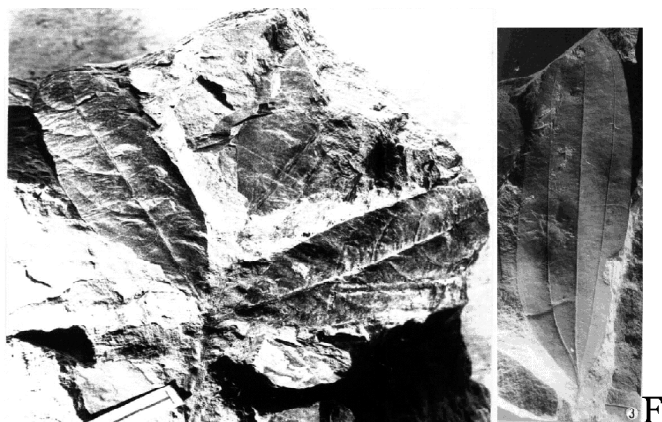


a. Fossil leaf *Ficus palaeoracemosa* b. Extant *Ficus racemosa*

Project 4.6: Sub-Himalayan floral diversity and its palaeoclimatic and stratigraphic implications

Morphotaxonomical study on the plant fossils (leaf and fruit impressions) collected from Lower Siwalik sediments of Tanakpur area, Uttarakhand revealed the occurrence of 57 species of 25 angiospermous families. Of these, 39 species have been recorded new to the fossil

flora of Himalayan foot hills. The family Fabaceae (Legume family) represented by 15 species is the most dominant family in this Siwalik fossil assemblage followed by Anonaceae (8 species), Sapindaceae (5 species).



Fossil leaves A. *Sapindus trifolius* (Sapindaceae), B. *Cinamomum tamala* (Lauraceae); typical evergreen taxa from Siwalik of Tanakpur area, Uttarakhand

Lauraceae and Euphorbiaceae (4 species) and Dipterocarpaceae and Rutaceae (3 species). The family Fabaceae which appeared in Upper Palaeocene became a major component of the evergreen forest during Mio-Pliocene times all along the Himalayan foot hills. The evergreen elements (54%) dominate the fossil flora of Siwalik in Tanakpur area during Mio-Pliocene in contrast to mixed deciduous elements at present; indicating the prevalence of tropical warm humid climate with plenty of rain fall during the deposition of Siwalik sediments. The analysis of present day distribution of all the species recovered from the Sub Himalayan zone of Tanakpur area shows that they are mostly known to occur in North-east India, Bangladesh, Myanmar and Malaysia wherever favourable climatic conditions exist. Only about 14% taxa of the total assemblage are found to grow presently in the Himalayan foot hills and the remaining 86% taxa are locally extinct, suggesting changes in the climatic condition. Foliar physiognomy method (study of the structural features of leaf-impressions) suggests that the

Tanakpur area in the Himalayan foot hills of Uttarakhand enjoyed a tropical climate (with MAT 30.6°C and MAP 397 mm) along with plenty of rainfall during the Mio-Pliocene times.

Five phytogeographically important taxa, viz. *Artabotrys zeylanicus* Hook. f. (Anonaceae), *Fissistigma wallichii* Hook. f. & Th. (Anonaceae), *Dipterocarpus turbinatus* Gaertn. (Dipterocarpaceae), *Caesalpinia microphylla* Ham. (Fabaceae) and *Lagerstroemia flos-reginae* (Lythraceae) have been reported from Lower Siwalik sediments of Nahan area. Of these, *Artabotrys zeylanicus* Hook. f. reported for the first time from the Siwalik sediments. The present habit and habitat of the recorded taxa show that they occur in tropical evergreen and moist deciduous forests of North east India and South India which receive higher rainfall. None of them found in the Nahan areas or even whole Himalayan foot hills of Himachal Pradesh. Thus, it may therefore, surmised that changes in climate must there have taken place after Middle Miocene. The Plant fossils evidences also indicate an evergreen to moist deciduous vegetation in this area during Middle Miocene times in contrast to dry deciduous vegetation there at present.

Undertook a field excursion to the Siwalik of Oodlabari and near by area in Darjeeling district (WB) and collected a large number of plant fossils (petrified and Carbonised woods, leaf and fruit impressions) and some palynological samples for investigation. Besides, consulted Central National Herbarium, Howrah and identified above 25 leaf impressions and two fruits. The photographs of leaf and fruit specimens of about 15 species of the genus *Isoptera*, *Doona*, and *Vateria* of the family Dipterocarpaceae have been taken in order to differentiate them on the basis of morphological and cuticular features.

Mahesh Prasad

Late Mesozoic-Cenozoic Palynology Group

Project 5.1: Palynological investigation of Tertiary sediments of Kutch Basin: biostratigraphic and palaeoenvironmental applications

The study of the fossil Acariens recovered along with palynofloral studies of the samples collected from Intertrappean bed and gypseous shale member of Naredi formation exposed near Naredi village has been completed and finalized as 'First record of mites (Acarina) from the Palaeogene sediments of Kutch, western India, with comments on palaeoenvironment: support from palynological evidence'. The palynological studies of the samples collected from exposures of Naredi formation at

Madhwali Nadi near Matanomadh Temple have also been completed. The presence of dinoflagellate cysts in good amount along with few terrestrial floral in a sample at the base of the section indicates warm inner shelf depositional conditions followed by abrupt disappearance of dinoflagellate cysts with terrestrial floral assemblage in younger samples, but indicating warm tropical conditions.

R.K. Saxena & P.S. Ranhotra

Project 5.2: Palynological investigation, facies analysis and palaeoenvironmental interpretations of Palaeocene-Eocene sediments in Rajasthan Basin

Morphotaxonomic studies on palynofossils from Marh Formation, Nagaur district are continued. The studied sequence is constituted by carbonaceous shale, siltstone and lignite. Shale and lignite samples yielded a rich palynological assemblage which is dominated by angiosperm pollen. Significant palynotaxa in the assemblage are ascribed to *Lygodiumsporites* spp., *Tiodisporites* spp., *Lycopodiumsporites* spp., *Dandotiaspora* spp., *Arecipites* spp., *Palmidites* spp., *Longapertites retipilatus*, *Proxapertites* spp., *Matanomadhiasulcites* spp., *Pseudonyssapollenites kutchensis*, *Dermatobrevicolporites* spp., *Sastrapollenites trilobatus*, *Ratariacolporites plicatus*, and *Meliapollis* spp. Considering the stratigraphical record of palynofossils in Indian Palaeogene strata, the investigated Nagaur sequence is dated as early Eocene.

Palynological studies from subsurface Akli Formation, Barakha village, Barmer district have been

completed. The palynofossils were studied for taxonomic allocations and environmental interpretations. The recovered palyno-assemblage is dominated by fungal remains. Abundance of broken hyphae and fungal spores particularly, those having affinity with the family Xylariaceae (*Hypoxylonites* and *Spirotremesporites*) are the characteristic features of the assemblage. Abundance and diversity of spores of this family is indicative of tropical, much warmer and humid climatic conditions. Most of the members of the family Xylariaceae grow on rotten wood or are parasites on some angiosperms. Dominance and diversity of these spores in the assemblage along with other fungal remains suggest prevalence of tropical, warm and humid climatic conditions during deposition of Akli sequence. Sedimentological and palynological studies indicate that sediments of the Akli Formation were deposited under brackish water conditions.

S.K.M. Tripathi & Hukam Singh

Project 5.3: High resolution biostratigraphy of Cretaceous-Tertiary sedimentary sections of Cauvery Basin

Detailed morphotaxonomic studies on palynofossils recovered from Grey Shale, Dalmiapuram Formation (Kallakudi Mine-II, Tamil Nadu) have been done. The assemblage is dominated by dinoflagellate cysts (15 genera and 23 species), pteridophytic spores (17 genera and 20 species) and gymnospermous pollen grains (3 genera and 3 species). Angiospermous pollen belonging to *Neocouperipollis* and *Acanthotricolpites* (Arecaceae) have been recorded for the first time from this grey shale. Occurrence of marker dinoflagellate cysts *Florentina resex*, *Odontochitina costata*, *Ovoidinium* spp. with good representation of *Cyclonephelium*, *Spiniferites*,

Oligosphaeridium, *Hexagonifera* and *Callaisphaeridium*, a Late Albian age has been assigned to the grey shale. The view is corroborated by the presence of *Callialasporites*, *Appendicisporites* and *Podocarpidites*. The abundance of dinoflagellate cysts with less frequency of pteridophytic spores and a good representation of gymnospermous pollen is suggestive of more open, shallow marine environment of deposition. In addition, documentation of palynological assemblages from Kallamedu and other areas of Ariyalur is continued.

M.R. Rao

Project 5.4: Palynological studies of the Late Cretaceous-Early Palaeocene sediments of Central India and the Khasi Hills of Meghalaya, India

Deccan Intertrappean beds exposed around Padwar, Jhilimili and Mohgaoankalan of MP and Anjar in Gujarat have been chemically processed. The palynological assemblages recovered include marker palynotaxa *Mulleripollis bolpurensis* Bakshi & Deb, *Ariadnaesporites intermedius* Hall, *Triporoletes reticulatus* (Pocock) Playford, *Gabonisporites vigourouxii* Boltenhagen, *Azolla cretacea* Stanley, and *Aquillapollenites bengalensis* Bakshi & Deb, indicating a Maastrichtian age for these intertrappean beds. However, samples from the upper parts of the sections

from the Anjar area are marked by the presence of *Proxapertites* van der Hammen, *Kielmeyerapollis* Sah & Kar, *Matanomadhiasulcites* Kar, and few pollen genus assigned to the advanced angiosperms. This indicates that the deposition continued in the Upper most part of the Maastrichtian.

Samples of Late Cretaceous from Khasi Hills, Meghalaya are dominated by *Ariadnaesporites intermedius* Hall, *Minerisporites triradiatus* Kar & Singh, *Azolla cretacea* Stanley, *Triporoletes reticulatus*

(Pocock) Playford, *Appendicisporites problematicus* (Burger) Singh, *A. potomacensis* Brenner, *Cicatricosisporites doregensis* Potonie & Gelletich, *Contignisporites bellus* Kar & Singh, *C. assamicus* (Singh & Tiwari) Kar & Singh, *Microvoveolatisporites mahadekensis* Kar & Singh, *Araucaricites australis* Cookson, *Palmaepollenites eocenicus* (Biswas) Sah & Dutta, *Liliacidites variegatus* Couper, *Tricolpites archaius* Kar & Singh, *Spinizonocolpites* spp, Normapolles' pollen group (*Oculopollis orbicularis*, *Nudopollis* spp., *Krutzschipollis spatiosus*) and fungal

remains. The assemblage includes *Azolla cretacea*, *Ariadnaesporites intermedius*, *Triporoletes reticulatus*, indicating a Maastrichtian age. Based on the occurrence of elements characteristic of the Northern Hemisphere, viz. 'Normapolles' pollen and *Aquilapollenites* in India, it was speculated that before the actual locking of the two landmasses (Asia and India) occurred, some sort of land connectivity via the island-arc system was already in place, which allowed the northern elements to invade India and establish themselves in Indian Peninsula and eastern coast.

R.S. Singh

Project 5.5: Palynofacies analysis and palyno-cyclicity in Palaeogene-Neogene sediments of Upper Assam and Jaintia Hills, northeast India

The palynofacies and palynofloral assemblages of various lithotypes, e.g. coal, carbonaceous shale, siliciclastic clay of the 187 m thick section exposed at Tirap colliery in Upper Assam Basin showed predominance of organic-rich horizons. The entire section showing rich biodegraded terrestrial and amorphous sedimentary organic matter (SOM) followed by structured terrestrial, resins and black debris; suggesting moderate oxic-anoxic and dysoxic condition during their burial. These SOM assemblages display weak to moderate fluorescence images. The spores-pollen recorded from the bottom to the top of the section resembling plants of the families Cyatheaceae, Dicksoniaceae, Pteridaceae, Matoniaceae, Polypodiaceae, Lygodiaceae, Parkariaceae, Arecaceae (Palmae), Annonaceae, Bombacaceae, Theaceae,

Alangiaceae, Meliaceae, Anacardiaceae, Gunneraceae, Pellicieraceae, etc. Few recycled Gondwanic miospores have also been recorded in some of the samples. Based on the characteristics of the palynoflora, two broad vegetation types are recognized– i) plants associated with a mangrove habitat, and ii) freshwater inter-fluvial swamps, lakes and ponds. The basal two-third part of the section associated with fine-grained sediment suggests a lower delta plain environment of deposition. The rest upper part of the section is characterized by coarser sediments, predominantly fine sand facies, and a relative paucity of coal deposition indicate stacked channels with erosional bases, all suggest a high pass-through of sediment, as well as more quiescent floodplain interfluvial deposition.

Madhav Kumar

Project 5.6: Palynological investigation of Miocene sediments of Mizoram and Tripura

A rich and well-diversified palynofloral assemblage mainly consists of pteridophytic spores, gymnospermous, angiospermous and fungal spores has been recovered from the sediments of Damchara road sections, north Tripura. Palynofloral analyses show the herbaceous plant such as Cyperaceae and Poaceae (*Carex* and *Phragmites*) were the most important components of wetland communities. Fossils of obligate aquatic fungi (*Tetradigita stellata* and *Stauromyca radiata*) indicate open water environments, these include microfossils of Characeae, *Potamogeton*, algal resting cells, free cells and colonies (*Zygnemataceae*, *Closterium*, *Botryococcus* and *Pediastrum*) are found. Much of the fungal remnant reflects nutrient induced bloom associated with plant roots and mycorrhizal *Glomus* is locally abundant. The palynotaxa recovered from the shales at Damchara are *Osmundacidites*,

Pteridacidites, *Polypodiacesporites*, *Hammenisporis*, *Bombacacidites*, *Retitrescolpites*, *Polyadopollenites*, *Palmidites*, etc. indicating early Miocene age.

The rare occurrence of dinoflagellate cysts (*Operculodinium*, *Homotryblum*, *Achomosphaera*, *Cordosphaeridium*, *Polysphaeridium* and *Tuberculodinium*) also in some samples from grey marl indicates the transgressive phase of the sea level fluctuations. The mixed association of *Crassoretitrites*, *Pteridacidites* and *Spinizonocolpites* suggest a shoreline inhabited by mangroves. The occurrence of *Malvacearumpollis*, *Hibisceapollenites* taxa which belong to a coastal marsh vegetational communities support the presence of tidal swamps near the area of deposition. The predominant occurrence of *Podocarpidites*, *Pinuspollenites* indicates the high topographically elevated areas were not far away from

the basin of sedimentation. The qualitative analysis of palynoassemblage indicates prevalence of swampy conditions near the coast under subtropical regime, where large amount of plant derived organic remnant from nearby forest along with eroded

material of pre existing Gondwana deposits (*Striatopodocarpites*, *Crescentipollenites*, *Faunipollenites*, *Microbaculispora*) were transported, eroded and intriguing towards the depositional site.

B.D. Mandaokar

Project 5.7: Palynological investigations of the Disang Group its palaeofloristic trends, palaeoecological and palaeogeographical interpretations

Completed palynological study of Disang Group exposed in Jatinga river (Jatinga River Section), North Cachar Hills district, Assam. The lithology of Disang Group is alternations of sandstone and shale bands, with shale being the dominant lithology. The lithology is very much similar to Kopili Formation, equivalent of Disang Group in shelf facies. The palynological assemblage recovered is dominated by pteridophytes than other plant groups. The pteridophytes belong to families like Cyatheaceae, Polypodiaceae, Parkeriaceae, Schizaeaceae, Matoniaceae, while Gymnosperms belong to family Pinaceae while angiosperms belong to families like Arecaceae, Caesalpiniaceae, Pelliciaeriaceae. Significant palynotaxa of the assemblage are: *Cyathidites australis*, *C. minor*, *Todisporites major*, *T. minor*, *Lygodiumsporites eocenicus*, *Dictyophyllidites kyrtomatus*, *Intrapunctisporis apunctis*, *Hammenisporis multicostatus*, *H. susannae*, *Laevigatosporites levis*, *L. tertiarus*, *Gleicheniidites senonicus*, *Deltoidospora minor*, *Baculatisporites*

wellmami, *Polypodiisporonsites repandus*, *P. tuberculensis*, *Pinuspollenites crestus*, *Monolites mawkmaensis*, *Neocouperipollis kutchensis*, *Densiverrupollenites eocenicus*, *Pellicieripollis langenheimii*, *Lakiapollis ovatus*, *Favitricolpites magnus*, *Palmaepollenites ovatus*, *Margocolporites sahnii*, *Cingulatisporites* sp., *Klausipollenites sulcatus*, *Callialasporites segmentatus*. Presence of gymnospermous bisaccate pollen, *Pinuspollenites* suggest that the topographically elevated areas were not far away from the basin of sedimentation. The recorded palynoassemblage indicates that the area enjoyed moist, warm, humid, tropical to subtropical climate with plenty of rainfall and the sedimentation seem to have taken place in fresh water environment close to the shore with ponding conditions nearby. Additionally, chemically processed rock samples of Disang Group exposed along Silcher-Haflong Road, North Cachar Hills. The study is in progress.

G.K. Trivedi

Thrust Area: INTEGRATIVE MICROPALAEONTOLOGY, BIO-PETROLOGY AND ORGANIC FACIES: RELEVANCE TO FOSSIL FUEL CHARACTERIZATION & EXPLORATION (Integrated approach to realizing economic potential in prospective basins)

Marine Micropaleontology Group

Project 6.1: High resolution biostratigraphy, biotic turnover, paleoclimate and relative sea level changes during Late Cretaceous-Early Palaeogene (~80-35 Ma) in South Shillong Plateau, Meghalaya, northeastern India

Dinocyst/ palynofacies assemblages from Mahadek Formation, Kynrem-Mawsmi section, Cherrapunji area (Cretaceous-Palaeocene) have been carried out. Palynofacies study shows specific levels of well-preserved cyanobacteria followed by dinocyst dominated horizons indicative of fluctuating tidal flat and shallow inner neritic depositional conditions. Dinocyst assemblage is represented by *Areoligera senonensis*,

Amphorosphaeridium, *Cordosphaeridium* sp, *Achomosphaera* sp *Exochosphaeridium* sp. and *Glaphyrocysta ordinata*. Within a sedimentological framework (in collaboration) the palynofacies data is interpreted in terms of transgressive regressive cycles.

Rahul Garg (superannuated w.e.f. 30.11.2010),
Vandana Prasad & Khowaja Ateequzzaman
(superannuated w.e.f. 31.12.2009)

Project 6.2: Mesozoic nannofossils from western Indian continental shelves and its palaeobiogeographic significance

Kachchh Basin (Wagad Island)— First record of bennetitalean fossil flower represented by *Williamsonia* sp. along with *Carpolithes* (seed), from the upper part of the Callovo-Oxfordian Washtawa Formation (Nara Shale Member) is recorded. The specimen is comparable with *W. kakadbhitensis* of Albian age from the Bhuj Formation of Kachchh Mainland area. All the known record of *Williamsonia* is from early to late Cretaceous sediments in India and this is about 40 million years earlier record. The horizon with plant fossils is rich in datable ammonites and also contains nannofossils. The mainland sections display exceptional preservation of Callovian age calcareous nannofossils but in Oxfordian strata nannofossils are not well preserved (worked jointly with Neeru Prakash).

In the bed of the Trambau River between Kantkote and Jharsa villages a succession of brick-red to yellowish (iron-rich) calcareous, mudstone is exposed. One bedding surface at the nala is, for several hundred metres, studded with a variety and size range of ammonoids, belemnites, large bennetitalean fossil wood logs and pieces with attached fructifications and seeds at places, along with large *Thalassinoides* burrows. At places symmetrical ripple marks are also seen suggesting wave influence and hence comparatively shallow-water conditions. The ammonite assemblage has been dated as late Middle Oxfordian for this part of the succession. More precisely, the ammonite assemblage belongs to Oxfordian *Transversarium* Zone, *Schilli* Subzone (Krishna et al., 1994, 1995). Associated with the ammonites is a moderately diverse nannofossil flora, represented by *Axopodorhabdus cylindratus* *Biscutum dubium*, *Carinolithus magharensis*, *Crepidolithus perforate*, *Cyclagelosphaera margerellii*, *C. tubulata*, *Ethmorhabdus gallicus*, *Lotharingius contractus*, *L. sigillatus*, *Stephanolithion bigotii*, *Stradnerlithus geometricus*, *S. fragilis*, *Triscutum expansus*, *Triscutum* spp., *Watznaeuria barnesae*, *W. britannica*, *W. ovate*, etc. The calcareous matrix of the sandy Nara Shales has been provided by calcareous nannofossils. The low-diversity, moderately preserved nannofossils from the upper part of Nara Shales Member (Washtawa Formation) can also be placed, with confidence, in the NJ 15 *Cyclagelosphaera margerelli* Zone of Bown et al (1988) of Lower Oxfordian (cordatum AZ) to Lower Kimmeridgian (autissiodorensis AZ).

The Wagad Island section contains excellent datable ammonite in hard calcareous bands and moderately-

preserved nannofossils in calcareous sandy shales in between these hard bands. Early and early Middle Oxfordian ammonites are recorded from Mainland Kachchh, whereas Middle and Late Oxfordian ammonites have been recorded from Kantkote of the Wagad region. Possibly, the mainland area underwent sediment starvation, while sedimentation was going on in Wagad Island. The part of the section in question may correspond to a maximum flooding zone.

Jyotsana Rai

Jaisalmer Basin (Tanot Bore Well-1)— 114 well cutting samples have been studied from Tanot Bore Well-1 containing 222 nannofossil species belonging to 86 genera and 22 families. On the basis of recorded global marker taxa— *A. octoradiata*, *R. levis*, *T. orionatus*, *E. eximius* *S. primitivum* *Z. biperforatus* *Z. noeliae* *Z. kerguelensis* *R. planus* *E. rarus* *H. chiastia* *A. albianus* *C. kennedyi* *S. gausorhethium* *Z. xenotus* *B. africana* *E. turrisieffellii* and *B. stenorhetha* the age assigned for these sediments is from Albian to Lower Maastrichtian. The whole sequence is divided into 17 nannofossil assemblage zones on the basis of last occurrences and 5 subzones are erected on the basis of first occurrences of marker taxa. The record of high latitude cold water forms, viz. *S. primitivum*, *R. parvidentatum*, *B. dissimilis*, *A. octoradiata*, *Z. kergulensis* and *Nephrolithys* spp. with warm water taxa *W. barnesae* and nannoliths (Braarudospherids and nannoconids) indicate mixing of warm and cold water currents in Jaisalmer Basin during Late Cretaceous time situated at mid latitudes (ca. 30°S). Presence of *B. enormis*, *B. matalosa*, *B. parca expansa* and *L. carniolensis* indicates mixing of taxa from Austral Province current. The recorded nannofossil assemblage broadly indicates shelf deposit. 23 light-microscopic plates containing family-wise alphabetically arranged nannotaxa and 4 scanning electron microscopic plates are prepared. The recovered nannotaxa have been plotted with respect to stratigraphic distribution, preservation factor, and r-strategist and k-strategist mode related frequency distribution.

Pariwar Formation— the formation in the Jaisalmer Basin has been precisely dated for the first time as early Middle Albian on the basis of presence of a well diversified, moderately preserved calcareous nannofossil assemblage of the upper part of *Chiastozygus litterarius* Zone CC7b/ *Prediscosphaera columnata* Zone CC8 of

Sissingh 1978 corresponding with NC8/9 zones of Bown et al. (1998).

Presence of nannoconids in the assemblage indicates Tethyan affinity and *Seribiscutum primitivum* showed presence of bipolar high cold water taxon from Austral province to mid latitudinal position. The Tethyan nannofossil laden water current appears to have been

mixed with cold water current during Aptian-Albian time (Kale & Phansalkar, 1992) and continued up to Campanian time. Record of *B. constans*, *Z. erectus* indicates surface water nutrient rich upwelling conditions. A paper entitled 'Albian age calcareous nannofossils from Tanot Bore-well, Jaisalmer Basin in Rajasthan area' is finalized.

Jyotsana Rai & Abha Singh

Project 6.3: Integrated diatom stratigraphy and palynofacies analysis of Tertiary sediments of Andaman-Nicobar Group of Islands: Implication to palaeoclimate and basin evolution

Several rich palynofloral associations have been studied from measured stratigraphic section of the Baratang Formation exposed on the Andaman trunk road from Nilambar Jetty towards Gandhi Jetty in the Baratang Island. The palynofloral assemblage mainly consists of a variety of dinoflagellate cysts, spores, pollen grains, fungal and algal remains. The chief constituents of the assemblage are— *Enneadocysta arcuatum*, *Deflandrea phosphoritica*, *Operculodinium exquisitum*, *Palaeocystodinium hampdenense*, *Homotryblum oceanicum*, *Achomosphaera multifurcata*, *Cyathidites australis*, *Retitrisyncolpites thaungii*, *Spinozonocolpites baculatus*, *Lakiapollis ovatus*, *Acanthotricolpites kutchensis*, and *Neocouperipollis brevispinosus*. Quantitatively dinoflagellate cysts and acritarchs dominate the assemblage. A large number of reworked palynofossils, viz. *Crescentipollenites fuscus*, *Lunbladisporea* sp., *Falcisporites stabilis*, *Staurosaccites quadrifidus*, *Aequitriradites spinulosus*, etc. have also been recorded from the older

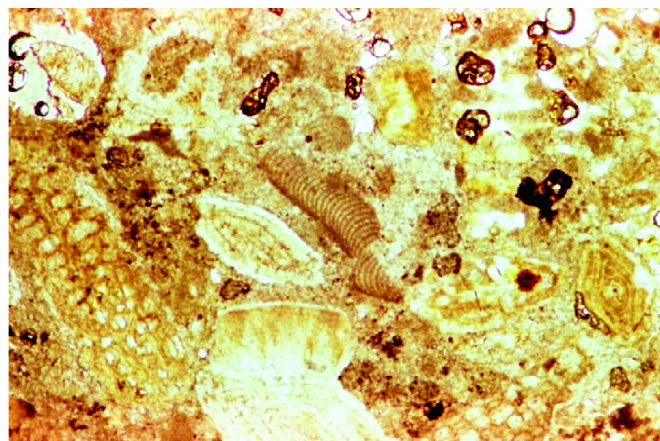
horizons of one of the section.

Palaeoecological and palaeoenvironmental analyses of the recorded palynoflora demonstrate that the dinocysts/spore-pollen assemblage ratios run in an inverse proportion from the base to the top of the succession. Three distinct palynoassociations have been recognized. These palynoassociations correlate with those established by earlier workers in the Assam- Arakan basins. Biostratigraphic significance of the recorded palynotaxa has been worked out. The palynoflora indicates the prevalence of tropical to subtropical warm humid climate. The palynoflora has been compared with the Eocene assemblages recorded from various sedimentary basins of India and has been assigned LateYpresian-Early Lutetian age for the sediments on the basis of palynofossils. An attempt has also been made to throw light on the provenance of the recorded terrestrial palynofossils.

Samir Sarkar

Project 6.4: Taxonomic analysis of calcareous algae from the Cenozoic sediments of Andaman-Nicobar Basin and its implications on palaeogeography, palaeoecology and palaeobathymetry

Based on thin section analysis coralline red algae and halimedacean green algae have been recorded from the Limestone unit of Hut Bay (Little Andaman) belonging to Middle Miocene age. The study also reveals the occurrence of benthic foraminifera. Non-geniculate coralline algal taxa belonging to subfamily Melobesiodeae (Family Hapalidiaceae) in association with other non-geniculate taxa of subfamily Mastophoroideae and Lithophylloideae (Family Corallinaceae) have been recognised. The geniculate coralline red algae are represented by species of *Amphiroa*. Interpretation on the palaeoecology based on the algal assemblage as well as benthic foraminifera has been made. The algal build up including the relevant micropalaeontological and stratigraphical evidence of the Late Middle Miocene



Foraminiferal – Coralline Algal wackestone-packstone Facies, from the Guitar Formation (Middle Pliocene) of Car Nicobar Island, India

sequence of Little Andaman Island indicate a shallow marine condition having water depth less than 40 meters. Finalization of the manuscript is in progress.

From the Car Nicobar Island (Nicobar Group of Islands) thin sections have been prepared based on the samples collected from the Kakana Limestone unit (Middle Pliocene Limestone outcropping in the Car

Nicobar Island). Identification and statistical analysis of the algal forms have been done. Photomicrography and description of the algal forms are in progress. Preliminary study indicates that the Middle Pliocene algal assemblage comprises variety of geniculate and non-geniculate coralline red algae.

A.K. Ghosh

Organic Petrology Group

Project 7.1: Biopetrological investigations on the coals of Wardha-Godavari coalfields in relation to coal bed methane

Petrological work regarding maceral constitution and rank estimation of coal succession intersected in bore-hole 561 from Belampalli area of the Godavari Valley Coalfield has been carried out. In all seven coal seams (viz., IB, IA, II, IIB, III Top & Bottom, IV and V) have been encountered in this bore-hole between 230.40 and 423.18 m depth range. The coal maceral study has revealed that the seams IB and III contain vitric type of coal, seam IIB contain fusitic type of coal and IA, II and

IV seams contain both the fusitic and vitric type of coal. The lowermost V seam, however has mixed type of coal. Significantly low mineral matter association has been recorded from these coals, which indicates their high economic potentials. The vitrinite reflectance study suggests that these coals in general have attained high volatile bituminous C stage of the rank, barring a few coal bands which have reached a slightly higher rank.

O.S. Sarate

Project 7.3: Organic petrological and geochemical characterization of South Indian lignite deposits

Organic petrological studies of Ratnagiri lignitic beds have been carried out under normal light for their maceral and associated mineral matter characterization. The study has shown the association of huminite, liptinite and inertinite group of macerals along with mineral matter. The maceral and sub maceral of huminite in lignites mostly shows medium grey in colour, reflectance ranges in between associated darker liptinite and higher inertinites. Generally, the isotropic tendency has also been observed in all the huminitic macerals in the sample studied. Huminites are well represented by telohuminite and detrohuminite, while gelohuminite mark its presence rarely in these lignites. Corpohuminite, phlobaphinite, suberinite have also been recorded in the samples. Liptinite is represented by sporinites, cutinites, resinites and liptodetrinite. The fusinite, semifusinite and funginite constitute inertinite group of maceral suggesting the occurrence of oxidative tendencies in the development of these beds. Two axial diagrams showing huminite versus inertinite maceral distribution are prepared. The study has shown the prevalence of the variable oxidative

and reductive conditions in Ratnagiri swamp. The high incidence of huminite group of macerals in the samples studied has suggested the contribution of woody dominant flora under the influence of euxinic condition in the deeper part of the swamp. Inertinites represent very less amounts in comparison to the huminites. Spores, pollens, cutinites, resins and liptodetrinite form Liptinite group suggesting the richness in hydrogen content in these samples. Mineral matter forms clay minerals and pyrites, the association of framboidal pyrite suggests reducing condition during the development of lignitic seam in the swamp. Geochemical signatures recorded in the resin from these lignites show the presence of cadalene based aromatic, saturated and unsaturated C30-C31 bicadinanes and bicadinenes. These are the characteristic biomarkers of dammer resins of angiosperm family of Dipterocarpaceae. The study suggests that the tropical climate controlled the development of woody dominant forest in palaeo swamp contributing to the genesis of lignitic seam in the area.

Rakesh Saxena

Project 7.4: Organic matter characterization of lignite-bearing successions of western India

Documented the petrological data (macerals both under normal and fluorescence modes, and huminite reflectance) of lower Tertiary lignites from Tadkeshwar mine (Surat district, Gujarat). These lignites, belonging to the Main and Leader seams, are found to be rich in huminite macerals (average 71%) followed by liptinite (av. 26%) and inertinite (av. 3%) with moderate to high proportions of associated mineral matter (4-32%). Liptodetrinite (av. 9%) and resinite (av. 5%) are the dominant macerals of liptinite group in these lignites. The type of huminite suggests that the lignite is formed from mixed vegetal source, i.e. woody forest vegetation and herbs, shrubs. The composition of macerals indicates the deposition of lignite in sub-aqueous condition in wet-reducing environment with intermittent exposure and subsidence of the peat surface. The rank of the lignites, determined through reflectance measurement ($R_{o\text{ mean}}$: 0.26-0.27%), indicate that the lignite is less mature. The considerable amount of perhydrous huminite may have contributed to the lower *reflectance values* in some of the samples. Low rank and appreciable amount of mineral matter make the lignite suitable for its utilization in thermal power plants, however when upgraded or mixed with better quality coals it can be used for other industries.

Alpana Singh, O.P. Thakur & B.D. Singh

Studied lignites from Amod mine of the Rajpardi field (Bharuch district, Gujarat) for their maceral composition (both under normal and fluorescence modes) and rank. The study revealed that these early Eocene lignites are predominant in huminite macerals (average 55%) followed by liptinite (av. 34%) and inertinite (av. 5%) macerals, along with low amount of associated mineral matters (argillaceous and pyrite: av. 5%). Among the huminite group of macerals, detrohuminite (attrinite + densinite) is dominant in these lignites followed by structured telohuminite. The liptinites are chiefly constituted by liptodetrinite (detritus) and resinite, besides sporinite, cutinite, suberinite, etc. Semifusinite, fusinite, inertodetrinite and funginite represent the inertinite group. The mean huminite reflectance values (0.27-0.32%) suggest that the studied lignites are less mature (of brown coal or lignitic stage) and fall in the 'early diagenetic' zone of methane generation. The overall petrographic composition indicates the existence of wood dominated forest contributing as the source vegetation for lignite deposits in a fast subsiding basin with only minor fluctuations in swamp water conditions.

Alpana Singh & B.D. Singh

Fossil Fuel Exploration Research Group**Project 8.1: Development of Advance Centre of Applied Palynology and Stratigraphy for Fossil Fuel Exploration Research**

Project proposal for establishment of the 'National Centre of Applied Palynology and Stratigraphy for Fossil Fuels exploration' and "Central Core Lab Facility" offering Palynology as a Tool to the Industry in Hydrocarbon Exploration Research has been updated and revised as per OIDB guidelines and submitted to Directorate General of Hydrocarbons for consideration.

**N.C. Mehrotra & team of Scientists
(engaged in Palynological & Organic Petrological studies)**

Studied coal samples received from BRGM, France/ MECL, Nagpur. The samples belong to the Tertiary field in the frame of the MECL-BRGM Project on resource estimation in respect of the Oil Shale deposits

in north-east India. The samples have been re-analysed as under- maceral contents (both under normal and fluorescence modes), mineral matter association and vitrinite reflectance (rank). A report containing these data is forwarded to both the agencies.

B.D. Singh & Alpana Singh

Analysed the palynological assemblages recovered from the sub-surface Pre-Tertiaries samples of the Ganga Basin. Estimated the TAI and EDS values of the samples in relation to hydrocarbon prospects. Also studied the surface samples from the Balian-Krol-Tal sequence.

Rupendra Babu & V.K. Singh

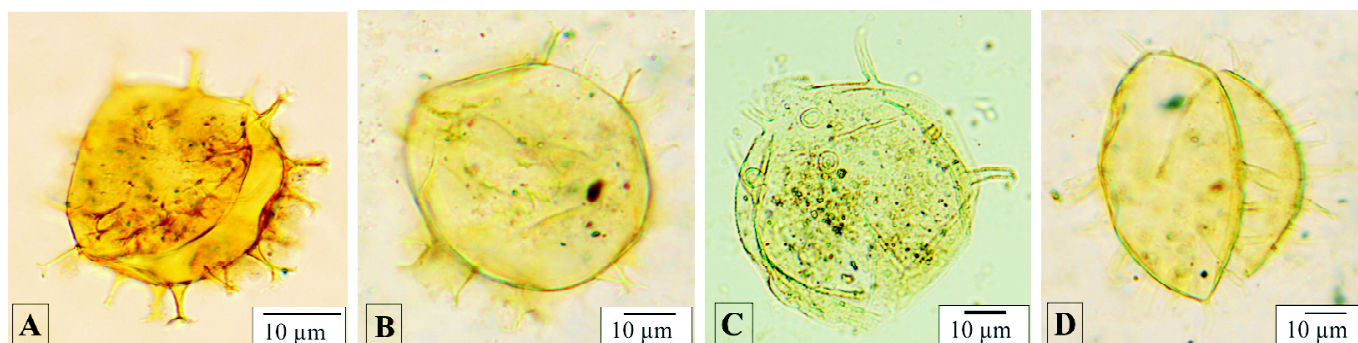
Thrust Area: MULTI PROXY PARAMETERS FOR QUATERNARY PALAEOCLIMATE RECONSTRUCTIONS, VEGETATION DYNAMICS, RELATIVE SEA LEVEL CHANGES AND ANTHROPOGENIC INFLUENCE (Integrated Approach to Climate Change, Modelling and Sustainable Ecosystems)

Quaternary Palaeoclimate Group

Project 9.1: History of mangrove vegetation in Mahanadi Delta

Investigations of dinoflagellate cysts of 2 sediment cores (CHI 31 and CHI 10) of the Chilka Lake have been completed. The modern dinocyst assemblages are mostly dominated by gonyaulacoid species, particularly *Spiniferites* sp. and *Operculodinium* sp. The study of 20 surface samples exhibited very poor recovery of fresh water diatoms. The palynological investigations of surface

and sub-surface sediments have been completed and results have been interpreted to understand the evolution of mangrove vegetation in relation to sea-level and concurrent climatic fluctuations around the Chilka Lake. The compiled data has been documented in the form of Ph.D. dissertation.



Dinoflagellate cysts- (A-B, *Spiniferites* sp.; C-D, *Operculodinium* sp.)

Asha Khandelwal (superannuated w.e.f. 31.08.2009) &
Shilpa Singh

Project 9.2: Evolution of Mangroves and Coastal Vegetation; Its implications in Palaeoclimate and sea-level studies during Quaternary

Studied one core (180 samples) from Vizayanagram, north of Visakhapatnam. Palynologically, three phases have been categorized supported by Radiocarbon age, sedimentology and geochemistry of the sediment cores. Phase-1 is characterized by high percentage of pollen taxa that belong to evergreen and moist deciduous rain forest during middle Holocene. These constitute pollen grains of *Anogeissus*, *Bombax*, *Buchanania*, *Cullenia*, *Diospyros*, *Eugenia*, *Garuga*, *Hopea*, *Madhuca*, *Melia*, *Shorea*, etc. The latter part of middle Holocene ~4 to 3 k yrs BP shows a drastic decline in pollen assemblage showing low percentage of pollen that belong to dry deciduous forest. Dominance of *Boswellia*, *Dalbergia*, *Lannea*, *Mitragyna*, *Schleichera*, *Butea*, *Casuarina* and *Lagerstroemia* are recorded. However, the last Phase-3 shows rare occurrence of arboreal pollen (tree pollen) except exotic

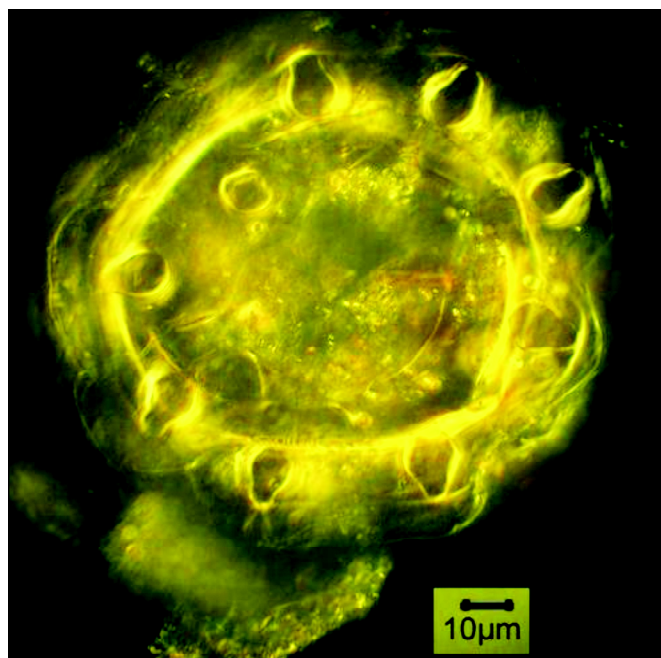
pollen of *Acacia*, *Casuarina*, *Eucalyptus*. Low percentage of herbaceous pollen taxa dominated by pollen grains of family Asteraceae, Caryophyllaceae, Chenopodaceae, Cyperaceae, Malvaceae and Poaceae are recorded.

The qualitative and quantitative vegetation reconstructed through palynology shows vegetational change from moist deciduous lowland forest community to dry deciduous forest during Holocene. Results indicate a shift in climatic conditions from warm and humid to dry and arid conditions since middle Holocene. Rapid decline in pollen assemblage during Late Holocene suggest further deterioration in climatic conditions which was enhanced by extensive anthropogenic activity. Also visited NGRI, Hyderabad for the study of oxygen isotopes.

Anjum Farooqui

Project 9.3: Multi-proxy palaeoclimatic studies in coastal and marine sediments of western Indian region

Fifty-two surface sediment samples collected during SK117 cruise are analyzed for the distribution of dinoflagellate cysts from 14° to 16° latitude and 70° to 75° longitudes in the Arabian Sea. The study shows rich assemblages of Peridinoid dinoflagellate cysts along with *Tuberculodinium vancampoe*, *Lingulodinium macherophorum* in the shallow shelfal region (up to 100 m depth). The outer shelf and slope region shows dominance of *Gonyaulocoids* represented by



Tuberculodinium vancampoe

Spiniferites, *Nemato sphaeropsis*, etc.

Tuberculodinium vancampoe- a warm water dinoflagellate form, occur profusely in the Arabian Sea

sediment, is an indicator for moderate to high SW monsoonal activity

Eight surface sediment of Arabian Sea collected from SK-237 cruise off Ponani coast 25-2150 m depth have been studied for primary productivity behavior pattern. Quantitative distribution of diatom, dinoflagellate cysts, nannoplankton and cyanobacteria in the oxygen minimum zone OMZ (~150-1200 m) has been studied in detail. The study shows negative correlation with the diatoms, dinoflagellate cysts and nannoplankton with OMZ. Luxuriant growth of cyanobacteria in the oxygen minimum zone transect is a significant phenomena and has been studied in detail. The study is in progress. Surface grab sediments from 17 stations in the Vembanad Estuary has also been carried out for accessing the variation in the diatom assemblage. In the study it was found centric diatoms dominated over the pennate forms. The distribution shows the high frequency of fresh water centric diatoms viz. *Cyclotella*, *Podosira*, *Stephanodiscus* species indicating continuous inundation of freshwater in the estuary with low occurrences of pennate diatoms, viz. *Navicula*, *Nitzschia*, *Gyrosigma*, *Pleurosigma*, *Achnanthes*, *Luticola* species. The presence of *Actinocyclus ingens* indicate marine incursion.

Vandana Prasad, Biswajeet Thakur & Rahul Garg
(superannuated w.e.f. 30.11.2010)

A manuscript entitled 'Primary productivity and organic matter distribution study during SW and NE monsoon: A case study from Alleppey mudbanks, Kerala, is under review.

Biswajeet Thakur, Vandana Prasad & Rahul Garg
(superannuated w.e.f. 30.11.2010)

Project 9.4: Studies on Quaternary vegetation and climate change in southwestern Madhya Pradesh, based on pollen proxy evidence

Pollen analysis of 5 surface samples from Khedla Quila, Betul district has shown the dominance of non-arboreals over the arboreals. Among the arboreals, the major forest constituents, such as *Madhuca indica*, *Holoptelea*, *Lannea coromandelica*, *Grewia* and *Terminalia*, are represented consistently in moderate to low frequencies, whereas Sapotaceae, *Schrebera*, *Sterculia*, *Acacia*, etc. are sporadic. However, the high pollen frequencies of *Flacourtia* and *Butea monosperma*

in a few samples denote their local abundance. The excessively high frequencies of grasses (Poaceae) followed by Tubuliflorae, Cheno/Am, etc. correspond with their actual presence in the herbaceous flora. In addition, completed pollen analysis of a 2 m deep sediment core from Khedla Lake, Betul district. The study has revealed the presence of open vegetation dominated by grasses, Asteraceae, Cheno/Am, Caryophyllaceae together with the scanty occurrence of trees, viz. *Madhuca indica*,

Acacia, *Holoptelea*, *Symplocos*, *Adina cordifolia*, etc. The retrieval of *Potamogeton*, *Trapa* and *Nymphaea* denotes the prolonged existence of the lake. The sedges and *Polygonum serrulatum* inhabited the lake margin abundantly. The radiocarbon dates are awaited for the chronological reconstruction of vegetation succession.

Finalized two pollen based papers on sediment profiles from Kachia-Jhora Lake (1.25 m) and Kachhar Lake (2 m) of Seohore district. The pollen sequence from Kachia-Jhora Lake has inferred the presence of open mixed deciduous forests between 3,300 and 2,250 yrs BP, followed by mixed forests between 2,250 and 800 yrs BP and open mixed forests again from 800 yrs BP to Present under less-humid, more humid and moderately humid climatic conditions respectively in the region. The Kachhar Lake pollen data have unfolded the short-term climatic variability and vegetation shifts during the Late Holocene. Around 2,050 to 1,610 yrs BP, *Acacia*-scrub forests occupied the region under a humid climate, which later on got enriched with the arrival of a more humid climate around 1,610 to 600 yrs BP. From 600 yrs BP onwards a less-humid climate prevailed as evidenced from the decline in *Acacia*- scrub forests. Besides, partly pollen analysed a 2

m sediment profile from Manjharkui Lake, Seohore district.

Accomplished a paper on a 1.5 m deep sediment core from Sapna Lake, Betul district, demonstrating the presence of open *Acacia*-scrub forests together with scanty trees of *Madhuca indica*, *Holoptelea*, *Shorea robusta*, *Lagerstroemia*, etc. under a dry climate around 3,800 to 2,250 yrs BP. The vicinity of the lake was under cereal-based agricultural practice as revealed by the presence of *Cerealia* and other culture pollen taxa. Around 2,250 to 1,260 yrs BP, the *Acacia*-scrub forests got transformed into the mixed deciduous forests with the improvement in *Madhuca indica*, *Holoptelea* and *Shorea robusta* as well as invasion of *Terminalia*, *Mitragyna*, *Flacourtia*, *Grewia*, *Lannea*, etc. owing to initiation of a warm and humid climate. The rising trend of *Cerealia* and other culture pollen taxa suggests the acceleration in agrarian activities. Since 1,260 yrs BP onwards, the dwindling of the prominent trees implies that the forest became open and less varied due to a warm and less-humid climate. Additionally, documented a Ph.D. thesis entitled 'Reconstruction of Quaternary vegetation succession and climate change in Central India, based on pollen proxy records'.

M.S. Chauhan & Md. Firoze Quamar

Project 9.5: Studies on Quaternary vegetation and Climate from Himalaya

Carried out geochemical analysis of 4 sedimentary profiles— TT-III (85 cm deep) from Talli Tal, MT-I (360 cm deep) from Malli Tal, KT-I (300 cm deep) and KT-II (330 cm deep) from Khurpa Tal, Kumaun Himalaya and prepared their text-figures which has revealed the knowledge of total organic matter (OM) and corresponding climate existed at the region during late Quaternary (radiocarbon dates of 2 profiles awaited). The generated data is comparable to the data reported from earlier studied profiles from the region showing that in Early Holocene the investigated area had well-representation of total OM and low carbonate contents, reflecting that humid climate existed at the region during the tenure. Near onset of middle Holocene the OM became low and carbon contents high, indicating change in climate towards arid (-moist) conditions. Around late Holocene the OM again became high and carbonate

contents low, reflecting restoration of humid conditions at the region.

Palaeontological analysis has revealed molluscan shells from the younger portions, again supporting humid conditions during late Holocene. Lithologically, these profiles are largely comprised mainly of silty clay without or with pebbles and charcoal pieces which reflect natural disturbances and forest fire at the region. Also prepared tables exhibiting results of multidisciplinary analysis (palynological, palaeontological and geochemical) of same samples of three other profiles from Himalaya. Different analyses deal with different types of objects which may differ in climate susceptibility but the inferences drawn broadly corroborate each other and has revealed the knowledge of past vegetation and climate more authentically and more precisely.

Asha Gupta

Project 9.6 Proxy climatic signals from lacustrine lake sediments of Upper Assam Basin and adjoining foot-hill forests of Arunachal Pradesh (Subansiri District) during Holocene: A comparative palaeoecological assessment

Modern pollen assemblage from Abhaypur reserve forest, Sibsagarh district reveals the existence of open

land vegetation comprising grasses, *Mesua*, *Cinnamomum*, *Arecaceae*, *Symplocos*, *Elaeocarpus*,

Duabanga and *Semecarpus*. The good value of fern allies and fungal remain indicate humid climatic depositional environment. The occurrence of high land exotic plants is suggestive of long distance transportation of pollen through upthermic wind. The study also predicts high rate of precipitation during deposition as evidenced by high input of organic remain in sediment.

One 28 ka BP vegetation and climatic record has been recovered from Dikhou river section, Sibsagarh District, Assam hints the existence of scattered tropical semi evergreen forest under cool and dry to warm and humid climatic regime. Palaeoflood episodes are recorded during 14ka BP and 6ka BP as evidenced by consistent silty layer intermixed with pebble.

S.K. Bera & S.K. Basumatary

Dendrochronology Group

Project 10.1: Development of long-term high resolution proxy climate record from the Himalayan region

Consulted literature on climate change, its impact on vegetation, biodiversity and sustainable development in Himalayan region, India. To prepare comprehensive review on climate change and teleconnections, reviewed

the published literature on high-resolution climate records from the Himalayan as well peninsular region of India.

R.R. Yadav

Project 10.2: Analysis of climatic changes based on multi-proxy data during Holocene from Peninsular and Himalayan regions

Tree-ring samples of *Cedrus deodara* from six sites of Garhwal Himalaya analyzed and chronology prepared. The chronology is ranging from 272 to 594 years. Its relationship with other previously analyzed sites and climate reconstruction are in progress.

The Palynological analysis from sub surface samples from 1.20 m deep sediment profile from Srinagar,

southwest Tripura provides information of vegetation and climate during 7000-3000 years B.P. of this region. During this time span, the area is occupied by moist deciduous forest under warm humid climate with intermittent changes in precipitation regime ie. comparatively less humid around 6.8 Kyr. B.P. and 3.7-3.8 Kyr. B.P.

Amalava Bhattacharyya & S.K. Shah

Palaeoethnobotany Group

Project 11.1: Palaeoethnobotany: Ancient man, plants and environment in northern and north-western India

Palaeoethnobotanical investigations continued at ancient Ahichchhatra, 14 km north of Aonla, a tehsil headquarter in District Bareilly from PGW, NBPW, Kushana and Mauryan levels. The site lies between the Ramganga and Ghagan Rivers, and the excavations were undertaken by ASI, Agra Circle. The botanical remains were retrieved by water floatation technique from two trenches, viz. Bx78x28 (Qdt. 3 & 4) and Bx50x75 (Qdt.3). The samples comprised of small sized wood charcoal pieces along with, carbonized seed and fruit remains of field crops belonging mainly to cereals, legumes/pulses of west Asian origins, viz. *Hordeum vulgare* (barley), *Triticum aestivum* (bread-wheat), *Pisum arvense* (field-pea), *Lathyrus sativus* (grass pea), and *Lens culinaris* (lentil), along with indigenous *Oryza sativa* (rice), *Vigna*

radiata (green gram), *Vigna mungo* (black gram), *Cajanus cajan* (Pigeon pea?); amongst the millets *Echinochloa crusgalli* (Barnyard/sawan), *Setaria* sp. (Italian millet), and minor crop *Coix lachryma-jobi* (Job's tear), etc. A number of weeds associated with winter and summer season crops as well as wild taxa, viz. *Andropogon* sp (Blue stem grass), *Dactyloctenium aegyptium* (crow-foot grass), *Eleusine indica* (Goose grass), *Ischaemum rugosum* (dhanua), *Panicum* sp. (Panicum grass), *Poa* sp. (Blue or meadow grass); *Carex* sp., *Cyperus* sp. (Flat sedge), *Elaeocharis* sp. (spikerush sedge), *Fimbristylis* sedge, *Scirpus* sp.; *Chenopodium* sp. (White Goose foot/Bathua), *Cleome* sp. (Hurhur), *Commelina* sp., *Convolvulus* sp., *Polygonum barbatum*, *Sida* sp., *Trianthema* sp., *Scleria* sp., *Solanum* sp.

Anagallis arvensis (Pimpernel/Jonkh-mari), *Argemone Mexicana* (Mexican thistle), *Desmodium gangeticum* (Tick clover), *Indigofera hirsuta*, *Vicia* sp. (common vetch) and fruit remains of *Ficus glomerata* (gular), *Ziziphus* sp (Jujube) have been retrieved.

Ahichchhatra strategically in the upper reaches of Middle Ganga Valley, epitomizes the cultural flourish typical of the Ganga Valley. The palaeo-ethnobotanical investigations have enhanced quantitatively and added more finds thereby revealing advanced agricultural

practices in this region of Ganga Plains during Chalcolithic and Early Historic times.

Chanchala Srivastava & A.K. Pokharia

Learned technique of aDNA (ancient DNA) extraction from ancient seeds during a visit to RIHN, Kyoto, Japan from July 1- September 30, 2010. Besides, participated in the excavation and collected botanical remains from the Harappan archaeological site Khirsara in Kachchh district, Gujarat.

A.K. Pokharia

Project 11.2: Studies on phytodiversity and ethnobotany of Bilaspur in Chhattisgarh State and Anuppur in Madhya Pradesh State

Visited Achanakmar, Amarkantak, Keunchi, Samna forest, Bandichhor, Ganesh dhara, Chheenpani, Chak ghat, Benibari, Harrapani, Kapildhara, Maharshi jungle, Shambhu dhara, Dudh dhara and Dharahar areas in Achanakmar-Amarkantak Biosphere Reserve, Bilaspur and collected about 450 plant specimens (research materials). All plant specimens are identified as 157 species belonging to 89 genera and 53 families.

Ethnobotanical survey are also conducted in different Baiga dominant areas and documented 307 plant species of various uses, Analysis of data is being in progress. Identified 8 plant species as new record for Flora of Madhya Pradesh, i.e. *Cosmos caudatus*, *Ipomoea triloba*, *Crotalaria* sp., *Vitex negundo* var. *alba*, *Solanum pimpinellifolium*, *Solanum diphyllum*, *Cassia* sp., and *Desmodium* sp.

D.C. Saini

Isotope and Geochemistry Group

Project 12.1: Tectonoclimatic signatures in Ladakh and Lahul sectors of Tethyan Himalaya during Quaternary period: A multi-proxy approach using mineral magnetic, geochemical and geochronological parameters

The Spituk-Leh palaeolake section is a fluvio-lacustrine deposit. It has been studied for their geomorphological and sedimentological characteristics. Grain size, LOI, bulk and clay mineral including mineral magnetic and geochemical data has been generated. The chronology established through ¹⁴C conventional radiometric dating is providing much older dates due to hard water effect and therefore AMS dating was preferred and rechecked with OSL technique. Both AMS and OSL dates are giving the same age bracket (late Quaternary- mid Holocene).

The distribution and geomorphological studies of the Spiti valley is discussed and finalized. An attempt has been made by using the geomorphometry approach to access the areas in terms of its neotectonic instability of this basin that feeds one of the very important rivers of India- the Sutluj. Two basins of the Sutluj river catchment,

Spiti and Parachu are mapped and assessed to elucidate the spatio-temporal scale dependencies of surface processes active in the region. A paper is finalized.

A paper dealing with the water quality particularly in relation to the weathering of rocks in the Shyok-Nubra river valleys is re-examined as per the reviewer's comment and work is under progress for the resubmission. Additionally, visited WIHG, Dehradun for mineralogical work by XRD technique and mineral magnetic analysis of samples collected from Arctic and Ladakh in 2008 and 2009 respectively. Also visited JNU, New Delhi for the geochemical analysis work. The XRF data on samples prepared in 2007 is almost complete and documentation is in progress. As the number of samples was large due to a high resolution sampling, data generation was partly completed and therefore a lab visit is proposed to complete the remaining work.

Anupam Sharma & Binita Phartiyal

Project 12.2: Developing and combining physical, geophysical and geochemical methods to make a comparative study of Late Quaternary climate recorded in lake sediments/ deposits from Himalayan regions

Sediment samples have been collected from Phubla, Loktak Lake, Manipur and dated with dates ranging from modern (near top) to about 3470 yrs BP $\pm$ 100 yrs (at 70 cms). Radiocarbon and elemental analyses on sedimentary samples from shores of 2 lakes in Uttarkashi, viz. Maradunga and Nachiketa, are carried out. The dated deepest sample (165 cm) from Maradunga yielded an age of about 4700 yrs BP $\pm$ 100 yrs ages. The sediment samples from Nachiketa are richer in organic carbon than Maradunga samples (Harsil, Uttarkashi) as expected based on the altitude and surrounding vegetational coverage. But the Nachiketa samples between 90 and 170 cm depth were organic carbon- poor. The three samples yielded dates of 1180 yrs BP $\pm$ 70 yrs (30 cm), 1900 yrs BP $\pm$ 80 yrs and 2540 yrs BP $\pm$ 70 years. The other analyses will follow and data interpreted.

During the period, the results on international radiocarbon dating comparison studies (VIRI) also were published and our results are in reasonable agreement for the materials of our interest, viz. wood, charcoal, shells and humic acid. The joint work with several other groups from within and outside Institute is being pursued on palaeoclimatic and archaeological problems connected through radiocarbon and geochemical measurements. Discussions were held with collaborating researchers on samples from Dzuko Valley (Nagaland). The suitability of carbonate samples from high altitude had been critically examined based on Ladakh and Lahaul-Spiti sediments. The constraints in interpreting the dates in carbonate- rich regions were identified and the submission based on these findings was revised.

C.M. Nautiyal

Thrust Area: POLAR AND MAJOR PLANETARY EVENTS (Polar research and record of events such as Tsunamis, Earthquakes and Volcanism)

Arctic-Antarctic Research Cell

Project 13.1: Quaternary climatic history of Schirmacher and Larsemann Oasis (East Antarctica), Ny Alesund Area (Svalbard, Norway) and surrounding ocean: A multi-proxy approach based on polar lake sediments

Geomorphological studies of the Schirmacher Oasis region of Antarctica are taken up. Large former glacial lakes and their sediments are described from the Schirmacher Oasis region. The water bodies were present during the late Quaternary (~13-3 ka BP) and have reduced in size by negative water balance. This desiccation can possibly be attributed to the combined effect of recession of glaciers feeding them, low melt water, low precipitation and strong winds. Seven representative sections from five dry lake beds have been studied using loss-on-ignition (LOI) and Magnetic Susceptibility (MS). The LOI indicates a very low organic content, while MS enables assumptions to be made about the reconstruction of changing detrital input. Detailed study of sediment profiles was used to reconstruct the evolution of the Schirmacher Oasis from 13 ka BP to the present.

A mineral/environmental magnetic investigation has been carried out in the dry lacustrine/sediment fills of the Schirmacher Oasis to reconstruct past climatic condition. The statistically run mineral magnetic data on PAST

(multivariate cluster analysis) placed on AMS radiocarbon chronology of the three sediment sections (SWDL, DLL and PDL) studied, trace 6 phases of climatic fluctuation between 13-3 ka BP, (Phase 1, 3 and 5 represent cold periods, while Phases 2, 4, and 6 represent warmer periods). There was one short warm period ~12.5 ka BP (Phase 2) and two marked warm periods within the Holocene, between 11.5-9 ka BP (Phase 4), and 4-3 ka BP (Phase 6). The high susceptibility, SIRM and soft IRM values correspond to the cold periods and low values reflect comparatively warmer lacustrine phases. Holocene Optima (Phase 4) and Mid Holocene Hypsithermal (MHH) (Phase 6) are distinctively seen with a decrease in the value concentration dependent parameters. Magnetite is the primary carrier of remanence and heavy metals in order of abundance include Fe, Rb, Zn, Mo, Co, Pb, Mn, Cu and As in these sediments.

Geochemical and mineralogical data is partly generated for few sediment cores, a pit and an exposed

section under the MoU with WIHG, Dehradun. The grain size data indicate an inverse relation in sand and silt-clay component. The clay content is invariably low and comprised dominantly of illite clay mineral with little amount of kaolinite and smectite minerals. Under surface conditions the immobile elements such as Al, Fe, Ti, Y, Zr, and REE are enriched in the finer sediments, whereas silica, Ca, Na, Sr shows depletion. All information will be clubbed for understanding the role of surface processes and their palaeoclimatic significance.

A technical report has been prepared and submitted to the Team Leader of 26th ISEA Mr. D. Jaipaul where in data is generated on selected samples of 25th and 26th scientific expeditions. Geomorphological, sedimentological, mineralogical and geochemical parameters are discussed in relation to weathering and erosion in the Schirmacher Oasis, Antarctica and their palaeoclimatic significance as well.

A group of selected samples of the Schirmacher Oasis are analyzed for the mineralogical and geochemical work, however some more samples need to be analyzed to generalize the observation and publish the work. Visited WIHG, Dehradun for mineral magnetic analysis of samples collected from Arctic in 2008 of the Cliff section; As the number of samples was large due to a high resolution data generation a part of the analysis was completed and a lab visit is to be taken again. The grain size and LOI data generation part of the Arctic samples has been completed, however, mineralogical and geochemical data need to be generated at a national laboratory.

Binita Phartiyal & Anupam Sharma

Under the ongoing project in India's Arctic Programme, visited Ny-Alesund (Svalbard) for field related studies during July-August, 2010. The main emphasis was on perfecting the modern palynological analogs with reference to the dispersal, transportation and subsequent deposition of local and extra-local palynomorphs in the sediments. The work was carried out under two broad categories– i) aeropalynological studies, and ii) collection of pollen from the flowers.

For aeropalynological studies, 8 slides (4 in horizontal position on the ground and 4 in vertical position at 2 m height, facing the four directions), smeared with glycerine jelly, were exposed in the open for twenty four hours each during the duration of the expedition. The sites for the four horizontally placed slides were chosen on the basis of varying vegetation on the ground, such as moss dominant, grass dominant, flower dominant and barren

land. Besides, 2 slides per day (at an interval of twelve hours each) were also exposed using 'Burkard Personal Sampler'. Studies of the slides reveal a diverse spectrum of pollen, algal and fungal entities including extra-local pollen, which have been carried by air-currents from the mainland. The slides have yielded pollen of Oleaceae, Polygonaceae, Chenopodiaceae, Asteraceae, Saxifragaceae, Ranunculaceae, Caryophyllaceae, Poaceae, Cyperaceae, *Eugenia*, *Pinus* along with fungal and algal bodies. This data can be used to understand the pattern of deposition of the palynomorphs in the Quaternary sediments. The data for the month of July (2010) is also being compared with that of August (2009), which was collected during the previous expedition.

The major part of the field work involved the collection of polleniferous material from the flowers. The plants in the Arctic region flower for a very short duration of time, just after the snow melts and therefore, this time phase of the expedition was chosen so as to have the maximum number of plants in their flowering state. However, this year was marked by the early melting of snow (end of May to early June) and consequently, the flowering season was also earlier and by mid July most of the plants began to dry up. The salient points of the work involved– i) Identification of the flowering plants, ii) Photography of the plant and flower, and iii) Collection of the floral parts for extracting pollen in the laboratory. Polleniferous material from about thirty different flowers was collected. The extraction of pollen from the above flowers was done and type slides were prepared. Besides, samples collected from sedimentary profiles during 2009 are being macerated for the release of palynomorphs and qualitative and quantitative studies of the same are continuing for the interpretation of Quaternary climatic changes of the Arctic Region. In addition, the magnetic susceptibility data has been generated on the subsurface samples.

Ratan Kar & P.S. Ranhotra

Surface sediment samples from the fresh water lakes near scientific bases and those which are away from direct human influence, of Larsemann Hills and Schirmacher Oasis are being studied to look for the change in assemblage of palynomorphs. This will help to detect any change in pristine Antarctic ecosystem. Antarctic sediment samples have been submitted to the Radiocarbon dating laboratory, Gliwice. The C14 dating results are awaited, which will help in final data interpretation and preparation of manuscript, by providing the age control.

Study of late Quaternary raised beach sequences of Ny-Alesund, Svalbard— detailed studies of the Ny-Alesund trench sediments have revealed significant data regarding the late Quaternary climate and sea level conditions, which were regional in nature. This work has been finalized. More detailed work using dinoflagellate cysts as palaeoceanographic proxies is in progress and is

leading towards significant data generation from the raised beach sediments of Ny-Alesund. The recovered cysts of *Operculodinium centrocarpum* are being studied in particular for palaeoceanographic reconstruction. One manuscript based on the use of dinoflagellate cysts as palaeoceanographic proxies is under preparation.

Vartika Singh

Project 13.2: Gondwana floristics of Wardha-Godavari Basin, India and Trans- Antarctic Mountain, Antarctica: Evolution, biostratigraphy, palaeoecological signatures and palaeophytogeographical implications

The detailed morphology and comparative anatomy of least to high thermally altered plant fragments preserved in carbonaceous shales of Lashly Formation (middle to late Triassic) of Allan Hills, South Victoria Land (SVL), Antarctica have been observed under light, fluorescence and scanning electron microscope. The microscopic fragments include charred spores and pollen grains along with organic matter derived from wood and leaf pieces. These demonstrate the evidences of effect of fire on vegetation during middle to late Triassic (240-200 million years). The evidence of palaeofire in Antarctica during the Triassic Period is supported by the presence of a thin bed of silicic tuff interlayered with *Dicroidium*-bearing shale. Most of the charred particles retain identifiable structures with well to distorted cellular details. Such plant fragments are dark brown, blackish brown, quadrangular-multangular, equi-dimensional, opaque and non-fluorescent. The pollen grains recorded from Member C of Lashly Formation show distorted exinal sculptures and are light to dark brown in colour indicating intensive thermal effect. The detailed microscopic images of such fire affected plant remains also explain their preservation biases in the sediments. The magnitude of the charred pieces indicates severity of fire in Allan Hills.

Rajni Tewari, Madhav Kumar, Sankar Chatterjee & N.C. Mehrotra

Investigations are carried out on Triassic flora from Lashly Formation, Allan Hills, South Victoria Land, Central Transantarctic Mountains. The megafloral assemblage is dominated by the order Corystospermales of Gymnosperms; Pteridophytes such as lycopsids and sphenopsids are rare. The assemblage represents various groups of plants e.g., Corystospermales, Coniferales, Equisetales, Calamitales and lycopsids. The flora is dominated by the genus *Dicroidium* of the order Corystospermales. The most common species is *D. odontopteroides* followed by *D. dutoitii*, *D.*

fremouvensis and *D. crassinervis* Other taxa of this order are *Umkomasia macleani*- the female fructification and *Pteruchus* sp.- the male fructification of the genus *Dicroidium*. Coniferales are represented by a single taxon *Deasmiophyllum taeniatum*. The order equisetales includes the taxon *Phyllothea griesbachii*, *Phyllothea* sp., equisetalean axes and equisetalean nodal diaphragms. The order calamitales is represented by a few calamitalean axes Preliminary descriptions of the floral elements have been carried out. Detailed systematic analysis is under progress.

Photodocumentation of about 60 specimens from the Barakar Formation of Prakasham Khani Colliery, OCP II, Manuguru Area, Godavari Graben, Andhra Pradesh is carried out. A preliminary investigation reveals presence of *Glossopteris* species, viz. *Glossopteris angustifolia*, *G. communis*, *G. feistmantelii*, *G. indica*, *G. damudica*, *G. subtilis*, *G. pandurata*, *G. stenoneura*, *G. browniana*, *G. retifera*, *G. rhabdotaenioides*, *G. syaldiensis* and *Phyllothea* sp. Work is under progress.

Rajni Tewari

A field trip was undertaken to Manuguru, Kothagudam and Yellandu areas of Godavari Graben, Khammam district, Andhra Pradesh for the collection of plant mega remains and rock samples for the recovery of megaspore and seeds etc. There are two opencast (Prakasham Khani-2 OCP, Prakasham Khani-4 OCP) and 2 underground mines (Prakasham Khani-1 u/g, Kondapuram u/g) in Manuguru area. Prakasham Khani-2 OCP and Prakasham Khani-4 OCP were visited and a rich assemblage of plant fossils has been collected from the Prakasham Khani-4 OCP (PK-4). The fossiliferous shales of this mine belong to thick seam and show the presence of *Gangamopteris*, *Glossopteris*, *Noeggerathiopsis*, seeds, equisetalean and simple axes. A very few plant fossils have also been collected from

Prakasham Khani-2 OCP (PK-2).

Well preserved impressions and compressions of *Vertebraria* have been collected from the Index seam of Gautam Khani OCP (GK OCP) of Kothagudam area. Venkatesh Khani-7 incline (VK-7) was also visited and carbonaceous shale samples have been collected for the recovery of megaspores and seeds etc. Yellandu area is represented by two opencast (Jawahar Khani OCP, Koyagudam OCP) and one under ground mine (21 incline). Jawahar Khani and Koyagudem OCPs were visited but plant mega remains were not found in these areas. Carbonaceous shale samples were collected for the study of megaspores, seeds and sporangia.

Rajni Tewari, SSK Pillai, Deepa Agnihotri & Kirti Singh

Finalized and compiled data of bore core MCP-7 from Chintalapudi area along with photodocumentation of stratigraphically significant taxa. Reviewed and compiled palynological studies from Sattupalli, Amavaram, Gattugudem, Bottapagudem, and Chintalapudi areas of Chintalapudi sub-basin of Godavari Graben. Early Triassic palynoflora demarcated in Sattupalli and Chintalapudi areas of the Chintalapudi sub-basin.

Neerja Jha

Finalized the paper on Early Triassic palynoflora represented by abundance of *Lundbladispora*, *Densoisporites* and *Lunatisporites* in Manuguru area of Godavari Graben. Photodocumented stratigraphically significant taxa. Finalised and compiled palynological studies on coal bearing sediments from bore core MMV-6 from Venkatpur area, Godavari Graben and also carried out DOM studies for palaeoenvironmental interpretations and photodocumentation of stratigraphically significant taxa.

Neerja Jha & Pauline K. Sabina

Palynological investigations carried out in Kachinapalli area of Godavari Graben indicated existence of two coal horizons: one belonging to Lower Barakar (early Permian) showing dominance of non striate disaccates chiefly *Scheuringipollenites* and other belonging to Raniganj (late Permian) showing dominance of striate disaccates chiefly *Faunipollenites* and *Striatopodocarpites* along with stratigraphically significant taxa, viz. *Lunatisporites*, *Falcisporites*, *Chordasporites*, *Guttulapollenites*, *Klausipollenites*, *Stroterisporites*, *Hamiapollenites*. Also photodocumented significant taxa.

Neerja Jha & Neha Aggarwal

Thrust Area: FRONTIERS IN PALAEOBOTANICAL RESEARCH (Reconnaissance Projects to aid in development of future research direction)

Project 14.1: Carboniferous land plants in the Himalaya (Spiti): Phytogeographic and palaeogeographic implications

An excursion to the Spiti Valley in Himachal Pradesh has been undertaken during August 2010 and collected around 170 specimens of early Palaeozoic ages. The rocks belonging to early Ordovician (Thango Fm.), early-middle Silurian (Takche Fm.), early Devonian (Muth Fm.), early-late Carboniferous (Lipak, Po and Ganmachidam Fms.) have been traversed and searched for meso- and megafossils in and around Losar, Takche, Guling, Nadang, Tabo and Lari villages. Fragmentary plant

fossils were collected from some of these localities. We have not found any evidence of *Glossopteris* flora in this collection. In addition, around 30 meso- and megafossils belonging to the Carboniferous and Permian ages collected in the earlier excursion from the Spiti Valley have been processed, identified and studied. The specimens are fragmentary and poorly preserved and identified as the genera *Diplothemema*, *Zoophycus*, *Triphyllopteris*, lycopod stems and conifer axes.

K.J. Singh [& S.K. Parcha (WIHG)]

Project 14.2: Megaflora and palynology of the Kargil Molasse

Plant fossils have been analyzed from the Kargil, Tharumsa and Pashkyum formations (Kargil Molasse Group) belonging to Wakha-chu River Section near Kargil area based on the samples collected in two field excursions

(2008-2009 & 2009-2010). Plant fossils represented by leaf impressions of angiosperms and pteridophytes, spores and pollen grains of pteridophytes, gymnosperms and angiosperms, algal and fungal fruiting bodies, gyrogonites

of charophytes etc. have been recorded from the Kargil and Tarumsa formations belonging to the Kargil Molasse Group of northwest Ladakh Himalaya.

Preponderance of reworked miospores of Gondwanic affinity in the Oligo-Miocene sediments of Tarumsa Formation has been visualized. The sediments of Tharumsa Formation exposed along the Wakha-chu River yielded palynomorphs of Late Cenozoic affinities, along with rich reworked Gondwanic miospores of Late Permian (Tatarian) and Early Triassic (Scythian) age. Qualitative and quantitative analyses of reworked palynomorphs of Gondwanic affinities have been done. Interpretation has been made on the significance of abundant reworked Gondwana miospores in the Oligo-Miocene sediments of Tarumsa Formation. Occurrence of Late Permian and Early Triassic palynomorphs of Gondwanic affinity in the Oligo-Miocene sequence of

Tharumsa Formation suggests that the Late Permian - Early Triassic palynomorphs bearing older sedimentary formations were deposited within the leading passive edge of the Indian plate i.e., Zaskar Range and Lamayuru Complex. These palynomorph bearing sediments have been eroded, recycled and re-deposited into the Indus Suture trench-subduction complex during the Cretaceous Period. This erosional phenomena possibly continued till Late Miocene and Pliocene that resultantly affected by tectonic up-liftment and transportation of eroded older sediments through several fluvial channels towards the depositional and accommodation sites in the northwestern Himalayan regions. Two manuscripts are being finalized for publication.

R.C. Mehrotra, Madhav Kumar & AK Ghosh [& Ashok Sahni (Chandigarh) & K. Kumar (WIHG)]

Project 14.3: Chronology, palaeobotany and magnetostratigraphy of the Rajmahal volcano-sedimentary succession

Compiled the palaeofloral records recovered from the Intertrappean beds of the Rajmahal Basin. The palynoflora from the bed at Moti Jhama yielded long ranging taxa (*Auracariacites*, *Callialsporites*, *Podocarpidites*) occur from Jurassic to Early

Cretaceous. No significant age marker taxa could be observed. Hence precise age could not be defined.

Archana Tripathi (superannuated w.e.f. 31.07.2009) & B.N. Jana (superannuated w.e.f. 30.06.2009) [& Kanchan Pande (IITB) & G.V.R. Prasad (Jammu)]

Project 14.4: Neyveli lignites: Biostratigraphy and Palaeoecology

Analysis of samples from Mine-1A and Mine-II of Neyveli Lignite Mine, Tamil Nadu revealed a diversified assemblage of palynomorphs along with rich and varied organic matter. Significant palynotaxa in the assemblage are: *Proxapertites*, *Monocolpopollenites*, *Acanthotricolpites*, *Retipollenites*, *Tricolpites*, *Marginipollis*, *Pelliceroipollis*, *Dermatobrevicolporites*, *Lanagiopollis*, *Tribrevicolporites*, *Meliapollis*, *Retitrescolpites*, *Palaeosantalaceae*, *pites*,

Rhoipites, *Dipterocarpuspollenites*, *Verrutricolpites*, *Cruciferoipollenites*, *Ctenolophonidites*, *Jacobipollenites* and *Clavaperiporites* indicates early to middle Eocene age and coastal environment of deposition. In addition, documentation of palynological assemblages from Neyveli Lignite mine continued.

Rahul Garg (superannuated w.e.f. 30.11.2010) & M.R. Rao [& Ashok Sahni (Chandigarh) & R. Nagendra (Anna Univ, Chennai)]

Additional Research Contributions

The Owk Shale Formation of the Kurnool Group has yielded a rich assemblage of Neoproterozoic acritarchs, cyanobacteria *Obruchevella* and vaucheriacean alga *Jacutianema solubila*, *Parmia*, *Leiosphaeridia jacutica*, *Ostania microcystis*, *Navifusa*, *Polysphearoides filiformis*. Age constraint of the assemblage is an important indicator for the Kurnool Group. This is the first record of *Obruchevella* from peninsular Indian sequence. Besides, a manuscript on *Proterozoic Fossil Cyanobacteria*, prepared under ILTP, has been finalized.

Mukund Sharma

Collected and processed the palynological sample from the seepage in stagnant water filled Nala near Umaria village of Lakhimpur-Khiri district, Uttar Pradesh after Dainik Jagran News in January, 2011. No conclusive results are obtained.

Rupendra Babu, B.D. Singh, Madhav Kumar & Keshav Ram

The study of fossil leaves from the *Glossopteris* flora of the Lower Permian Gondwana sequence of the Barakar Formation of the Raniganj Coalfield has revealed the presence of different types of insect traces. The structures are compatible with a variety of insect activities on fossil leaves. Nibbled and cusped margins, trench marks, obliterated surfaces, blotch marks, and holes of various shapes constitute feeding traces, whereas egg pouches along the midrib and irregularly distributed oviposition marks are traces of egg laying. Although fossil records of both insects and their activities in the *Glossopteris* flora of India remain scarce, the different types of insect traces identified during the study demonstrate the existence of a diverse insect fauna during the Permian Period of India.

A. K. Srivastava (superannuated w.e.f. 31.01. 2011) &

Deepa Agnihotri

Analysed cuticular features of *Glossopteris stenoneura* Feistmantel from Barakar Formation, Churulia Area, Raniganj Coalfield (WB). The cuticular features indicate warm humid conditions with spells of high and low light intensities during deposition of Barakar sediments in the area.

A.K. Srivastava (superannuated w.e.f. 31.01. 2011),

Rajni Tewari & Deepa Agnihotri

Finalized two papers entitled 'Holocene ostracod and gastropod records from the lake sediments of Ganga Plain: Palaeoecological implications' and 'Spatial and temporal variations in the Lakes and Ponds of the interfluvial areas of Ganga Plain in the ~Past Hundred Years' based on the research work of Ph.D. thesis. Another paper entitled 'Holocene palaeoclimate reconstruction inferred from the phytoliths of the lake fill sequence of Ganga Plain' is being finalized.

Anju Saxena

Bennettitales were group of extinct seed plants characterized by pinnately compound crown of leaves occur on top of the stem gives superficial resemblance with Cycads. These plants constitute major part of the Mesozoic vegetation. The morphological variations, i.e. simple to compound leaves are apparent in Mesozoic fossil records of Indian Gondwana. It is observed that the simple leaf (*Nilssoniopteris*) is the ancestral form is maintained in ontogeny, while leaflets of compound leaves were developed gradually by subdivision and suppression of simple laminas. Furthermore advancement is visible through reduction in size of the pinnae (*Otozamites*) whereas, longitudinal differentiation is also apparent in *Ptilophyllum* along with catadromic and anadromic fusion of bases of various pinnae, exhibit morphological variations among bennettitalean fronds. The observation has been compiled and finalized.

The highly diversified plant fossils of conifers are preserved in compressed state in the vicinity of Sher River near Sehora village. They are represented by number of species of *Brachyphyllum*, *Pagiophyllum*, *Elatocladus*, *Araucarites* and *Coniferocaulon*. Podocarpaceae and Araucariaceae are predominant families and are cosmopolitan in southern hemisphere, but they grew and evolved simultaneously in both the hemisphere (Krassilov, 1974). The Baquero' flora of Patagonia, South America, Bluff flora of Alexander Island, Antarctica and flora of Mirihuku basin New Zealand have dominant conifers over other plant groups henceforth resembles to present Jabalpur flora. The presence of common elements in eastern Gondwana indicate that the Antarctic peninsula might have acted as biotic gateway for south America and India during Jurassic Cretaceous period before the breaking of Gondwanaland. A paper has been documented on the aspect.

Neeru Prakash

Palynological investigation on the Siwalik sediments of Gambhrola River section (30° 19'N: 76° 50'E) has been carried out for the first time (jointly with K. Ambwani). The samples were collected from river cutting section exposed near the bridge on Bilaspur-Swarghat Road, Himachal Pradesh. The palyno-assemblage comprises algal, fungal, pteridophytic spores, gymnosperm and angiosperm pollen grains. Algal genera are represented by *Azolla* (Azollaceae) and *Thalassiosira* (Fragilariineae). Fungal bodies of Microthyraeae and Ascomycetes are also present. Pteridophytes are representing the genera *Lycopodiumsporites* (Lycopodiaceae), *Cyathidites* (Cyathiaceae), *Polypodiisporites* (Schizeaceae) and *Schiesporites* (Schizaeaceae). Gymnosperm is represented by three genera— *Araucariacites*, *Pinuspollenites* and *Tsugaepollenites*. The angiosperm pollen grains belong to the genera *Inaperturopollenites* (Cupressaceae), *Graminidites* and *Monoporopollenites* (Poaceae), *Pseudonothofagidites* (Fagaceae), *Monosulcites* (Arecaceae), *Pseudonothofegidites* (Nothofagaceae) and *Tricolpate* (Dipterocarpaceae) are the significant taxa recovered from the area. On the basis of their affinities with modern equivalents taxa, a humid tropical to sub-tropical climate has been inferred during the deposition of sediments. The palynoassemblage indicates a fresh water environment during Lower Siwalik time. The plant fossils evidences (mega and micro) also indicate an evergreen to moist deciduous vegetation in this area during the Middle Miocene. Probably the pollen grains of gymnosperm taxa *Pinus*, *Tsuga* and *Araucaria* have been derived from a near by high mountain area.

Mahesh Prasad, E.G. Khare & S.K. Singh

A systematic study on the leaf impressions collected from the Mahuadanr valley, has been carried out which revealed the occurrence of 4 new taxa, viz. *Sweitenia mahogani* Linn., *Dysoxylum procerum* Hiern. (Meliaceae), *Opilia amentacea* Roxb. (Opiliaceae) *Rhamnus purpurea* Edgew. (Rhamnaceae) of dicotyledonous families. Present day distribution of all the modern comparable species of the fossils indicates that these taxa presently found to grow in the mixed deciduous forests of the Himalayan foot hills, central India, south India as well as in the adjoining area of the Mahuadanr Valley which suggests that such type of forest was flourishing in and around the fossil locality during the sedimentation and also continued till now.

Mahesh Prasad & S.K. Singh

Morphotaxonomic work on palynofossils recovered from the samples of Tarkeshwar lignite mine, Surat, Gujarat are continued. Palynofloral assemblage is

represented by algal cysts, fungal remains, pteridophytic spores and angiospermous pollen. Significant spore-pollen genera in the assemblage are— *Lygodiumsporites*, *Biretisporites*, *Todisporites*, *Dandotiaspora*, *Polypodiaceasporites*, *Arecipites*, *Palmaepollenites*, *Longapertites*, *Spinizonocolpites*, *Proxapertites*, *Acanthotricolpites*, *Margocolporites*, *Ctenolophonidites*, etc. The assemblage is marked with dominance of fungal remains, and angiospermic pollen. Data analysis and interpretation are in progress.

S.K.M. Tripathi & Hukam Singh

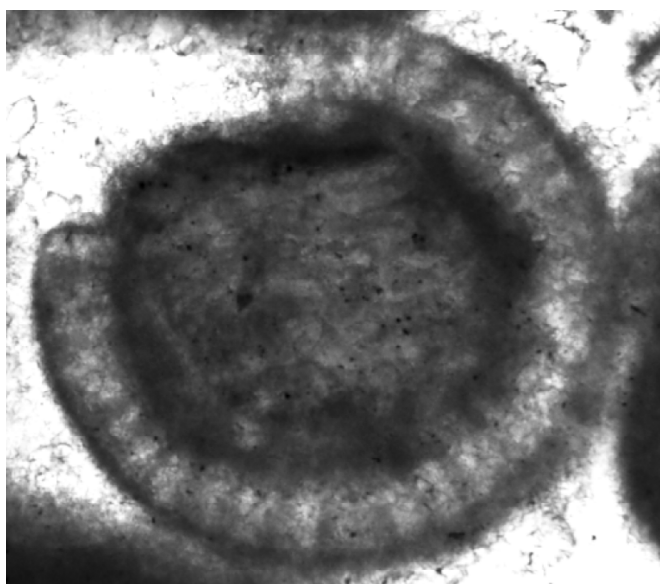
Palynological investigations of the Eocene sediments exposed along the Tura-Dalu Road, West Garo Hills, Meghalaya have been carried out. The palynoflora recorded from the Tura Formation is qualitatively poor. The recorded palynoflora mainly consists of *Intrapunctisporis intrapunctis*, *Polypodiisporites repandus*, *Podocarpidites ellipticus*, *Matanomadhiasulcites microreticulatus* followed by *Psiloschizosporis psilata* and fungal remains. A rich palynofloral assemblage has been recorded from the overlying Siju Formation which is dominated by dinoflagellate cysts, viz. *Achomosphaera ramulifera*, *A. sagena*, *Areoligera senonensis*, *Cordosphaeridium inodes*, *C. gracile*, *Homotryblum floripes*, *H. plectilum* and *Operculodinium centrocarpum*, whereas the Rewak palynoflora is mainly represented by spores, pollen and fungal remains. Some of the important constituents of the Rewak palynofloral assemblages are *Lygodiumsporites eocenicus*, *Polypodiisporites ornatus*, *Densiverrupollenites eocenicus* and *Hammenisporis susannae*.

Four distinct palynozones have been recognized on the basis of abundance and distribution of stratigraphically significant palynofossils. Palynological data suggest that the Siju Formation was laid down in transgressive phase of a shallow sea with sea floor oscillations. The dominance of terrestrial elements and decrease in dinocyst population in the overlying Rewak Formation clearly indicate two regressive phases along with a minor transgressive phase during the sedimentation. The difference in the composition of palynofloral assemblages between the Siju and Rewak formations is mainly due to facies changes. The Siju Formation is predominantly marine, whereas the Rewak Formation represents sediments deposited in coastal swamp environment. The palynoflora has been compared with the Eocene assemblages recorded from various sedimentary basins of India and abroad and has been assigned middle Eocene and late Eocene age for the Siju and Rewak Formation, respectively.

Samir Sarkar & R.K. Saxena

Eutrophication is a demon symbolizing the menace of water pollution, threatening the entire world by spreading its malignant impact across all water bodies around the globe. Several negative environmental effects like anoxia in water follow this leading to severe reductions of fishes and other biogenic entities of animal origin inhabiting the aquatic ecosystems. A review article entitled 'Eutrophication: A formidable foe' has been finalized.

Various aspects of extinction with particular reference to the major extinction events in the history of planet earth have been reviewed. The possible causes of these mass extinction events have been analysed. Attempts have been made to evaluate the present day anthropogenic activities i.e., man made extinctions responsible for the extinction of present day flora and fauna. Major threats to the present day biodiversity, chain extinction, concept of keystone species and activities of the International Union for Conservation of Nature and Natural (IUCN) resources also have studied in detail. A paper entitled 'Biodiversity dynamics in relation to the Mass Extinction Events on planet earth' has been finalized.



Ovulites arabica (udoteaceae green algae) from the Middle Eocene of Shella Formation, Jaintia Hills, Meghalaya

A.K. Ghosh & Suman Sarkar

Compiled data on macerals (both under normal and fluorescence modes), rank palaeofloral assemblages in Indian Cenozoic lignite deposits and discussed their significance in relation to economic aspects and depositional conditions. The deposits are sparingly banded in nature and chiefly constituted of huminite with subordinate proportions of liptinite and inertinite macerals. Associated minerals in the lignites are pyrite, siderite and

calcite. Argillaceous matter (clay, quartz) is usually in low proportions. It is evident that these lignite deposits originated from wood dominated peat accumulated in lagoons or near-shore back swamps. The vegetal matter experienced both anaerobic (wet-reducing) and aerobic (dry-oxidative) microbial degradation under neutral to alkaline subaqueous conditions.

B.D. Singh & Alpana Singh

Pollen analysis of honey from RDSO area (Alambagh) of Lucknow has revealed a good assemblage of pollen in terms of quantity and diversity. Among the recovered taxa *Syzygium cumini* was the major source of nectar as marked by higher frequency (37.38%) of its pollen. In addition, *Prosopis juliflora* (22.7%) and *P. spicigera* (10%) were also frequently visited by the bees for nectar and forage. The overall assemblage elucidates that these plants were in full bloom during the course of honey production and the honey was of multifloral nature. *Pithecellobium dulce*, *Tinospora cordifolia*, *Moringa oleifera* were the minor sources of nectar and bee forage as depicted by relatively low frequencies of their pollen. Further, the scanty pollen of nectarless plants *Chenopodium album* and Poaceae got trapped in the honey by wind or involuntarily carried by the honeybees to the hives.

M.S. Chauhan & Anjali Trivedi

Reported the account of *Cryptothallus mirabilis* v. Malmb.— an unique, non-chlorophyllous Bryophyte which grows hidden, below the ground layer. It is significant for palaeobotanical studies, particularly for Indian once because the description of this taxon is not available in the bryological literatures from here. This taxon is widely distributed (as reported from British Isles, Scotland, Norway, Sweden, Finland, Scandinavia, Leningrad, Denmark, Ireland, Germany, France, Portugal, Greenland and Costa Rica) but the distribution extent is not ascertained due to subterranean habit. The palynological investigation of its Scottish plants, matured in India, has shown that it produces permanent spore-tetrads. In Indian records, the fossil spore-tetrads are evidenced since early geologic time. The palynological features of *C. mirabilis* show overlapping with palynomorphs of other plant groups and its distribution limit is also not known, so palaeopalynologists particularly Quaternary pollen analysts have to be extra conscious while investigating the subsurface sediments because areas preferred for the Quaternary studies (i.e. swamp and lake sites) are preferred by this taxon too.

Asha Gupta

Twenty-four modern moss and subsurface soil samples are pollen analyzed to assess pollen/vegetation relationship from Rongrengiri reserve forest of East Garo Hills, Meghalaya. Pollen spectra depicts the existence of deciduous open lowland forest. The abundance of both monolete and trilete fern spores along with fungal remains especially Microthyriaceae, *Xylaria*, *Glomus* and *Pleospora* are suggestive of humid climatic condition. Besides, a 2.0 m sedimentary soil profile from Rongre swamp has been pollen analyzed to deduce vegetation development and climatic oscillations in East Garo Hills. A 10,640 yrs BP pollen sequence has been detected under three climatic regime viz., onset warm and humid-warm and dry. In addition, a Ph.D. thesis entitled 'Quaternary vegetational history and climate in and around Garo Hills, Meghalaya, North east India' has been documented.

S.K. Basumatary & S.K. Bera

Study of 15 modern surface soil samples shows a good agreement between modern vegetation and modern surface pollen samples across Cherrapunjee areas, Meghalaya. However, presence of some common non-forest taxa, grasses, *Artemisia*, Rosaceae, *Plantago*, Ranunculaceae, ferns and degraded pollen spores along with adequate fungal remain suggest deterioration of forest in recent past.

S.K. Basumatary, S.K. Bera & R. C. Mehrotra

Diatoms are sensitive indicators of environmental conditions in aquatic ecosystems and their distribution is mainly governed by the physicochemical composition of the water bodies and wet sediments. In the Mahi river basin of western India, water samples were investigated for their physiochemical characteristics and diatom assemblages. Overall the water samples collected from the Deccan basalt dominated areas compared to regions dominated by felsic rocks corroborates the lithologic control in determining the water composition. The distribution of diatoms population shows dominance of fresh water pennate forms represented by *Navicula* spp., *Achnanthes lanceolata*, *Pinnularia braunii*, *P.gibba*,

Gyrosigma sp., *Cymbella aspera*, *Stauroneis* spp. and *Cocconeis* sp. while the centric forms are marked by few occurrences of *Cyclotella* sp. and *Melosira* sp. only. The diatom population also shows significant variation in water bodies of upper and lower Mahi basin which further suggest control of lithology, meteorological parameter and anthropogenic activity in determining the diatom distribution.

Anupam Sharma, Vandana Prasad, Kamlesh Kumar & Biswajeet Thakur

Radiocarbon dating and palynology-based interpretation of climate since 40,000 yrs BP has been attempted (jointly with Anjali Trivedi, MS Chauhan & Anupam Sharma) based on Jalesar lake, Unnao. A comparative study of sedimentation rates and organic carbon contents in Tsokar lake Ladakh, Didwana Lake (Rajasthan) and Berijan Lake (Tamil Nadu) was made (jointly with B. Sekar, SK Bera & A. Bhattacharyya).

Theoretical work has been done and characteristic features of phonon dispersion curves have been explained for the normal modes of vibration for polyoxacyclobutane medication- I. Explanations have been offered for some other properties like heat capacity (jointly with Subodh Kumar & personnel from University of Lucknow).

C.M. Nautiyal

Study of fresh water phytoplankton is done including learning various techniques of sample collection, under the guidance of Dr. Sophia Barinova, Haifa University, Israel during her visit in BSIP. This has contributed an immense amount of knowledge for studying the health of fresh water ecosystems and the factors contributing to the changes in terms of climate and anthropogenic impacts.

Vartika Singh

Twenty honey samples from Nalabari, Kamrup, Morigaon, Sonapur districts of Assam are being studied for Melissopalynological investigations.

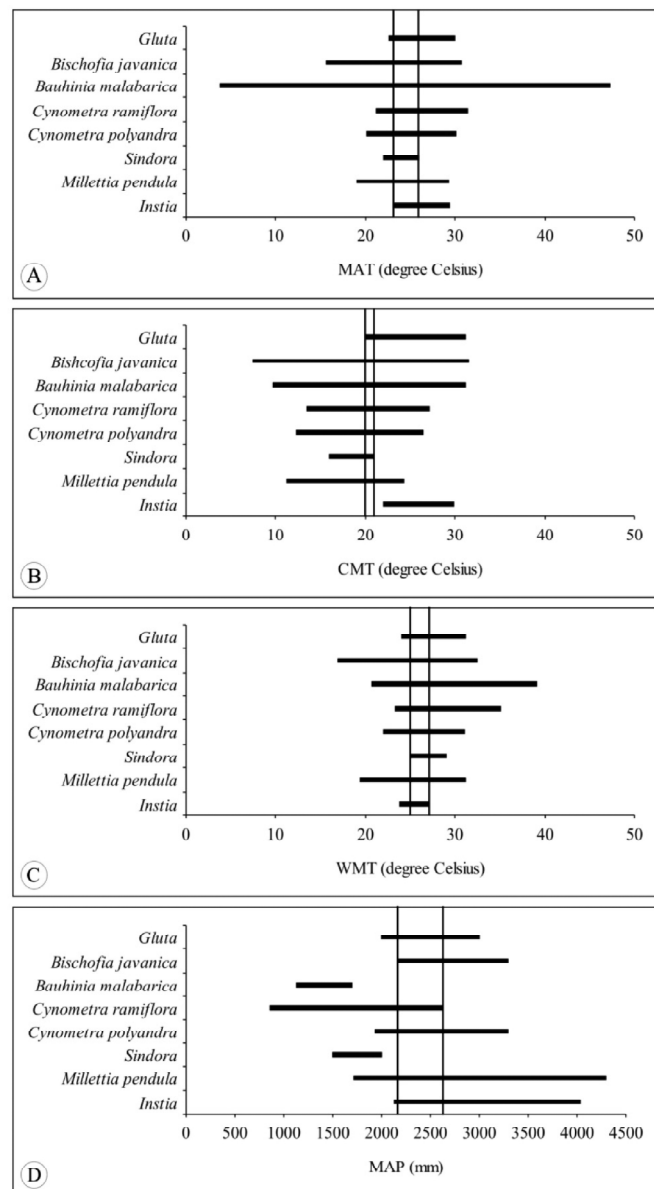
Shilpa Singh

Collaborative Work

Contributed to an internet based polling project on nomenclature of *Araucarioxylon* wood participated by different overseas scientists.

A. Rajanikanth [& Ronny Roessler & Marc Philippe (coordinators)]

Finalized a manuscript on the Green Island Ganges Delta based on CLAMP study.



Coexistence interval of the climatic parameters of the megafossils showing, (a) MAT, (b) CMT, (c) WMT, and (d) MAP (vertical lines indicating common range of all the modern comparable forms).

N.C. Mehrotra, R.C. Mehrotra & G. Srivastava [& R.A. Spicer, T.E.V. Spicer & J. Yang (Open University, UK) & Subir Bera & Sreelekha De (Calcutta University, Kolkata)]

The angiospermous megafossil remains reported from intertrappean sediments of Rajmahal Hills, Jharkhand were investigated critically. The examination of the previously reported flower-like and fruit-like fossils from Rajmahal Formation rules out their angiosperm affinity. It has been observed that they are related to bennettitalean and pentoxylean gymnosperms. A paper entitled “Revision of Early Cretaceous angiosperm remains from Rajmahal Basin, India, with notes on paleoecology of *Pentoxylon* plant” by Rashmi Srivastava and Valentin A. Krassilov is submitted in Cretaceous Research.

Rashmi Srivastava (& Valentin A Krassilov (University of Haifa, Israel))

Finalized palynological and petrological studies on early Eocene Matanomadh lignites of Kutch Basin. It is inferred that the studied sequence was deposited in tropical to subtropical coastal areas in proximity to the palaeo-shoreline and angiosperm dominated woody forest vegetation was the chief source for the lignites. Presence of pollen grains showing affinity with the family Dipterocarpaceae and biomarkers of dammar resin derived from the resin of these plants, suggest the appearance of this family during Eocene on the Indian subcontinent. Rock-Eval T_{max} and vitrinite reflectance data indicate that the studied lignites have fall in the early diagenetic zone of methane generation. High TOC content and presence of Type II/III kerogen suggest that the lignite bearing sequence has the potential to generate both oil and gaseous hydrocarbons. High hydrogen index (HI) as evidenced by Rock-Eval pyrolysis and high content of lipid-rich macerals determined through fluorescence study are in accordance with each other.

S.K.M. Tripathi, B.D. Singh & Alpna Singh [& S. Dutta & co-workers (IIT Bombay, Mumbai)]

Latest Maastrichtian nannofossils have been recorded from the Kallamedu Formation of the Ariyalur Group in the Cauvery Basin. These nannofossils are recovered from the matrix surrounding the clusters of dinosaurian eggs. The nannofossil assemblage can be correlated with UC 20d^{BP} Boreal zone of latest Maastrichtian age as *Corollithion exiguum* is present. Presence of *Pseudomicula quadrata* indicates UC 20 a-b^{TP} Tethyan and Tethyan intermediate zones of Upper Maastrichtian age. Rest of the forms recorded belong to Upper Maastrichtian except the record of *Biantholithus* cf. *sparsus* which indicates dawn of Palaeocene or NP1

zone of Martini, 1971 equated with NNTp1A of Varol, 1998. It appears that few zones are either missing or mixed at boundary level.

**Jyotsana Rai [& Mu. RamKumar
(Periyar University, Salem)]**

Finalized a manuscript entitled 'Early to Middle Albian age calcareous nannofossils from Pariwar Formation of Jaisalmer Basin, Rajasthan, western India and its significance'. Preparation of another manuscript on integrated ammonite-nannofossil studies in the Mesozoic succession of Jaisalmer Basin, a sequence stratigraphic framework is under progress.

**Jyotsana Rai & Abha Singh [& D.K. Pandey
(Univ. of Rajasthan, Jaipur)]**

A diversified palynofloral assemblage has been recovered from the Middle and Upper Siwalik sediments from Uttarbehania and its adjoining areas of Jammu, which is mainly dominated by gymnospermous pollen grains followed by pteridophytic spores, fungal spores and ascostromata and algal zygospores. Some of the significant constituents of the assemblage are *Pteridacidites*, *Polypodiaceasporites*, *Polypodiisporites*, *Lycopodiumsporites*, *Malvacearumpollis*, *Monoporopollenites*, *Compositoipollenites*, *Pinuspollenites*, *Cedripites*, *Podocarpidites* and zygospores of zygnemataceae. Quantitative dominance of gymnospermous pollen is an important feature of the recorded Upper Siwalik palynoflora. The distribution pattern of the palynofossils in the Middle and Upper Siwalik sediments clearly points toward palaeovegetational change as well as in palaeoclimate during the deposition of the sediments. Recorded palynoflora suggests that during the sedimentation the vegetation was of subtropical to temperate type and climate became colder and drier. The various palynoassociations that are identified from the pollen records of the Parmandal-Uttarbehani areas show patterns of interaction indicative of shifts in the mosaic vegetation types dominating the landscape during the Siwalik times. A freshwater swampy environment of deposition is interpreted for the older horizons, subsequently swampy conditions seems to have changed to a bottomland habitat.

**Samir Sarkar (& G.M. Bhat & S.K. Pandita
(Jammu University, Jammu)]**

A diverse zygnematacean zygospores assemblage along with gymnospermous and angiospermous pollen, pteridophytic spores has been recorded from the Upper Siwalik sediments of the Salauni River section exposed

near Kala-Amb in Sirmaur district (HP). High incidence of zygospores belonging to Zygnemataceae indicates stagnant shallow freshwater conditions during the sedimentation of Upper Siwaliks in the area. The presence of *Striatriletes*, *Palmidites* and *Cycadopites* in the assemblage indicates tropical-subtropical environment of deposition.

**Samir Sarkar & O.P.Thakur
[& N.N. Dogra (Kurukshetra University)]**

For the first time recorded the occurrence of coralline red algae from the lower part of Kopili Formation exposed in the Jaintia Hills of Meghalaya. Samples collected from the highly fossiliferous limestone bed (1-1.5m) of Nongkhleish village belonging to Jaintia hills yielded both smaller and larger foraminifera, characteristic of Upper Eocene age along with an assemblage of coralline red algae represented by *Spongites* sp., *Lithothoporella melobesioides*, *Lithothamnion* sp., and *Melobesioidae* gen et. species indet. Special emphasis has given on the palaeoecology and growth form analysis of the algal assemblage. The manuscript has been finalized.

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

Further work on fresh water diatoms and desmids collected from the Bankura district of West Bengal has been done. The previous work on fresh water diatoms and desmids collected from the Burdwan district (WB) has been finalized. Taxonomic analysis based on light microscopic as well as SEM observations on the present study have been done. Interpretation on the ecological perspectives on the algal assemblage is in progress.

A.K. Ghosh [& J.P. Keshri (University of Burdwan, WB)]

The selective resin material from Ratnagiri area for the organic geochemical characterization of South Indian lignite is processed for Pyrolysis GCMS studies. The FTIR work is under progress.

**Rakesh Saxena [& S. Dutta & associate
(IIT Bombay, Mumbai)]**

Pollen analysis of a 2.5 m sedimentary profile from Subankhata reserve forest, Baksha district (27 ka BP), Assam predicts four palynozones under cool and dry to increasing warm and humid climatic regime. Interpretation of data and preparation of manuscript is in progress.

**S.K. Basumatary & S.K. Bera [& G.C. Sarma (Gauhati
University, Guwahati)]**

Contributed data in the studies of tree-ring chronologies from the 'High Asia' region of the Himalayas, Karakorum, Tien Shan, and Tibetan Plateau for the reconstruction of large-scale summer monsoon drought variability over India and the Tibetan Plateau which is published in Science, 2010, vol. 328, pp 486–489 by Ed Cook and others and our inputs have been acknowledged as contributing authors of the paper.

A. Bhattacharyya & S.K. Shah [& Edward R. Cook (Lamont Doherty Earth Observatory, New York)

Two papers on Isotope analysis ($d^{13}C$ and $d^{18}O$) of tree-ring of *Abies pindrow* collected from forest near to Dokriani Bamak glacier, Uttarakhand and Interannual variations in cellulose oxygen isotopic composition ($d^{18}O$) of teak *Tectona grandis* from Peninsular India have been finalized.

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

Finalization papers in the reconstruction of climate from lake sediments of Ladakh and Eastern Himalaya based on magnetic susceptibility and other parameters are in progress

A. Bhattacharyya [& N. Basavaiah (IIGM, Mumbai)]

A paper entitled "Reconnaissance of Quaternary sediments from Khasi Hills, Meghalaya" has been finalised based on the work on spatial and temporal extent of Quaternary sediments at this region. In general such deposits are restricted to shallow depths in most of the sites except in one site where it is several meter (>4m) thick. AMS C-14 dates of these deposits suggest that sediments deposited are mostly of Holocene or in rare cases belong to later part of Pleistocene. Early Quaternary deposit is either missing or yet to be explored from this region. Natural hazards combined with human activity effecting degradation of vegetation and sediment cover are probably the main cause for poor Quaternary exposure at the region. Past climate and vegetation history from based on pollen data from these sub-surface sediments are in progress.

A. Bhattacharyya [Pawel Prokop (IGSO, Polish Academy of Sciences, Krakow)]

Studied vegetation dynamics of the Timberline zone and analysed impact of climate change on vegetation shift and species composition in Langtang National Park, Nepal Himalaya.

S.K. Shah [& R. Bhujju, Nepal Academy of S&T, Nepal)]

Thin veins of pseudotachylites are observed for the first time within the SAT zone of the Almora Crystallines, Kumaun Lesser Himalaya. The SAT zone presents a relatively wide zone of variety of mylonite types and thin dark coloured veins of these pseudotachylites are found as both cm wide veins as well as folded veins of irregular thickness. The pseudotachylites are formed by rapid crystallization of melts. Intense deformation and friction-related heating is generated during the thrust sheet movement and are responsible for producing the melts. Small amount of melts generated during the frictional heating cools rapidly in association of the wall rock and form thin veins, which have sharp boundaries (or folded) within the wall rock. Quartz, K-feldspar and plagioclase occur as porphyroclasts in the host rocks.

Anupam Sharma [& K.K. Agarwal, Nigar Jahan, Chandra Prakash & Amar Agarwal (Lucknow University & BHU)]

The hydrogeochemical study of surface and sub-surface water of Mahi River basin has been undertaken to assess the major ion chemistry, solute acquisition processes and water quality in relation to domestic and irrigation uses. The analytical results show the mildly acidic to alkaline nature of water and dominance of Na^+ and Ca^{2+} in cationic and HCO_3^- and Cl^- in anionic composition. $Ca^{2+}-Mg^{2+}-HCO_3^-$ is the dominant hydrochemical facies both in surface and groundwater of the area. The weathering of rock forming minerals mainly controlled the solute acquisition process with secondary contribution from marine and anthropogenic sources. The chemical composition of the water is largely controlled by silicate weathering with limited contribution from carbonate weathering and marine and anthropogenic sources.

Anupam Sharma & Kamlesh Kumar [& Abhay K Singh (CIMFR, Dhanbad)]

Studied samples from Spiti Valley for their sedimentary architecture and chronological parameters. Lithofacies analyses of relict sedimentary sequences located in the rain shadow zone of Tethyan Himalaya shows six different lithofacies. The valley is divided into two segments— Upper valley with broad, braided channel where sedimentary sequences rise above the river bed, and Lower valley which is meandering, narrow and incises the bed rock with fluvio-lacustrine deposits sitting on a bed rock bench. Geomorphic configuration of terraces, nature of channel, shape of river valley and seismites indicates a normal fault at transition between Upper and Lower valleys with activity around 7 ka. The six different lithofacies can be grouped into three lithofacies associations: i) glacial outwash, ii) sedimentation in channel and accreting bars under braided conditions, and iii)

formation of lakes due to channel blockage by landslide activity. Abnormal monsoon years at 14-8 ka and 50-30 ka are responsible for the phases of channel damming and lake formation in the valley.

Anupam Sharma & Binita Phartiyal [& Pradeep Srivastava & Yogesh Ray (WIHG, Dehradun)]

An integrated approach of field observations and magnetic analysis has been used to study the Khalsar palaeolake deposits of the Trans-Himalayan region to correlate its fabric with local and regional deformation events. The faults and thrusts in the Himalayan zones are active areas where the continuous northward movement has its impact on the sediments. This can be deciphered by visible strain markers like micro folds and faults, however in areas where this visible deformation is absent, it is challenging to carry out strain quantification. Thus a proxy like low-field magnetic susceptibility was used for fabric quantification in these sediments. The fluvio-lacustrine deposit at Khalsar is characterized by soft-sediment deformation structures (seismites) in its middle part while the upper part is devoid of any such features. The magnetic anisotropy indicates presence of tectonic fabric and E-W trending vertical to sub-vertical foliation in the entire section with magnetite being the primary remanence carrier in these sediments. The Karakoram Fault Zone (KFZ) shows regional curvatures (bends) in the north and south of this deposit and it is envisaged that this sequence was deposited probably due to formation of a pull-apart basin along the Shyok river valley due to top-to-the-south shearing along the KFZ. It is also suggested that the tectonic magnetic fabric has formed due to shearing assisted rotation and the steep dip can be attributed to northward convergence along the KFZ. The age and the type of magnetic fabric indicate a Late Quaternary tectonic event due to continuous northward convergence of the Indian plate along the KFZ.

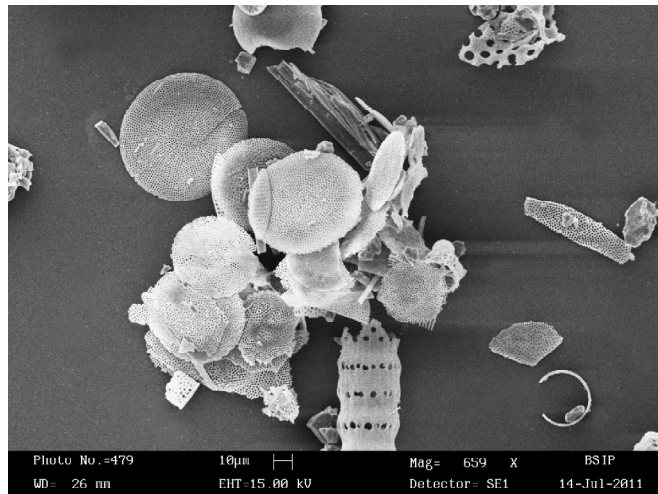
Binita Phartiyal [& Narendra Meena & Koushik Sen (WIHG, Dehradun)]

Detailed systematic studies on floral elements of Weller Formation (Early Permian) and Lashly Formation (Middle to Late Triassic) of Allan Hills, South Victoria Land, Transantarctic Mountains, Antarctica vis-à-vis correlation with flora of Gondwana sedimentary basins of India is in progress.

Rajni Tewari [& Sankar Chatterjee (Texas Tech University, Lubbock, USA)]

Processing of two short cores from the Southern Ocean sediments has been completed. Samples are processed for recovery of calcareous, siliceous and other

organic matter contents in order to ascertain the role of Southern Ocean in Quaternary palaeoclimate and palaeoceanographic changes. In addition, recovered organic matter (OM) content consists of siliceous OM, charcoal, degraded OM and amorphous OM content as revealed under the microscope.



Siliceous micro fossils from the deep sediments of the southern Indian ocean

Quantitative and qualitative distribution of the OM content is being done. Photography of the recovered OM under a light microscope is also being done along with the OM study. Samples are also being prepared for Scanning Electron Microscopy of siliceous microfossils.

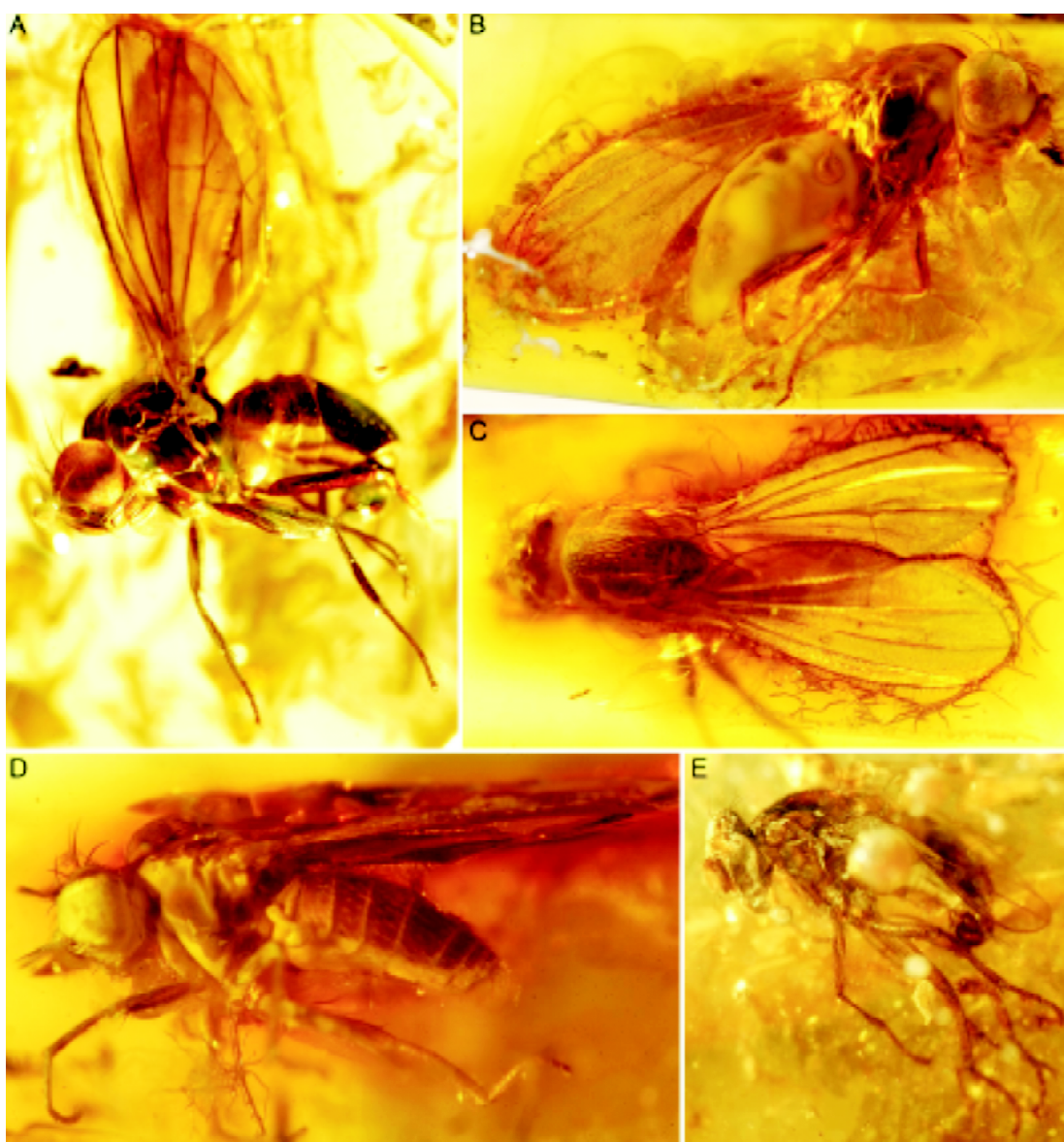
Processing of samples for study of core samples from eastern coastal region of southern India has been started for search for palaeo-tsunami and 2004 tsunami signatures based on changes in biotic components.

Vartika Singh [& NCAOR, Goa]

The genus *Pareuthychaeta* had previously been known only from two described species in Eocene Baltic amber (Lutetian, ca. 42 Ma), *P. electrica* Hennig and *P. minuta* (Meunier), some details of which are revised based on new specimens. A third Baltic species is described, *P. mcalpinei* Grimaldi, n.sp. Another new species, *Pareuthychaeta eoindica* Grimaldi, is described in earliest Eocene (Ypresian-aged, ca. 50-52 mya) amber from Gujarat, western India. Comments are provided on the relationships of *Pareuthychaeta* to Recent genera of Diastatidae sensu lato (including Campichoetinae), and implications of this extinct genus are discussed regarding biogeography and the early Paleogene Schizophora radiations. The extinct genus *Pareuthychaeta* Hennig was erected to accommodate two species preserved in

Eocene Baltic amber, *P. minuta* (Meunier) and *P. electrica* Hennig (Hennig, 1965). It was placed into the family Diastatidae since the two species bore some distinctive features with the Recent genera *Diastata* Meigen, *Campichoeta* Macquart, and *Euthychaeta* Loew. Diastatidae s.l. is most diverse in the Northern Hemisphere, though some species of *Diastata* and *Campichoeta* occur in southern Africa (Barracough, 1992) and South America (Grimaldi, unpubl.). *Diastata* contains approximately 40 described species, many of which have strikingly patterned wings; *Campichoeta* contains nine species; and the monotypic genus *Euthychaeta* contains just the European species *E. spectabilis* Loew, 1864.

All three of the Recent genera have traditionally been classified within Diastatidae (e.g., Duda, 1934; McAlpine, 1962), as they are treated here, but Griffiths (1972) proposed placing *Diastata* into Ephydridae (on the basis of possessing sclerotized ventral receptacles) and placing *Campichoeta* into its own family, Campichoetidae. The ventral receptacle is uniformly heavily sclerotized and U-shaped in *Diastata* (the spermathecae are vestigial and unsclerotized), but in *Campichoeta* the ventral receptacle is more globular and possesses a fine, tightly spiraled tubular extension (spermathecae are also sclerotized) (Kotrba, 2006). Chandler (1987), in his revision of the paleoarctic species of these genera, alternatively placed *Diastata* in



(A, B). *Pareuthychaeta electrica* Hennig, (C, D). *Pareuthychaeta macalpinei* Grimaldi, n.sp.(E). *Pareuthychaeta eoindica* Grimaldi, n. sp.

Diastatidae, and *Campichoeta* plus *Euthychaeta* in Campichoetidae. Grimaldi (1990) placed Campichoetidae as the sister group to Diastatidae+ Camillidae+ Risidae+ Ephydriidae, partly on the basis of ventral receptacle structure.

Hukam Singh [& David Grimaldi (USA)]

The development of mycorrhizae, symbiotic associations between the mycelium of fungi and vascular plants is considered to be a key innovation that enabled land plants to extensively colonize terrestrial habitats. Reported the first known fossil ectomycorrhizae associated with an angiosperm. Our fossils are preserved in a 52 million-year-old piece of Indian amber produced by the dominant hardwood tree (Angiospermae: Dipterocarpaceae) of an early tropical broadleaf forest of Gondwanan origin. Different developmental stages of the fossil mycorrhizae are delicately preserved in the ancient resin. Dissolving the amber surrounding one of the fossils allowed ultrastructural analyses and Raman spectroscopy, which revealed traces of fossil melanin in the dark hyphae – the first record of fossil melanin in amber and in a fossil fungus. The mycobiont is considered to be an anamorphic ascomycete and is described as *Eomelanomyces cenococcoides* new gen. et spec. Ectomycorrhizae may have conferred an evolutionary advantage on Dipterocarps, allowing them to become the prevalent overstory trees in India, from whence they spread into South East Asia, where they are still predominant today.

The find reveals that ectomycorrhizae occurred contemporaneously within gymnosperms (Pinaceae) and angiosperms (Dipterocarpaceae) by the Lower Eocene. Mycorrhizae, symbiotic associations between fungi and vascular plant roots, are ubiquitous in terrestrial ecosystems. Up to 90 % of all vascular plants live in a mutualistic association with fungi. One selective advantage of mycorrhizal symbioses is an increase in the plant's uptake of phosphorous and nitrogen. Additionally, some fungal partners protect the plants against droughts and diseases such as microbial soil-borne pathogens. At the

same time, the fungus gets a relatively constant and direct access to carbohydrates like glucose and sucrose that are transported from the leaves of the plants to the mycorrhizal systems. This symbiosis is considered to be a key innovation of early land plants that enabled them to extensively colonize terrestrial habitats. Additionally, visited Cambay Basin (Surat district), Gujarat lignite mines for collection of Eocene amber, lignite and shale samples for multidisciplinary work, viz. inclusions, palynology and mega botanical fossil study.

Hukam Singh [& Scientists (from Germany, USA & Srinagar, India)]

Pollen analysed a 3.06m deep sediment core from the temperate lake-Nachiketa Tal Garhwal Himalaya. The pollen sequence has depicted that between 5,304 and 3,912 yr BP the mixed conifer forests dominated by *Pinus* cf. *wallichiana* together with *Cedrus* and *Abies* occupied most of the landscape under a regime of a cool and dry climate. The broad-leaved forests mainly constituted of oak (*Quercus*) occurred sparsely in the moist and shady situations. The record of aquatic element, *Potamogeton* and freshwater alga-*Botryococcus* implies the existence of the lake. Between 3,912 and 2,975 yr BP, the mixed conifer forests got transformed into mixed oak-broad-leaved forests as evidenced from the much expansion of *Quercus* in response to inception of a warm and humid climate. Around 2,975 to 1,872 yr BP, the abrupt decline in *Quercus* and its broad-leaved associates and a corresponding spurt in *Pinus* cf. *wallichiana* reflect the re-establishment of pine dominated conifer forests with reversal of cool and dry climate. Around 1,872 to 767 yr BP expansion of *Quercus* with broad-leaved taxa and a decline of conifers reflect a warm and moderately humid climate. The encounter of *Cerealia* indicates that the area was under cereal-based agricultural practice. Since 767 yr BP onwards a warm and less-humid climate prevailed and consequently less-diversified mixed broad-leaved oak forest continued in the region.

Anjali Trivedi [& B.S. Kotlia & L.M. Joshi (Kumaun Univ., Nainital)]

Sponsored Projects

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)

Pollen analytical investigation of different profiles from Quaternary sediments of central Narmada Valley has unfolded palaeovegetation dynamics and corresponding climatic events of the region since early Pleistocene to Holocene. The following conclusions have been drawn:

The area in the vicinity of Dhansi Formation was covered with sparse grassland vegetation, chiefly constituted the members of Poaceae, Asteraceae, Chenopodiaceae and *Artemisia* with few intermittent trees of *Holoptelea* sp. and *Acacia* sp. under arid climate condition during Early Pleistocene. Around 35,000 yrs BP, tree savannah prevailed under warm and humid climate conditions. During 32,600 to 30,600 yrs BP, area experienced cool and arid climate which catered conditions to flourish open grassland type vegetation. Between 30,600 to 23,700 yrs BP, moderately warmer and semi arid climate which possibly altered open grassland in to tree savannah type of vegetation. During 23,700-19,700 yrs BP, the vindictive climate depleted the vegetation again to open grassland vegetation under cool and dry climate, corresponds to Last Glacial Maximum (LGM) episode, which has been globally documented in between 18 to 22ka (Bradley, 1999).

After the LGM Phase, the vegetation gradually changes from grassland to tree savannah and showing warm and humid conditions during 23,000-12,000 yrs BP. Presence of mixed moist deciduous forest components in the area suggest maximum vegetational concentration and diversity occurred during 11,000 to 8500 yrs BP under warm and humid climate which could be corroborated to invigoration of SW monsoon known as 'early Holocene climate optimum'. During 8500 to 7000 yrs BP, the tree savannah type of vegetation developed under relatively cool and dry climate which can be related to 8.2 ka yr BP global short lived cooling event, which is 'cool poles and dry tropics' pattern of short term. On the basis of increased concentration and diversity of arboreal taxa, the area shows the existence of dry deciduous forest flourished during 7000 to 5000 yrs BP under warm and humid climatic condition. During 4000 to 3100 yr BP, tree savannah flourished under cooler and dryer climatic conditions. The recurrence of both moist and dry deciduous

trees and increase in total diversity of flora indicate warmer and wetter conditions with improved monsoon during 3100 to 1350 yr BP. During 1350 to 377 yr BP, floristic composition shows improving trends of vegetation enhancement towards edifice of dry deciduous forest suggests a warm and humid climate more or less similar to today's climatic conditions.

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)

As per the objectives several exposed sedimentary profiles (Rayka, Jaspur, Dodka, Pratappura, Mujpur, and Dabka etc) were selected for the study. After establishing the chronology of these sampling sites, multiproxy data was generated on four profiles (Rayka, Pratappura, Mujpur, and Dabka). The interpretation of data on three sediment profiles is complete. The Mujpur and Dabka profiles are basically tidal estuarine deposits showing signatures of marine, fluvial and aeolian characteristics. The lower part has marine playnomorphs suggesting marine influence. The sediment character and sedimentary structures in middle section indicate deposition under fluvial state and more or less homogeneous sediment character in terms of mineralogy and geochemistry with only equi-size charcoal particles turn it to be of aeolian origin. The dominance of lithic component in the sediment, low Chemical Alteration Index (CIA) values and other geochemical parameters suggest that the sediment has gone under little chemical weathering and derived largely from the Aravali provenance. The Pratappura section is showing a time bracket of 29-3 ka BP, where the basal part is deposited at the terminal phase of MIS-3 under the fluvial regime. The successive sandy layer is an artifact of glacial regime probably related to LGM. A change in successive lithology indicates a change in provenance, more so it has appreciable amount of phytoliths including the burnt phytoliths of cultivated grains indicating human settlement. The magnetic, mineralogical, geochemical and biological parameters are also employed for their palaeoclimatic records. Besides, to understand contemporary ecological and surface geological processes, water samples from

the entire Mahi Basin was collected and analyzed. Based on the work two papers have been finalized.

Anupam Sharma, Vandana Prasad, Binita Phartiyal & Kamlesh Kumar [& S. Chakraborty (IITM, Pune) & Vivek Prasad (Lucknow Univ.)]

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)

Studied pollen morphology of 80 major tropical arboreal taxa belonging to moist deciduous and semi evergreen forest of Jokai and Jeypore reserve forest, Dibrugarh. The pollen morphological features and phenological data help in precise ecological status and identification of sub fossil pollen in sediments. Pollen assemblage from Jokai (2100 yrs BP at 120 cm), Jeypore (4200 yrs BP at 120 cm) and Jairampur (6650 yrs BP at 310 cm) sedimentary profiles of Upper Assam reflect three fold of climate sequences, viz., semi arid–warm and humid– increasing warm and humid. The establishment of vast low land forest with marshy swamp is evident during 1200 yrs BP in Jeypore, 700 yrs BP in Jokai and 500 yrs BP in Jairampur reserve forest. The area is threatened at medium to high level anthropogenic impact as evidenced by the occurrence of degraded palynomorphs along with fungal remains mostly of grass pathogen, viz. *Helminthosporium*, *Alternaria*, *Curvularia*, *Nigrospora*, *Botryococcus*, *Cookeia*, *Glomus*, *Xylaria*, Microthyriaceae, etc., providing clues for pastoral activity and biological degradation of microbiota during sedimentation under mostly warm and moist climate.

Assemblage of *Carya arborea*, *Rhododendron ellipti* and *Tsuga* pollen from Jeypore reserve forest sediment during 4200 yrs BP is significant which is not growing presently around the study area. The accumulation of exotic plants pollen in assemblage is suggestive of long distance transportation of pollen from high altitude. Ferns are suggestive of subtropical to cool temperate in origin. Presence of *Areca catechu* and *Persea* pollen in the sediment which is not growing in the vicinity of the Jeypore RF is significant. Saraighat river section is dated back to 5.83 Ka BP followed by three climatic phases, viz. relatively cool and dry to warm and moist. Detail diatom/pollen study is in progress.

A Ph.D. thesis entitled ‘Studies on palaeovegetation

and climate changes in tropical forests of lower Brahmaputra valley of Assam, Northeast India: a study based on phytodiversity, pollen record and anthropogenic impact’ is documented.

S.K. Bera & Swati Dixit

Project— Magnetostratigraphic, palaeontological and sedimentological studies of some selected sections of Bhuban Formation of Tripura-Mizoram Accretionary Belt (Sponsored by DST, New Delhi, No. ESS/16/254(4)/2005 dated 20.04.2007)

A large number of fossil woods collected from the Tipam Group of Mizoram have been sectioned and identified. They show affinities with *Dipterocarpus*, *Shorea* (Dipterocarpaceae), *Gluta*, *Mangifera* (Anacardiaceae), *Bursera* (Burseraceae), *Elaeocarpus* (Elaeocarpaceae), *Lagerstroemia* (Lythraceae), *Bauhinia*, *Cynometra*, *Millettia-Pongamia* and *Ormosia* (Fabaceae). The distribution pattern of these taxa clearly indicates a tropical climate. As majority of the taxa occur in tropical evergreen to moist deciduous and littoral and swampy forest, it can be inferred from the above facts that a warm and humid climate was prevalent in Mizoram during the Late Miocene. As 90% of the fossil taxa possess diffuse porous wood, this indicates typical tropical conditions with little seasonality. In the present assemblage majority of the taxa lack vasicentric tracheids and have generally large vessels with simple perforation plates which indicate high precipitation. The fossil assemblage is conspicuous in having some Southeast Asian elements, such as *Gluta*, *Shorea* and *Dipterocarpus*.

A Ph.D. thesis entitled ‘Palaeofloristics of northeast India and its implications based on megaremain’ is documented.

R.C. Mehrotra & Gaurav Srivastava

Project— Cenozoic vegetation and climate changes in China and India and their response to the Himalayan uplift (Sponsored by DST, New Delhi, No. DST/INT/PRC/Proj-1/2008, dated 11.09.2008)

Investigated about 20 fossil woods collected from the Pliocene sediments of Yunnan Province, China. They were exposed under the high power microscope and have been tentatively identified up to the family level. They belong to the Anacardiaceae, Lythraceae, Euphorbiaceae and Fabaceae. Their further identification is under progress.

Visited (RCM) Institute of Botany, Chinese Academy of Sciences (CAS), Beijing and discussed with

Prof. Song Ge (Vice Director) on several scientific matters of mutual interest. Also visited the Natural History Museum, Beijing to have a glimpse of the important elements of the fossil flora of China. This is the first museum of natural sciences founded in China with strong research capability and abundant specimen collections. The museum building covering a floor space of 24,000 sq m houses four main exhibitions of palaeontology, botany, zoology and anthropology. One special attraction is the exhibition of dinosaur world. The museum displays some rare fossils including the first angiosperm named *Archaeofructus*.

Visited the Geological Museum, Beijing. It was opened in 1916. It has accumulated abundant natural treasures as well as intangible assets over decades of development along with China's modern science. It is known among its kind in Asia for its rich and systematic collection. The museum houses more than 200,000 pieces of geological specimens, covering almost all geological sectors. Also visited the Botanical Gardens of Beijing and Kunming and had interactions with the scientists working in the Institute of Botany, CAS, Kunming. Besides, surveyed the famous Xishuangbana Tropical Garden and Rain Forest of the Yunnan Province of China. Xishuangbana, situated in the south west of China, is the only region near the Tropic of Cancer where large areas of tropical rainforest are preserved. There exists diverse and unique ethnic forest culture that maintains the biological diversity.

N.C. Mehrotra, R.C. Mehrotra & D.C. Saini [& Cheng-Sen Li, Yu-Fei Wang & Yi-Feng Yao (IB, Beijing, China)

Project— Fluctuation in the Zemu area based on multi proxy records, tree-ring, pollen and isotopic data (Sponsored by DST, New Delhi, No. ES/91/38/2005, dated May 2008)

Field trip to North Sikkim, Eastern Himalaya (November 09-December 07, 2010): During this field trip tree-ring samples from three different conifer species; sub-surface and surface sample for pollen analysis have been collected covering sites ranging from temperate to close to Zemu Glacier, North Sikkim. Analysed 21 surface samples for pollen analysis collected during field expedition of May, 2008. The preliminary statistical analysis of the data shows separation of high altitude alpine sites from temperate sites based on the species composition.

A. Bhattacharyya & Mayank Shekhar

Project— Analysis of climatic changes since LGM from south-west continental margin of India using multi-proxy data: pollen, diatom and tree-ring data (Sponsored by ISRO-IGB, 2009)

Palynological analysis made from a core (PK2) collected from Pookot Lake situated at Kerala in the Western Ghats (11°32'30" N; 76°1'38" E) covering time span of 3100 yr. BP to recent has been prepared. Pollen percentage representation of tree shrub and herbs in the pollen spectra have been compared with the magnetic susceptibility data of that core analyzed by Prof. R. Shankar and Dr. Sandeep, Geology Department, Mangalore University. A positive correlation has been noticed in representation of trees around the Pookot Lake Site and magnetic susceptibility data i.e. higher representation of trees with higher magnetic susceptibility values. Detailed analysis with collaboration of Prof. R. Shankar is in progress.

A. Bhattacharyya, S.K. Shah & Sandhya Sharma

Project— Late Pliocene palynochrono-startigraphy in north-eastern part of Cauvery Delta: Implication in palaeoclimatic sea-level studies (Sponsored by DST, New Delhi, No. SR/S4/ES-264/2007, dated 30.09. 2008)

The study of surface sediment and 5 core samples from Pichavaram and adjoining estuarine areas has been completed. The study of surface samples has been published. Field work was undertaken in Vellar, Coleroon and Pichavaram areas. Ten core sediment samples are collected for Radiocarbon dates, geochemical and palynological study. About 20 surface soil/water samples are collected for geochemical and palynological study. Palynological study in the sediment core samples is under progress.

Anjum Farooqui & Jyoti Srivastava

Project— Palynology and sediment-geochemistry of the Chaurabari (Kedarnath) and Hamtah (Lahaul-Spiti) Glacier deposits, Western Himalaya: An investigation of high-altitude climate variability in Holocene (Sponsored by DST, New Delhi, No. ES/91/19/2008, till September 2010)

This was a one-year pilot project for reconnaissance field work around Chaurabari (Kedarnath) and Hamtah (Lahaul-Spiti) glaciers. Field excursions were undertaken around the two glaciers, the different glacio-geomorphic features were observed and potential areas for the collection of samples for palynological studies were identified.

Ratan Kar

Project— Palaeobotanical studies on Indian and Brazilian sedimentary basins with special reference to marine dinoflagellate cysts, Gondwana flora and their applications (Sponsored by DST, New Delhi, No. DST/INT/Brazil/RPO-24/2007, dated 22.01.2009 & CNPq, Brazil)

Pennsylvanian lycopsids from the third interglacial level of the paleofloristic succession of the Itararé Group, Monte Mor (SP), in the northeastern border of Paraná Basin, Brazil have been systematically analysed. The Pennsylvanian lycopods of the Itararé Group are represented by diverse megafossils, megaspores and microspores species. The taphoflora corresponds to the *Paranocladus-Ginkgophyllum-Brasilodendron* association (PGB as.) recovered from its type locality Volpe ranch, in Monte Mor municipality, SP. The megafossils belong to the taxa *Bumbudendron millani*, *B. cf. B. paganianum*, *Brasilodendron pedroanum*, *Brasilodendron* sp., *Leptophloeum cf. L. sanctaehelenae* and *Cyclodendron* sp. The diversity and abundance of the megafossils (sometimes forming coal beds in a glacial context) indicates climatic ameliorations of an interglacial phase of the “time Itararé”. They represent paleoecological hydro-hygrophylous communities of a fluvial-lacustrine depositional environment. The biostratigraphical distribution of these taxa and their association with *Paranocladus*, *Ginkgophyllum* and *Buriadia* suggests a paleofloristic correlation with the *Krauselcladus - Asterotheca* Phytozone of northwestern Argentinean paleofloristic zonation. The lycophytic megaspores recorded from this level previously suggests a diachronic correlation with the Permian Talchir and Kaharbari associations of Indian Gondwana Flora.

Sandra E. Mune, Mary E.C. Bernardes-de-Oliveira & Rajni Tewari

Finalized the studies on the Lower Pennsylvanian megaspores from northeastern border of the Paraná Basin, Brazil vis-à-vis correlation with Indian Gondwana. The megaspores are recorded from lower and middle levels of Itararé Group of Campinas municipality (Upper Bashkirian-Lower Moscovian) and of Monte Mor municipality (Kazimovian), São Paulo State, Brazil. 24 species of megaspores have been systematically analysed from one or both of these localities. Among them, synonymy of 4 previously described megaspores has been discussed. The megaspores recovered from Campinas, based on previous and present study are— *Banksisporites dijkstrae*, *B. endosporitiferous*, *B. tenuis*, *B. utkalensis*, *Biharisporites spinosus*, *Bokarosporites*

psilatus, *B. rotundus*, *Duosporites perversus*, *Duosporites* sp. a, *Lagenicula horrida*, *Lagenicula* sp., *Lagenosporites brasiliensis*, *L. nudus*, *L. sinuatus*, *L. rugosus*, *Lagenosporites cf. L. hispanicus*, *Lagenosporites* sp. and *Calamospora* sp. The complete list of megaspores based on previous and present study from Monte Mor includes the taxa *Banksisporites dijkstrae*, *B. endosporitiferous*, *B. tenuis*, *B. utkalensis*, *B. labiosus*, *B. vulgatus*, *Bokarosporites rotundus*, *Duosporites* sp. b, *Sublagenicula tripartites*, *Lagenosporites brasiliensis*, *L. nudus*, *L. sinuatus*, *L. rugosus*, *L. scutiformis*, *Lagenosporites cf. L. hispanicus*, *Setosisporites* sp. and *Calamospora* sp. Among these, *Banksisporites labiosus*, *Sublagenicula tripartites*, *Lagenosporites scutiformis* and *Setosisporites* sp in spite of being mentioned in previous studies are not recovered in the palynological analysis of present study. The taxa *Bokarosporites rotundus*, *B. psilatus*, *Banksisporites utkalensis*, *B. endosporitiferous*, *B. dijkstrae*, *B. tenuis* and *Biharisporites spinosus* are known from Permian of India. The presence of these taxa in the Pennsylvanian of Paraná Basin, Brazil indicates their appearance in the Carboniferous and while all of them persisted up to the Permian some like *Biharisporites spinosus*, *Banksisporites tenuis* and *B. utkalensis* extended up to Triassic and Early Cretaceous thus reflecting on the evolutionary history of early land plants. An attempt has been made to interpret the palaeogeographic distribution pattern of some of the megaspores.

Sandra E. Mune, Rajni Tewari & Mary E.C. Bernardes-de-Oliveira

Finalized the studies on the interglacial microflora from Monte Mor (SP) Itararé Group, North eastern Paraná Basin (Brazil) and its diachronic correlations with Indian Gondwanic microflora. Carried out studies on Monte Mor locality. Late Carboniferous (Kazimovian-Gzelian) palynoflora recorded from Itararé Sub-Group (Parana Basin) in Monte More locality, Sao Paulo State. Based on palynological content of surface samples from the upper and lower levels of coal beds from this locality its interval zone position has been revised and interpreted.

Neerja Jha, Mary E.C. Bernardes-de-Oliveira, Sandra E. Mune & N.C. Mehrotra

Project— Palaeobiological studies from the Ganga Basin and their biostratigraphic correlation with the pre-Tertiaries type sections of Garhwal Himalaya (Sponsored by ONGC, No. BLKM/Ganga/09-10/BSIP)

Recorded 233 microfossils taxa comprising of

acritarchs, algae, VSM and micro-invertebrates from the 27 palynological slides and 163 core samples belonging to Madhubani Group of Ganga Basin provided by Oil and Natural Gas Corporation, Dehradun, Uttaranchal State, under MOU. The detailed report has been presented before RAC and GB of Frontier Basins, ONGC, Dehradun (on October 21-22, 2010).

**N. C. Mehrotra, Rupendra Babu & V.K. Singh
[& P.K. Maithy & G. Kumar]**

Processed the provided samples both surface and subsurface of Himalayan Foot Hills, Vindhyan Supergroup and Krol Belt of Himalaya. The preliminary report of Himalayan Foot Hill samples has been submitted to Frontier Basins, ONGC.

**N. C. Mehrotra, Rupendra Babu & V.K. Singh
[& P.K. Maithy, G. Kumar & M. Kumar]**

Project—Biofacies analysis of Palaeogene and Neogene carbonate sediments in India with special reference to calcareous algae (CSIR JRF (NET) Fellowship, CSIR Grant No. 09/528 (0016)/2009-EMR-I).

Contemporary taxonomic perspectives of fossil coralline red algae have been reviewed and their possible origin vis-à-vis evolution has been traced. Besides, calcareous algae have been recovered from 4 samples and two distinct facies types have been recognized in the thin section analysis algae collected from the Umlatdoh Limestone Member of the Shella Formation. One of the facies is chiefly dominated by non-geniculate coralline red algae and benthic foraminifera. The non-geniculate corallines are represented by species of *Lithothamnion* and *Mesophyllum* of family Hapalidiaceae, species of *Lithoporella* belonging to family Corallinaceae and species of *Sporolithon* of family Sporolithaceae. The other facies type is rich in calcareous green algae along with benthic foraminifera. The green algal genera belong to families Dasycladaceae, Udoteaceae and Halimedaceae. This is the first comprehensive report on the occurrence of non-geniculate coralline red algae from the Umlatdoh Limestone Member of the Shella Formation. Based on the algal-foraminiferal assemblages, two facies types have been identified and an interpretation has been made on the palaeoenvironment and palaeobathymetry. A manuscript has been finalized.

The diversification pattern of the family Sporolithaceae (Corallinales, Rhodophyta) in India has been studied. The genus *Sporolithon* belonging to family Sporolithaceae witnessed the K-PG Mass Extinction in India have survived one of the world's largest catastrophic

event. Analysis of the data recorded from India has been done and the manuscript has been finalized. Work on the diversity, growth-form analysis, taphonomy and palaeoecological implications of Corallinacean Red Algae and Halimedacean Green Algae from the Prang Limestone Formation of South Shillong Plateau has been completed. The manuscript has been finalized.

A field excursion has been undertaken to Jowai-Badarpur road section of Jaintia Hills district, Meghalaya. The Jowai-Badarpur road cutting sections exhibits classical shallow marine sediments of late Paleocene/early Eocene to late Eocene age. Three Limestone units of Shella Formation (Jaintia Group) are very well exposed in the NH 44. These limestone units are Lakadong, Umlatdoh and Prang in ascending order. These limestones are highly fossiliferous and are rich in benthic foraminifera and calcareous algae. In order to analyze the algal rich facies survey and field work have been conducted at 6 outcrops between Jowai and Tonseng on the Jowai-Badarpur Road (NH-44). In all the outcrops, sections have been measured and rock samples have been collected for the study of calcareous algae and other biofacies components.

Suman Sarkar & A.K. Ghosh

Project— Studies on Quaternary vegetation, climate change and human habitation in the Central Ganga Plain (Sponsored by DST, No. SR/WOS-A/ES-18/2009)

Pollen analysis of 5 surface samples from Jalesar Lake, Unnao district (UP) has revealed the dominance of non-arboreals and relatively low frequencies of arboreals trees and shrubs. Among the tree taxa, *Acacia* (av. 6.35%) and *Madhuca indica* (av. 4%) are the principal components and they are consistently represented with av. 9.35% pollen, whereas rest of the trees viz., *Capparis*, *Holoptelea*, *Bauhinia*, *Ailanthus*, etc., which occur commonly are recovered very scantily. The under-representation of all these taxa could be inferred to their low pollen production owing entomophilous mode of pollination. On the whole, the trees taxa constitute av. 17% fraction of the total pollen rain. The representation of grasses, sedges, Chen/Am, Caryophyllaceae, Brassicaceae, Asteraceae, etc. substantiates their actual composition in the ground flora. The frequent encounter of Cerealia along with other culture taxa viz., Chen/Am, Brassicaceae, *Artemisia* and *Cannabis sativa* reflects the proximity of human habitation.

Pollen analysed a 2.8 m deep trench profile from Jalesar Lake, Unnao district. The pollen sequence has demonstrated that between 43,000 and 25,291 yrs BP this

region supported open vegetation largely comprising grasses; Asteraceae, Chenopodiaceae/ Amaranthaceae with sparingly distributed trees of *Syzygium*, Meliaceae, etc. under a cool and dry climatic condition. The record of the aquatic elements, viz. *Typha*, *Potamogeton* and freshwater alga-*Botryococcus* suggests the existence of the lake. Between 25,000 and 3,846 yrs BP, the gradual immigration of a few trees, viz. *Holoptelea*, *Acacia*, *Emblica officinalis*, etc. occurred with the amelioration of climate. Around 3,846 to 2,006 yrs BP, the incursion of a large number of trees, *Madhuca indica*, *Aegle mormelos*, *Adina cordifolia*, etc. took place and consequently the groves of forest got established, which were interspersed with open herbaceous vegetation. This change in the floristic pattern elucidates that the region experienced a warm and humid climate. The debut of *Cerealia* pollen ca around 4,000 yrs BP suggests the onset of agricultural practice in the region. The lake assumed a wider dimension as manifested by the consistent presence of aquatic elements. Since 2,000 yrs BP onwards the depletion in the arboreals implies that the forest groves turned sparse due to prevalence of a relatively less-humid climate.

Undertook a field excursion to Bari Tal, Gohna Kala, Lucknow and collected a 2.8 m sediments profile comprising 32 samples for pollen analysis at 10 cm intervals and 5 bulk samples for C-14 dating at broader intervals. In addition, 10 surface samples are also picked up from the vicinity of Bari Tal to study modern pollen deposition pattern in the region.

Anjali Trivedi

Project— Hydrological changes in western Himalayan region during the last millennium (sponsored by DST, New Delhi; No. SR/S4/ES-468/2009)

Selection for the appointment of project staffs has been done. The research work is yet to be taken up.

R R Yadav & B. Sekar

Project—Development of long-term high-resolution climate records for western Himalaya, India using multi proxy tree-ring parameters (sponsored by ISRO-GBP)

Advertisement for the recruitment of project staff has been done. The research work is yet to be taken up.

R R Yadav

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- Vijaya, Murthy S & Vethanayagam SM – Palynology and age of the subsurface strata in Birbhum Coalfield, West Bengal, India. *Gondw. Geol. Magz.*

Consultancy / Technical Assistance Rendered

The **Radiocarbon Laboratory** also served as a national facility for various organizations and workers across the country for dating materials like sediments, charcoal, shells and other carbonates, etc. under consultancy. A total of 88 samples were dated under consultancy. Scientists from the following organizations availed of the consultancy services:

Sambalpur University, Orissa
Jadavpur University, Kolkata
Anna University, Chennai
Matkulia Bali, Amritsar
Archaeological survey of India, New Delhi
Archaeological Survey of India, Lucknow
UP State Archaeology Department, Lucknow
Agharkar Research Institute, Pune
Andhra University, Visakhapattanam
Institute of Archaeology, Columbo (Srilanka)
National Institute of Oceanography, Goa
Pondicherry University, Puducheri
Geological Survey of India, Kolkata
University of Lucknow, Lucknow
National centre for Biological studies, Bengaluru
Dibrugarh University, Assam
DST Project at BSIP

The **SEM Unit** has provided consultancy in investigating the ultra structural morphology and micro-analysis of samples received from about 80 researchers of following organizations/ universities:

Department of Physics, Lucknow University, Lucknow (Nanofilm/powder- 80)

Department of Chemistry, Lucknow University, Lucknow (Fly ash, adsorbent crystals structures /nanno powder- 45)

National Botanical Research Institute, Lucknow (Botanical, Microbiological samples- 44)

Banaras Hindu University, Varanasi ((Pharmaceuticals / algae- 9)

Central Drug Research Institute, Lucknow

(Pharmaceuticals samples- 8)

Saraswati Dental College, Lucknow (Dental materials- 8)

CSM Medical University, Lucknow (Tooth/ Dental materials- 15)

Babu Banarsi Das National Institute of Technology and Management, Lucknow (Teeth/ Pharmaceutical- 19)

Central Institute for Plastic Engineering and Technology, Lucknow (Polymer samples- 27)

Central Institute for Plastic Engineering & Technology, Hazipur, Bihar (Polymer surface-27)

Sant Gadge Baba Amravati University, Amravati (Botanical samples- 33)

Department of Chemistry, Agra College, Agra (Powder material- 5)

Indian Institute of Toxicology Research, Lucknow (Natural polymer, fly ash, nannomaterials- 18)

Career Post Graduate College of Dental Sciences, Lucknow (Dental material- 24)

Central Institute of Medicinal and Aromatic Plant, Lucknow (Botanical samples- 24)

UP Dental College and Research Centre, Lucknow (Dental materials- 54)

Integral University, Lucknow (Nano material/crystal samples - 44)

Kothiwal Dental College and Research Centre, Moradabad (Teeth/ dental material-70)

Allahabad University, Allahabad (Spores, woods- 31)

Sardar Patel Institute of Dental and Medical Sciences, Lucknow (Dental material- 45)

Amity University, Lucknow (pharmaceuticals - 2)

Chandra Dental College and Hospital, Barabanki (Dental material- 4)

Bundelkhand University, Janshi (pharmaceuticals- 11)

Computer Section has provided the training to two students of B.Tech. (Computer Science) from Rameshwaram Institute of Technology and Management,



Sitapur Road, Lucknow for a period of one month (July 01-30, 2010).

The **Library** staff provided technical training to Ms Priyanka Srivas deputed by the Board of Apprenticeship Training (Northern Region), Kanpur.

Neerja Jha provided summer training in Gondwana Palynology to a M.Sc. (Tech., Geology) student from Banaras Hindu University, Varanasi.

Samir Sarkar provided palynological training to Mr. U.V. Singh, B. Tech. student of Rajiv Gandhi Institute of Petroleum Technology, Raebareli, U.P.

S.K.M. Tripathi imparted training for palynological studies to Mr. Runcie P. Mathews, Research Scholar, IIT, Bombay, Mumbai for a period of three weeks (in September, 2010).

Chanchala Srivastava imparted training on investigation of macro-remains from Archaeological sites to Ms Tulika of Department of Ancient History and Archaeology, University of Allahabad, Allahabad.

A. Rajanikanth as Convener, Museum extended specialized services to visitors from time to time.

Mukund Sharma imparted training on Micropalaeontology and its application to Mr. Swami Manikanta and Mr. Udai Kiran of the Department of

Petroleum and Earth Sciences, University of Petroleum and Energy Studies, Dehradun for a period of five weeks (in June-July 2010).

Alpana Singh and **B.D. Singh** provided consultancy services to BRGM (France)/ MECL (Nagpur) for the coal petrographic study (maceral contents and reflectance values). In addition, provided scientific assistance in observation of coal samples under SEM to Mr. Parashar Mishra, Research student of CIMFR, Dhanbad.

B.D. Singh provided scientific assistance in observation of coal microconstituents (both under normal and fluorescence modes) and in measurement of vitrinite reflectance to Mr. Ashish C. Shukla, Research student of IIT Bombay, Mumbai for a period of three weeks (in May-June 2010).

C.M. Nautiyal imparted training to Mr. P.K. Gautam of Geology Department, Pondichery University Puduchery, who worked as a Summer Research Fellow for 8 weeks under Indian Academy of Sciences' joint programme with other academies in the Radiocarbon Laboratory (in May-July, 2010).

Anjum Farooqui guided Dissertation (B.Tech-Geoscience; final year) work of one student (Alice Deepika Prasad) of University of Petroleum and Energy Studies, Bidholi Campus, Dehradun.

Papers presented at Conferences/Symposia/Meetings

- Alok, Kannaujia AK & Prasad M – Plant fossils from Siwalik sediment of Tanakpur area, Uttarakhand, India and their significance. *Nat. Conf. & XXVII-Conv. Indian Assoc. Sedimentol.*, Jammu, December 2010.
- Bali R, Agarwal KK, Bera SK, Nawaz Ali S, Nautyal CM, Patil SK & Srivastava P – Palaeovegetation and palaeoenvironmental inferences from the upper reaches of the Pinder valley, Kumaun Himalaya using multiproxy data. *Nat. Sem. Late Quaternary Geol. Himalayan Orogen & the Foreland Basin*, Lucknow, February 2011.
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- Bhattacharyya A & Shah SK – Climate reconstruction from tree ring data of western Himalaya and its teleconnection with global sea surface temperature and sea level pressure *World dendro 2010 The 8th Int. Conf. Dendrochronology*, Rovaniemi, Finland, June 2010.
- Chauhan MS – Late Quaternary vegetation and climate change in the sub-alpine belt of Parvati Valley, Himachal Pradesh. *Nat. Sem. Late Quaternary Geol. Himalayan Orogen & the Foreland Basin*, Lucknow, February 2011.
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- Prakash N – Vegetation and palaeoclimate Upper Gondwanas of Satpura Basin. *Indo-Brazilian Symp. Glimpses of Gondwana Research*, BSIP, Lucknow, November 2010.
- Prakash N – Paleoflorostics and palaeoclimatic interpretation of Sehora, Satpura Basin, India. *Nat. Conf. Stratigr., Paleontol. & Palaeoenvir.*, Jaipur, February 2011.
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- Prasad M, Khare EG, Ambwani K & Singh SK – Palynological investigation of the Middle Miocene sediments of Gambhrola, Bilaspur District, Himachal Pradesh. *Nat. Conf. & XXVII-Conv. Indian Assoc. Sedimentol.*, Jammu, December 2010.
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- Ranhotra PS – Holocene climate and glacial extent within Gangotri valley, Garhwal Himalaya. *Indian Sci. Congr. (Earth System Sciences)*, Chennai, January 2011.

- Ranhotra PS & Bhattacharyya A – Modern vegetational distribution and pollen dispersal study within Gangotri valley, Garhwal Himalaya. *IGBP PAGES PHAROS Int. Workshop*, Pondicherry, January 2011.
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- Sarkar Samir – Palynofossils from the Baratang Formation (Late Ypresian- Early Lutetian) of Andaman Sea and their biostratigraphic significance. *Nat. Conf. Stratigr., Palaeontol. & Palaeoenvir.*, Jaipur, February 2011.
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- Srivastava AK & Srivastava R – Plant-Arthropod association in Gondwana and post Gondwana. *Indo-Brazilian Symp. Glimpses of Gondwana Research*, BSIP, Lucknow, November 2010.
- Srivastava C – Palaeoethnobotanical investigations at the archaeological sites excavated in the recent past in Ganga Plain. *Joint Ann. Conf. IAS & Spl. Sem. Recent Archaeological Achievements in India*, Lucknow, December 2010.
- Trivedi A, Chauhan MS, Tewari DP, Nautiyal CM, Sharma A & Singh MP – Vegetation, climate change and human habitation in the Central Ganga Plain since 43,000 yr BP, based on pollen records from Jalesar Lake, Unnao District, Uttar Pradesh. *Joint Ann. Conf. IAS & spl. Sem. Recent Archeological Achievements in India*, Lucknow, December 2010.

Administrative Personnel

- Azad CS & Bajpai SC – Use of Solar and Wind Energy for Powering Telecom Towers in India, *53rd Annual Technical Convention*, The Institution of Electronics and Telecommunication Engineers, New Delhi, September 2010.
- Bajpai SC – Family Chulhas - An Energy, Health and Carbon Cycle Analysis, *National Conference on Changing Status of Families: Impact on Resources and Quality of Life*, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad, February, 2011.

Deputation to Conferences/Seminars

Amalava Bhattacharyya

- 8th International Conference on Dendrochronology: World Dendro-2010 held at Rovaniemi, Finland during June 13-18, 2010.

Ram Awatar & Neeru Prakash

- 8th International Congress on the Jurassic System held at Sichuan, China during August 09-13, 2010.

A.K. Pokharia

- International Symposium on Rethinking the Impacts of Climate Change in the Past held at RIHN, Kyoto, Japan in August 2010.

R.R. Yadav

- Asia 2k Workshop held at Nagoya University, Nagoya, Japan during August 26-27, 2010.
- PAGES 2nd Global Symposium on Global Mannsson and Low-latitude Processes: Evolution and Variability held at Tongji University, Shanghai, China during September 13-15, 2010.
- National Symposium on Climate Change and its impact on Water Resources held at University of Hyderabad, Hyderabad during November 08-09, 2010.

N.C. Mehrotra

- Joint Meeting of AASP- The Palynological Society (43rd Annual Meeting), The Geological Association of Canada, Paleontology Division (20th Canadian Paleontology Conference) and The Canadian Association of Palynologists held at Dartmouth, Nova Scotia, Canada during September 29-October 02, 2010.

Anupam Sharma & Kamlesh Kumar

- National Conference on Interdisciplinary Approaches in Environmental Sciences held at Baroda during October 09-10, 2010.

Asha Gupta

- International Symposium on Systematic Lichenology and Bryology held at Zhejiang, China during October 15-21, 2010.

Alpana Singh & B.D. Singh

- National Conference cum Workshop on

Geological and Technological Facets of CBM, Shale Gas, Energy Resources and CO₂ Sequestration (CSECS-2010) held at Indian School of Mines, Dhanbad during November 19-20, 2010.

N.C. Mehrotra, A.K. Srivastava, Neerja Jha, Ram Awatar, R.C. Mehrotra, Mukund Sharma, K.J. Singh, Madhav Kumar, Rajni Tewari, Rashmi Srivastava, Neeru Prakash, A.K. Ghosh, Deepa Agnihotri & Neha Aggarwal

- Indo-Brazilian Symposium on Glimpses of Gondwana Research held at BSIP, Lucknow on November 24, 2010.

Mahesh Prasad & Anjum Farooqui

- 4th International Conference on Plants and Environmental Pollution (ICPEP-4), held at NBRI, Lucknow during December 08-11, 2010.

Neerja Jha, Mahesh Prasad, Srikanta Murthy, M.F. Quamar & Neha Aggarwal

- National Conference and XXVII Convention of Indian Association of Sedimentologists (IAS-2010) held at Department of Geology, Jammu University, Jammu during December 22-24, 2010.

Chanchala Srivastava, A.K. Pokharia & Anjali Trivedi

- Joint Annual Conference of IAS (44th), IHCS (34th) and ISPQS (38th) and Special Seminar on Recent Archaeological Achievements in India held at Lucknow during December 28-30, 2010.

R.S. Singh, Ratan Kar & P.S. Ranhotra

- 98th Indian Science Congress (Earth System Sciences) held at Chennai during January 03-08, 2011.

N.C. Mehrotra, Madhav Kumar, Rupendra Babu, Neeru Prakash & Vartika Singh

- 2nd South Asia's Premier Gescience Event—GeoIndia held at Expo Centre and Mart, Greater Noida during January 12-14, 2011.

A.K. Ghosh

- UGC Sponsored National Level Seminar on Bioresource and Human Welfare, organized by

Lady Brabourne College in collaboration with BSI and ZSI and held at LBC, Kolkata during January 20-21, 2011.

S.K. Shah & P.S. Ranhotra

- *IGBP PAGES PHAROS International Workshop* held at French Institute of Pondicherry, Pondicherry during January 27-29, 2011.

Neerja Jha, M.R. Rao, Samir Sarkar, Jyotsana Rai, Neeru Prakash & Suman Sarkar

- *National Conference on Stratigraphy, Paleontology and Palaeoenvironment* held at Department of Geology, University of Rajasthan, Jaipur during February 03-05, 2011.

M.S. Chauhan, Anupam Sharma & Binita Phartiyal

- *National Conference on Late Quaternary Geology of the Himalayan Orogen and the Foreland Basin* held at CAS in Geology, Lucknow University, Lucknow during February 16-17, 2011.

M.R. Rao

- *National Conference on Development and Sustainability of Earth Resources and Environment* held at Adikavi Nannaya University, Rajahmundry during March 12-13, 2011.

Administrative Personnel

S.C. Bajpai

- *Workshop on Renewable Energy Certificate Trading*, The Indian Energy Exchange Limited, Clarks Avadh Hotel, Lucknow, September 23, 2010.
- *Seminar on Energy and Water Conservation*, Savedie Institute of Management and Technology, Lucknow, December 13, 2010.
- *National Conference on Changing Status of Families: Impact on Resources and Quality of Life*, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad, February 15-16, 2011.
- *Rashtriya Urja Jana-Jagruti Abhiyan (RUJJA)*, DAV College, Kanpur, January 21, 2011.

Training/Study/Visit in Country/Abroad

Rashmi Srivastava

Visited Poland for four weeks (June 23-July 21, 2010) under INSA International Exchange Programme and studied Tertiary fossil leaves showing insect/fungal activity and dicotyledonous woods from Antarctica at laboratories of Prof. Ewa Zastawniak, W. Szafer Institute of Botany, Krakow, and Dr. Krajewska, K, Museum of Earth, Warsaw. Also visited laboratories of Prof. Volker Wilde, Forschungsinstitut Senckenberg, Frankfurt, Germany (from June 21-24, 2010); Prof. Dario De Franceschi, National Museum of Natural History, Paris, France (July 22-26, 2010); and Dr. Milena Pika Boilzi, Curator, Swiss Federal Institute of Science and Technology, Zurich, Switzerland (from July 27-August 05, 2010).

During the stay, studied the anatomical, morphotaxonomical and cuticular features of Tertiary plant fossils of Poland and other European countries (Germany, France and Switzerland) in general. The European flora is known by temperate elements, whereas flora of India is mainly tropical. However, during Palaeogene times European flora was warm-temperate and subtropical. I had gone through a number of Palaeobotanical literatures on European fossils. Also had fruitful discussions about modern flora of Poland and climatic change since Tertiary times.

A.K. Pokharia

Visited Research Institute for Humanity and Nature (RIHN), Kyoto, Japan as Visiting Research Fellow for three months (July 01-September 30, 2010) for research-cum-training on extraction of ancient DNA from carbonized seeds.

A.K. Ghosh

Attended 3rd Meeting of the CGPB Subcommittee X on *Fundamental and Multidisciplinary Geosciences* held at Geological Survey of India, Kolkata on July 08, 2010.

N.C. Mehrotra & Rajni Tewari

Visited Department of Geosciences, University of Sao Paulo, Sao Paulo and Department of Palaeontology, Guarulhos University, Guarulhos, Brazil in August-September 2010 under the Indo-Brazil S&T Joint Research Programme. Participated in scientific

discussions regarding comparative studies on– i) Gondwana flora of India and Brazil, ii) Cuticular morphology of the genus *Glossopteris*, particularly *G. communis* with respect to stomatal index analysis, and iii) Brazilian megaspores from Carboniferous and their correlation with Indian Gondwana megaspores with Brazilian geoscientists, particularly Prof. Mary E.C. Bernardes Oliveira of Institute of Geosciences, São Paulo; Prof. Margot Guerra Sommer and Dr Judite Garcia of Department of Palaeontology, Guarulhos University, Guarulhos.

The visit was scientifically immensely successful and provided an unique opportunity to study the Gondwana flora of Brazil in comparison with India. The studies are proving helpful in filling in the gaps of knowledge. Whereas, the Carboniferous flora is not very well known from India from the peninsular region (it is known only from the Himalayan region from Spiti and Kashmir), it is well known from Brazil and corresponds to the earliest Permian of India. The interaction and discussion with graduate and post graduate students of University of Sao Paulo, Sao Paulo and Department of Palaeontology, Guarulhos University, Guarulhos was specially fruitful since a lot of interest was generated among the students regarding the palaeobotanical studies and most of them wished to pursue these studies as a result of lectures delivered to them.

Anupam Sharma & Kamlesh Kumar

Participated in the DST sponsored workshop on *Geomicrobiology of Soils and Sediments* held at Baroda on August 20, 2010.

A. Rajanikanth

Participated in the Meet on *Climate Change and Sustainable Development through Energy Efficiency and Clean Energy*, SN Tripathi Memorial Lectures-2010 organized by Swayam Sidha and Lucknow Management Association at Lucknow on August 23, 2010.

Attended DST sponsored programme on *Creativity and Innovation Management in Research* organized at Administrative Staff College, Bella Vista, Hyderabad from November 22-December 03, 2010.

Attended National Workshop on *Plant Science Practices* held at Osmania University, Hyderabad from January 28-29, 2011.

Rupendra Babu & A. K. Ghosh

Attended 6th Proficiency Course on *Modern Practices in Petroleum Exploration* organized at KDMIPE, ONGC, Dehradun from September 06-10, 2010.

A. Bhattacharyya

Under INSA-PAS Exchange of Scientists programme visited Poland during 15, September to 22 November, 2010 and had opportunity to exchange ideas with the scientists of several Tree ring research and Palynological laboratories at Warsaw, Krakow and Tarun; and also visited Antarctica Research Ins, Warsaw and discuss regarding paleoclimate and collection of lake sediments

M.R. Rao

Attended Training Programme on *National Security and Strategic Contexts* held at National Institute of Advanced Studies, Bangalore from September 20-24, 2010.

S.K. Shah

Attended International Course on *Wood Anatomy and Tree-ring Ecology* taught by eminent Dendrochronologist Profs. Holger Gartner and F.H. Schweingruber and held at Parque Florestal De Monsanto, Lisbon, Portugal, during October 10-18, 2010.

B.D. Singh & Alpana Singh

After attending the Conference CSECS-2010, visited Essar Oil, Durgapur and their several sites of coal bed methane (CBM) production wells in the eastern part of the Raniganj Coalfield. Also visited Central Institute of Mining and Fuel Research (both Digwadih and Barwa Road Campuses), Indian School of Mines, Dhanbad and Birsa Institute of Technology, Sindri during November 22-27, 2010. Had discussions with experts about coal proximate analysis, and regarding consultancy work on CBM aspect.

Rajni Tewari & Rashmi Srivastava

Attended DST sponsored Training Session on *Ladies Excellence and Attitude Programme (LEAP)* organized by Institute of Management, Training and Research, Goa and held from January 17-21, 2011 at the International Centre, Goa.

A. Rajanikanth & A.K. Ghosh

Attended Workshop on *Results- Framework Document* organized by Performance Management

Division, Cabinet Secretariat, Govt. of India and held at Vigyan Bhawan, New Delhi on February 22, 2011.

C.M. Nautiyal

Attended the National Conference on Climate Change- Response and Action: Promoting the Carbon Market by Confederation of Indian Industry held at Taj Residency on April 21, 2010.

Attended Workshop on Science Journalism under NCSTC (DST) and MASTEC as resource person held at Thoubal (Manipur) from April 29-May 03, 2010.

Attended National Conference on Archaeological Sciences organized by the Archaeological Survey of India and held at The Claridges, New Delhi in July 2010. Also attended Climate and Energy- Svayam Siddha on August 23, 2010.

Attended The 5th Uttarakhand Science Congress held at Dehradun during November 10-12, 2010.

Attended '*Hindi mein Shaikshik E- Samagree ka Vikas*' Workshop organized by Homi Bhabha Centre for Science Education (TIFR, Mumbai) during November 27-28, 2010 at Vigyan Parishad, Prayag.

Attended NIOS and UNFPA Workshop on science book at National Institute of Biologicals, Noida from October 03-07, 2010 and December 22-23, 2010.

Anupam Sharma

Attended DST sponsored Workshop on *Science of Shallow Subsurface: Present Status and Future Prospects* held at Baroda from March 05-06, 2011.

Anju Saxena

Participated in the Field Expedition to the Manali-Leh Nubra Valley area of Western Himalaya at AAPG, Dehradun from August 01-09, 2010.

Shilpa Singh

Attended Training programme on *Conservation and Management of Mangroves* from April 01-05, 2010 at Gujarat Ecological Education and Research (GEER) Foundation, Gandhinagar.

Suman Sarkar

Attended 3rd World Petroleum Council (WPC) for the *Petrotech Youth Forum* with the theme 'FuEL (Future Energy Leaders) the Youth' held at New Delhi on November 02, 2010 and WPC- *Petrotech Conference* during October 31 to November 03, 2010.

Lectures Delivered

N.C. Mehrotra

- *The Science of Fossils and the Science from Fossils* (under INSPIRE programme of DST) at CMS, Kanpur Road, Lucknow (May 2010).
- *Palynology in Hydrocarbon Exploration with special reference to application of Dinoflagellate Cysts* at the University of Sao Paulo, São Paulo & Department of Palaeontology, Guarulhos University, Guarulhos, Brazil (September 2010)
- *Introduction to Dinoflagellates: Cyst Morphology and Terminology* at the Department of Geosciences, University of São Paulo, São Paulo, Brazil (September 2010)
- *Status of Palynological studies in Petroliferous basins of India with special reference to Application of Dinoflagellate Cysts in Hydrocarbon Exploration* (Invited Talk) at Joint Meeting of AASP, GAC and CAP, Halifax, Canada (September 30, 2010).
- *Recent Advances in Palaeobotanical studies at BSIP* (Invited Talk) at Brock University, St. Catharines, Canada (October 2010).
- *Advancements in Palynological Researches for Hydrocarbon Exploration in India* at French Institute, Pondicherry, December 2010

M.R. Rao

- *Palaeopalynology and its applications* (Invited talk) at P.G. College of Science, Osmania University, Hyderabad (January, 2010).

Chanchala Srivastava

- *Palaeo-ethnobotanical investigations and their significance* at department of Ancient Indian History, & Archaeology, Lucknow University; on Refresher course in History (March 09, 2011).

Ram Awatar

- *The plant megafossils from the Indian Gondwana and stratigraphic enigma of supra-Barakar rocks in South Rewa Basin, MP* at programme on Palaeontology and Stratigraphy: Basic to applications, Centre of Advance Study in Geology, BHU (February 27-28 2011).

A. Rajanikanth

- *Modern practices in Geophytology* (Invited talk) at P.G. College of Science, Osmania University, Hyderabad (January 2010).

- *Can plants form rocks?* at the Interactive Camp on Environment organized by the Shri Guru Nanak Girl's Degree College, GB Marg, Lucknow (February 11, 2011)
- *Biotechnology of Nature* at Janata College, Bakewar, Etawah (August 21, 2010).

Mukund Sharma

- *Evolution-Post Darwin Scenario-Palaeobotanical Evidence* at Janata College Bakewar, Etawah (August 21, 2010).

A. Bhattacharyya

- *Vegetation vis a vis climatic change during Holocene in the Himalaya* at Warshaw, Poland (October 18, 2010)
- *Post glacial climatic changes around Gangotri Glacier* at Tarun, Poland (October, 20, 2010)
- *Vegetation vis a vis climatic change since late Pleistocene in the Himalaya* at Krakow, Poland (November 04, 2010)
- *Tree Ring analysis with emphasis its application in Geosciences* (invited talk) at Workshop on Paleontology and stratigraphy, BHU, Varanasi (February 28, 2011)

Asha Gupta

- *Pre-Quaternary and Quaternary Spores from Indian Geologic Deposits– Morphological Diversity and Systematic Categorization* at International Symposium on Systematic Lichenology Bryology, Zhejiang University, Hangzhou, China (October 16, 2010).

Jyotsana Rai

- *Nannofossils: the Goliath size and David Applications* (two lectures) at the MBA Programme on Petroleum Technology and Management, Institute of Management Sciences, University of Lucknow, Lucknow (May 2010).

Rajni Tewari

- *Birbal Sahni Institute of Palaeobotany* at the Department of Geosciences, University of São Paulo, São Paulo & Department of Palaeontology, Guarulhos University, Guarulhos, Brazil.
- *Late Palaeozoic Floras of India* at the Department of Geosciences, University of São Paulo, São Paulo, Brazil.

- *Cuticular morphology of Glossopteris flora of India: Implications in Palaeoclimatic Interpretation* at the University of Sao Paulo, São Paulo & Department of Palaeontology, Guarulhos University, Guarulhos, Brazil.
- *Megaspores from Palaeozoic and Mesozoic Sequences of India- Architecture, Distribution and Evolution* at University of São Paulo, São Paulo.
- *Birbal Sahni Institute of Palaeobotany and an introduction to Palaeobotany: Fossils, Type of fossils and significance of fossil studies* at the Department of Botany, BSNV Degree College, Lucknow.
- *The Glossopteris flora- Plant assemblage responsible for formation of coal in India* at the Department of Botany, BSNV Degree College, Lucknow.
- *Structural features of Indian Gondwana megaspores and their evolutionary significance* at the Department of Botany, BSNV Degree College, Lucknow.
- *Isotopes: From Earth to Sky*. INSPIRE at CMS, Kanpur Road, Lucknow (May 24, 2010).
- *Various Aspects of Radiocarbon Dating* at the National Conference on Archaeological Sciences by Archaeological Survey of India, New Delhi (July 2010)
- *The Planets and Satellites: In New light on Remote Sensing Day* by IRS Society at UP Remote Sensing Agency (August 12, 2010).
- *Energy in Future, Future in Energy: Context- The Climate Change* at Paryatan Bhawan, Seminar by Swayamsiddha (August 23, 2010).
- *A Time for Rethink in Physics* (Invited) Lead Lecture in Physics the USSTC- 2010, Doon University, Dehradun (November 2010).
- *Radiocarbon vidhi se aayu nirdharan: Siddhant evam anuprayog* at Vigyan Parishad, Prayag (November 27, 2010).

Rashmi Srivastava

- *Indian Upper Cretaceous-Tertiary Flora before collision of Indian Plate* at the Forschungsinstitut Senckenberg, Frankfurt, Germany (June 2010).
- *Deccan Intertrappean Flora of India and its palaeoecological and phytogeographical significance* at the Palaeobotany Laboratory, W. Szafer Institute of Botany, Krakow, Poland (July 2010).
- Two sets of (4) lectures on *Global warming and Energy and Environment* at UGC Academic Staff College, University of Lucknow (January 18, 2011).
- *Science in Everyday Life*. Science Expo-2011 at the Regional Science City (January 23, 2011).

A.K. Ghosh

- *Biodiversity Management in India* at Pioneer Montessori School, Jankipuram, Lucknow (July 31, 2010).
- *Recent Advancements on the studies of fossil calcareous algae and potential areas of India for their exploration* in UGC Refresher Course on New Horizons in Botanical Sciences, organized by Department of Botany, University of Allahabad (December 17, 2010).
- *Significance of fossil calcareous algae for the interpretation of palaeoenvironment, palaeobathymetry, sea level fluctuations and mass extinction event in the history of planet earth* in UGC Refresher Course on New Horizons in Botanical Sciences, Department of Botany, University of Allahabad (December 17, 2010).
- *Implication of plant fossils in the reconstruction of past vegetation, climate modeling and*
- *Key Note Address* at Inaugural Function of the Workshop on Science Writing and Science Journalism at Degree College, Thoubal, Manipur (April 27, 2010).
- *On Search and Possibilities of Life* under Manipur Council for Science Technology and Environment and NCSTC (DST) at WMG College Thoubal, Manipur (April 29, 2010).
- Six lectures on *Radioactivity and Related Hazards* (May 10, 2010); *Earthquakes: Causes and Consequences* (June 3, 2010); *Earthquakes: How, and What Follows* (July 7, 2010) at UP Academy of Administration and Management, Lucknow.
- Face to Face (along with Prof. KL Chopra, Prof. VD Gupta). During INSPIRE programme of DST



exploration of fossil fuels (Invited lecture III) in UGC Sponsored National Level Seminar on Bioresource and Human Welfare, organized by Lady Brabourne College, Kolkata in collaboration with BSI and ZSI at Lady Brabourne College, Kolkata (January 20, 2011).

S.K. Shah

- *Overview of Tree-ring research in India* at International Course on Wood Anatomy and Tree-ring Ecology, Parque Florestal De Monsanto, Lisbon, Portugal (October 2010).
- *Tree-ring studies in India* at IGBP PAGES PHAROS Workshop, French Institute of Pondicherry, Puducherry (January, 2011).

Vartika Singh

- *Antarctica: A voyage for Science* at the Department of Botany, Bappa Shri Narayan Vocational Post Graduate College, Lucknow (October 12, 2010).
- *Antarctica: Geological perspective* at the Department of Botany, Bappa Shri Narayan Vocational Post Graduate College, Lucknow (December 07, 2010).

Shilpa Singh

- *Usage of Domestic plants to cure common diseases* at Kanya Purv Madhyamik Vidyalaya, Bargadi, Bakshi Ka Talab, Lucknow (August 30, 2010)

By outside scientists in the Institute

Prof. Ram Sagar, Director, Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital

- *Astrobiology: A new emerging field in Astrophysics* (July 08, 2010)

Dr. Sankar Chatterjee, Paul Whitefield Horn Professor of Geology & Curator of Paleontology, Texas Tech University, Lubbock, Texas (USA)

- *Pterodactyl-inspired Robot to master Air, Ground and Seas* (July 26, 2010)

Dr. K.P. Navneeth Kumaran, Scientist-F, Agharkar Research Institute, Pune, India

- *Mangrove Response to Climate Change during Late Quaternary along West Coast of India* (Dr. B.S. Venkatachala Memorial Lecture; January 03, 2011)

Prof. Patricia Vickers-Rich, Monash University, Melbourne, Australia

- *In search of Ghosts-Ediacaran Metazoans* (January 21, 2011)

Prof. Walter Mike Hall, Monash University, Melbourne, Australia

- *Neoproterozoic Ediacarans of NW Namibia, southern Africa* (January 21, 2011)

Dr. Ravi Mishra, Scientist, National Centre for Antarctic and Ocean Research, Goa, India

- *Indian Polar and Oceanic Research Programme: Recent Trends* (January 27, 2011)

Prof. Martin J. Head, Chair of Earth Sciences, Brock University, St. Catharines, Canada

- *Deciphering Paleooceanographic Changes in the North Atlantic during the Pliocene and Early Pleistocene using a new proxy combining Dinoflagellate Cysts and Foraminiferal Geochemistry* (February 15, 2011)

Dr. Stephen McLoughlin, Senior Curator, Department of Palaeobotany, Swedish Museum of Natural History, Stockholm, Sweden

- *Glossopteris- New insights in to the Architecture and Relationship of an iconic Permian Gondwanan Plant* (March 11, 2011)

Administrative Personnel

S.C. Bajpai

- *Physics of Solar Cells, Effect of Low Input Voltage, Over Load, Low PF Loads, Fabrication and Sizing of Solar Cells, Building Integration of Solar PV, Cost Estimation of Solar PV Plant and Cost Effectiveness in Solar PV (Cost per kWh)* at the Short-Term Course on Solar Photovoltaic Field Engineers Training at the Center Climate Change, Engineering Staff College of India, Hyderabad (December 09-11, 2010)
- *Solar Energy* at Training Programme at the Alternative Energy Research, Development and Training Centre of Non-Conventional Energy Development Agency, UP, Lucknow (January 19, 2011)
- *Green Buildings* at Refresher Course of Environment Science at the Academic Staff College, University of Lucknow, Lucknow (January 22, 2011)

Recognition

A.K. Srivastava

Sessional Chairman, Indo-Brazilian Symposium on Glimpses of Gondwana Research held at BSIP, Lucknow (in November 2010).

Neerja Jha

Chaired one Technical Session of the National Conference and XXVII-Convention of Indian Association of Sedimentologists held at the Department of Geology, University of Jammu, Jammu (in December 2010).

Chaired one Technical Session of the National Conference on Stratigraphy, Palaeontology and Palaeoenvironment held at the Department of Geology, University of Rajasthan, Jaipur (in February, 2011).

M.R. Rao

Resource Person, National Workshop on Plant Science Practices held at the PG College of Science, Osmania University, Saifabad, Hyderabad (in January 2011).

Chaired a Technical Session of the National Conference on Stratigraphy, Palaeontology and Palaeoenvironment held at the Department of Geology, University of Rajasthan, Jaipur (in February, 2011).

Co-Chaired a Technical Session of the National Conference on Development and Sustainability of Earth Resources and Environment held at Rajahmundry (in March 2011).

Samir Sarkar

Chaired a Technical Session of the National Conference on Stratigraphy, Palaeontology and Palaeoenvironment held at the Department of Geology, University of Rajasthan, Jaipur (in February, 2011).

A. Rajanikanth

Session Chairman, Session on Climate Change, Sustainable Development and Energy Efficiency of the meet on Climate Change and Sustainable Development through Energy Efficiency and Clean Energy, SN Tripathi Memorial Lectures- 2010, Swayam Sidha and Lucknow Management Association, Lucknow.

Resource Person and Session Chairman of the National Workshop on Plant Science Practices held at PG College of Science, Osmania University, Hyderabad (in January 2011).

Jyotsana Rai

Chaired Session IX of the National Conference on Stratigraphy, Palaeontology and Palaeoenvironment held at the Department of Geology, University of Rajasthan, Jaipur (in February, 2011).

Rajni Tewari

Awarded the 'Most Sincere Delegate Award' and a certificate for 'Excellence' by the Director IMTR, Goa in the DST sponsored Training Programme on Ladies Excellence and Attitude Programme organized for senior women scientists (in January 2011).

B.D. Singh

Co-Chaired Technical Session VI- Brain Storming Workshop Discussion Session on Shale Gas of the National Conference cum Workshop on Geological and Technological Facets of CBM, Shale Gas, Energy Resources and CO₂ Sequestration held at ISM, Dhanbad (in November, 2010).

A.K. Ghosh

Judge, Poster Session in UGC Sponsored National Level Seminar on Bioresource and Human Welfare, organized by Lady Brabourne College, Kolkata in collaboration with Botanical Survey of India and Zoological Survey of India at Lady Brabourne College, Kolkata (in January 2011).

S.K. Shah

Session Rapporteur, Session: Vegetation and Land-cover Calibration: Models and Methods of the IGBP PAGES PHAROS Workshop: Land-cover reconstructions in the monsoon affected tropical world-pollen modelling approach and data synthesis held at French Institute of Pondicherry, Puducherry (in January, 2011).

Anjali Trivedi

Awarded TWAS (Third World Academy of Sciences) Post Doctoral Fellowship-2010 to work at Institute of Botany, Beijing, China.

**Suman Sarkar**

Selected for student sponsorship (by virtue of Resume and a competition based on a write up on the topic “Why do you want to be a part of the Energy Industry and how will you contribute to it?” by the organisers of the 3rd World Petroleum Council (WPC) for the Petrotech Youth Forum with the theme “FuEL (Future Energy Leaders) the Youth” held at New Delhi on November 2, 2010.

Received ‘Best Poster Presentation Award’ for the paper entitled “Recognition of algal rich facies from the

Umlatdoh Limestone of Shella Formation belonging to the Jaintia Group, Meghalaya” (authored by Suman Sarkar, Amit K. Ghosh & Madhav Kumar) presented at the National Conference on Stratigraphy, Palaeontology and Palaeoenvironment held at University of Rajasthan, Jaipur (in February 2011).

S.C. Bajpai

Guest Faculty in the M Sc Programme on Renewable Energy of the Department of Physics, University of Lucknow, Lucknow (2010-11).

Representation in Committees/Boards

N.C. Mehrotra

- President, *The Palaeobotanical Society of India*, Lucknow.
- Chief Editor, *The Palaeobotanist*.
- Member, Council of the Geological Society of India, Bangalore.
- 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 Council, National Centre for Antarctic & Ocean Research, Goa.
- Chairman, *Local Advisory Council, Regional Science Centre, Lucknow (Ministry of Culture)*.
- Chairman, Organizing Committees, *Indo-Brazilian Symposium on Glimpses of Gondwana Research*, BSIP (November 2010).

A.K. Srivastava

- Editor, *The Palaeobotanist* (up to 27.01. 2011).
- Secretary, *The Palaeobotanical Society of India*, Lucknow.
- Member, Editorial Board, *Geophytology*.
- Councillor, International Federation of Palynological Societies.
- 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.

Rahul Garg

- Joint Secretary, *The Palaeontological Society of India*.

Neerja Jha

- Judge, Event of Group Discussion, Ramswaroop Memorial Group Professional Colleges, Lucknow (in February 2011).

R.K. Saxena

- Chief Editor, *The Palaeobotanical Society of India*, Lucknow (since January 2010).

R.R. Yadav

- Member, Editorial Board, *Himalayan Geology*.
- Member, Editorial Board, *Phytomorphology*.

Rupendra Babu

- Liaison Officer SCs/STs employees, BSIP.
- Corresponding Member, International Working Group-IGCP Project-493: The rise and fall of Vendian Biota.

Asha Gupta

- Vice President, International Council for Biodeterioration of Cultural Property.
- Associate Editor, *Vegetos*.

Madhav Kumar

- Member, Executive Council, *The Palaeobotanical Society*, Lucknow.

R.C. Mehrotra

- Councilor, Executive Council, *The Palaeobotanical Society*, Lucknow.
- Convener, Smart Administration Cell, BSIP.

Mahesh Prasad

- President, BSIP Employee Co-operative Credit and Thrift Society, Lucknow.

Jyotsana Rai

- Member, International Nannoplankton Association.

A. Rajanikanth

- Joint Editor, Publication Unit, BSIP.
- Co-ordinator, Interactive Science Meet for Youth, BSIP (September 10, 2010).
- Convener, Museum Committee
- Convener, Lecture Co-ordination Committee
- Resource Person,

Ram Awatar

- Treasurer, *The Palaeobotanical Society*, Lucknow (since January 2010).

M.R. Rao

- Member, Selection Committee, Assured Career Progression Scheme (MACP).

D.C. Saini

- State Nodal officer for UP (Nominated), Society of Ethnobotanists, NBRI, Lucknow.
- Joint Secretary, *The Palaeobotanical Society*, Lucknow.



- Member, Sub-Committee, Ethnobotany of State Biodiversity Board, UP.

Rakesh Saxena

- Member, Advisory Committee, National Conference and Workshop on Geological and Technological Facets of CBM, Shale Gas, Energy resources and CO₂ Sequestration (CSECS2010), Indian School of Mines, Dhanbad.

Mukund Sharma

- Executive Editor, *The Palaeobotanist* published by the BSIP. (up to January 27th 2011)
- Joint Editor, BSIP Newsletter & Miscellaneous Publications, BSIP.
- Convenor, Research Development Cell, BSIP.
- Jury, Debate Contest, Regional Science City, Lucknow

Alpana Singh

- Member, Bureau of Indian Standards, Solid Mineral Fuel Sectional Committee– PCD-7.4: Methods of Analysis Subcommittee.
- Member, The Society for Organic Petrology (TSOP).

B.D. Singh

- Associate Member, International Committee for Coal and Organic Petrology (ICCP).
- Principal Member, Bureau of Indian Standards, Solid Mineral Fuel Sectional Committee– PCD-7.4: Methods of Analysis Subcommittee.
- 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.
- Member, Board of Examiners (Ph.D. Thesis), Vinoba Bhave University, Hazaribagh.
- Member, Advisory Committee, National Conference and Workshop on *Geological and Technological Facets of CBM, Shale Gas, Energy resources and CO₂ Sequestration* (CSECS-2010), ISM, Dhanbad (November 2010).

Rashmi Srivastava

- Editor, *Geophytology*.
- Councilor, Executive Council, The Palaeobotanical Society, Lucknow.

Rajni Tewari

- Organizing Secretary, *Indo-Brazilian Symposium on Glimpses of Gondwana Research*, BSIP (November 2010).

- Editor, *The Palaeobotanist* (since February 2011).
- Member, Executive Council, The Palaeobotanical Society, Lucknow.
- Member, Smart Administration Cell, BSIP.
- Convener, Women's Forum, BSIP.

C.M. Nautiyal

- Member (Outstation) Executive, Vigyan Parishad, Prayag.
- Member, Project Evaluation/Review Committee, Uttarakhand Council of S&T, Dehradun.
- Member, Technical Committee, 5th USSC, Dehradun.
- Advisor, Coordination Committee, National Children's Science Congress, UP.
- Member, Organising Committee, SCIENCE EXPO-2010 at Regional Science City.
- Member, National Executive Committee, The Society of Earth Scientists.
- Member, Organising Committee, INSPIRE Programme at Lucknow.
- Member, Selection Committee, Trainee Education, Regional Science City, Lucknow.
- Jury Member, Extempore Speech on World Ozone Day, Regional Regional Science City.
- Member, Local Advisory Committee, Regional Science City, Lucknow.

Anjum Farooqui

- Executive Member, International Society of Plant and Environment, NBRI, Lucknow
- Member, Working Group, International Geological Correlation Programme (IGCP-495)

A.K. Ghosh

- Organizing Secretary, Field Workshop in *Indo-Brazilian Symposium on Glimpses of Gondwana Research*, BSIP (November 2010).

Ratan Kar

- Assistant Editor, *The Palaeobotanist* (since February 2011).
- Course Coordinator, *Training Programme on Late Cenozoic Dinoflagellate Cysts* (conducted by Prof. Martin J. Head of Canada at BSIP)

Anju Saxena

- Co-Editor, Earth Science India e-Journal.

S.C. Bajpai

- Editor, Journal of Chemical, Biological and Physical Sciences (An International Peer Review E-3 Journal of Sciences).

Doctoral Degree Awarded

Name	Subject	Date	University	Supervisor	Title of Ph.D. Thesis
Om Prakash	Geology	May 2010	Kurukshetra University	Prof. N.N. Dogra Dr. Samir Sarkar	Palynology and stratigraphy of the Siwalik and pre-Siwalik Tertiary rocks of Yamunanagar and Sirmaur districts, north-western Himalaya, India.
K.G. Misra	Geology	November 2010	Lucknow University	Prof. A.K. Jauhri Dr. R.R. Yadav	Tree-ring based climate reconstruction in the western Himalaya: Implications for river-flow changes.

Units

Publication

The Publication Unit has timely attended to the following tasks utilizing institutional facilities and state of the art technology to accomplish the following publication assignments:

Annual Report

Bilingual (English and Hindi) versions of Annual Report were published with collated information on the research work carried out under different research projects during the period 2009-2010. Besides, conference participation, awards, research papers published/accepted, Foundation/ Founders' Day celebrations, reports of different units, annual accounts and related aspects with relevant graphics and photographs were included.

Journal— *The Palaeobotanist*

BSIP's peer-reviewed journal *The Palaeobotanist* Volume 59 was published with state of the art printing technology. Papers for the Volume 60 are being processed.

BSIP Newsletter

Annual BSIP Newsletter 2010 (No. 13) was published incorporating contents on important activities of the Institute during the period July 2009 to June 2010.

Catalogue

An inventory of type and figured specimens stored in BSIP Museum was compiled and published in the form of "Type and Figured Specimens at the Repository – An Inventory Part – IV (1991-2005)".

Handouts— Following biographical profiles and themes of lecture of eminent speakers delivered were published:

Dr. Harsh K. Gupta — *Gas Hydrates: The Indian Scenario* (14th Jubilee Lecture, September 10, 2010)

Dr. O.N. Bhargava — *Early Palaeozoic Palaeogeography, Basin Configuration, Palaeoclimate and Tectonics in the Indian Plate* (40th Birbal Sahni Memorial Lecture, November 14, 2010)

Dr. T. Ramasami — *Science of Managing Creative People in Climate related Research* (56th Sir AC Seward Memorial Lecture, December 18, 2010)

Miscellaneous

Invitation cards for Foundation Day, Founders' Day, and other programmes organized from time to time were printed. Printing of Identity Cards of Employees and Pensioners of BSIP has been done from time to time.



Library

Library and information services play an important role in facilitating the creation of new knowledge through the acquisition, organization, dissemination and preserving books, reprints and reference materials. It serves as a gateway to national and global knowledge. Developments in the field of Information Communication Technology have provided widespread and inclusive access to palaeobotanical knowledge to BSIP Library users. To achieve this objective it is continuously modernizing its collection, services and facilities and joined the institutional framework of the libraries and networking. Library has taken necessary steps towards the digitization of its certain publications in tune with National Knowledge Commission's Recommendations. All back issues of *Annual Report* and *BSIP News Letter* are digitized and hosted on Institute's web site. Complete digitization of Institute's science journal *Palaeobotanist* is in progress. Weekly service of *New Arrivals* having contents pages of journals/books displayed and *News Clipping* having scientific contents from Newspapers are being regularly communicated by e-mail to Institute's staff. Occasionally, library is also enriched by donations of personal collections of books and reprints. It is also participating in education and training of candidates of library sciences.

Entire records (catalogue and issue-return of the library) are in Libsys software, the integrated library automation software that enables working in integrated multi-user and networked environment. Activities like circulation, cataloging, serials control, binding management are carried out through this software. The holdings are accessible by a computerized on-line catalogue OPAC (Online Public Access Catalogue). OPAC is searchable by author, title, subject, call number and keyword.

The current holdings of library are as under:

Particulars	Additions during 2010-11	Total
Books	87	5,935
Journals (bound volumes)	131	15,995
Reprints	18	40,097
Reference Books	-	339
Books in Hindi	71	439
Ph.D. Thesis	1	92
Reports	-	46
Maps & Atlases	-	61
Microfilm/ Fisches	-	294
Compact Disk	-	74

Currently the library is receiving 164 journals (93 through subscription and 71 through exchange). There are 148 registered card holders using the library facilities.

Exchange Facility

Institutions on exchange panel with the journal <i>Palaeobotanist</i>	40
Journals received on exchange basis	71
Reprints of research papers purchased for exchange	15

Institute's Annual Report and Newsletter have been sent to individuals and various organizations/ institutions in the country.

e-Journals

Web based access of the journals is available over the Institute's LAN from the following publishers— Elsevier (Science Direct), Cambridge University Press, IOP Science (through CSIR-DST Consortium); Macmillan Publishers Limited (Nature), Oxford University Press, AAAS (Science), Taylor and Francis; Indianjournals.com; Web of Science; Online access of Geo-ref database.

Other Facilities

Lamination— To preserve the old and rare literatures, lamination and photocopying of such publications is being regularly undertaken.

Xeroxing— Xerox facility of relevant scientific literature is being extended to scientists.

Inter-Library Loan Service— Institute is part of a local library network facilitating the availability of books on loan for BSIP Library users on request.

The following Institutions/Organizations availed the library facilities:

Department of Botany and Geology, University of Lucknow, Lucknow

Babasaheb Bhimrao Ambedkar University, Lucknow

Department of Ancient Indian History and Archaeology, University of Allahabad, Allahabad

University of Petroleum and Energy Studies, Dehradun

Kendriya Vidyalaya Babina, Cantonment, Babina, Jhansi

Department of Geology, Bangalore University, Bangalore

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

Envis Centre, Botanical Survey of India, Howrah.

Museum

The Museum activities were widely participative through exhibitions, event celebrations, public interactions, visits of distinguished personalities, gift exchanges, educative tours around the museum, supporting activities to scientific research, repository and archive maintenance, database development and related activities. Efforts are on the way to prepare database of Museum holdings.

During the year BSIP Museum participated in the Science Expo Exhibition organized by the Regional Science Centre, Science City, Aliganj, Lucknow from January, 28 to February, 01. 2010. Activities of the institute were displayed in the form of display panels and visitors also were shown plant fossil material. The institute stall was visited by the Hon. Minister Science & Technology, Uttar Pradesh and other higher officials of Uttar Pradesh Government. Many students and general public got benefitted by the display.

An inventory of museum holdings- "Type and figured specimens at the Repository: An Inventory Part IV" was compiled and published. It was released on 14 November 2010 on Founder's Day.

Research material collected by the scientists of the Institute during 2010-2011 Field season from different locales of India (233) under approved Intra- and inter-institutional /various sponsored and collaborative researches projects were maintained with proper RLN (Registered Locality Number) and other field details. A database on field locales for last ten years is being prepared.

A well equipped WORKING CELL was fabricated in the Hall 2 of Museum as a *research work facility* and was inaugurated by His Excellency Governor, Uttar Pradesh Sri B.L. Joshi on 14 November 2010. The Cell is aimed to cater the need of scientists working with Museum specimens stored in the repository.

Besides, students and general public participated in outreach programs on specific events. Necessary images, photographs and line drawings have been made and provided to users. Proper records of specimens/issue/return/certificates/related archives are maintained in the museum. A digital library is being initiated to store research data/images/archives etc.

Details of additions to the type and figured specimens/slides/Compact discs (CD) are as follows:

Holdings	Addition during 2010-2011	Total
Type and figured specimens	91	7,662
Type and figured slides	174	13,597
CD/Negatives	4	4

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

Project	Specimens	Samples
Project- 1	-	227
Project- 2	284	231
Project- 3	289	-
Project- 4	1101	170
Project- 5	32	398
Project- 6	-	128
Project- 7	-	-
Project- 9	-	-
Project- 11	-	21
Project- 12	-	8
Project- 13	-	213
Project- 14	246	229

Details of Samples deposited under Sponsored / Collaborative Projects:

O.N.G.C. Project	12
D.S.T. Project No. SR/S4/ES-2	35
D.S.T. Project No. SR/S4/ES-21	09
D.S.T. Project No. ESS/91/38	137
Woman Scientist' Project. SR/WOS-A/ES-18	53
Misc. Project. (Assessment Based on New Report)	14

Specimens/slides gifted to the following institution/ College/University of India.

Nehru Science Center, (National Council of Science Museum), Dr. E Moses Road, Mumbai, Maharashtra 400018

Department of studies in Geology, Manasgangotri University, Mysore-570 006

Bal Guide Inter College, Sector 16, Indira Nagar, Lucknow-226 020

C.U. Shah Science College, Ashram Road, Ahmedabad-380 014

Department of Botany, Siliguri College, District Darjeeling, West Bengal-734 101

Indira Gandhi National Open University, Maidan Garhi,
New Delhi-110 068

Department of Botany, C.M.P. Degree College,
Allahabad-211 001

G.S. Paliwal Senior Consultant, Agricultural Finance Corp.
Ltd., Delhi-110 006

Dr. G. Rajagopalan, 2/73, Ramamanor Shankar Mutt Road,
Bengaluru-560 002

Institutional Visitors

Department of Botany, School of Life Sciences, Aizawl,
Mizoram-796009

Department of Botany, D.H.S.K. College, Dibrugarh,
Assam 786001

Forest Training Institute, Kanpur, U.P. 208002

Institute of Archaeology, Government of India, New Delhi
110001

Shree Baldev P.G. College, Baragaon, Varanasi, U.P.
221204

Sri Jagdamba Saran Singh Educational Institute, Balsar,
Gonda, U.P. 271303

J. B. Mahajan Degree College, Chaurichaura, Gorakhpur,
U.P. 273001

Department of Surgery, College of Veterinary Science,
Khanapur, Guwahati 781001

P.G. Department of Geology, Rashtrasant Tukadoji
Maharaj Nagpur University, Nagpur 440001

Department of Geology, Lucknow University, Lucknow,
U.P.226007

College of Biotechnology, B.A.University, Ranchi,
Jharkhand 834006

Department of Geology, North – Eastern Hills University,
Shillong, Meghalaya 793022

R.R.S. Inter College Itaunja, Lucknow, U.P.227205

Mahatma Gandhi Inter College, Malihabad, Lucknow,
U.P.227111

Overseas Visitors

Dr. Mike Hall, Monash University, Melbourne, Australia

Dr. Prof. Patricia Vickers-Rich, Monash University,
Melbourne, Australia

Prof. V.A. Krassilov, Institute of Evolution, University of
Haifa, Haifa, Israel

Dr. Ekaterina A. Serezhnikova, Palaeontological Institute,
Russian Academy of Sciences, Russia

Prof. Andrey Ivantsov, Palaeontological Institute, Russian
Academy of Sciences, Russia

Dr. Stephen McLoughlin, Department of Palaeobotany,
Swedish Museum of Natural History, Sweden



Herbarium

About 502 plant specimens, 40 wood slides, 25 wood core, 20 pollen slide, and 10 fruits and seeds have been added to the repository.

Holdings

Particulars	Addition during 2010-2011	Total
Herbarium		
Plant specimens	502	23,839
Leaf specimens	-	1,167
Laminated mounts of venation pattern	-	66
Xylarium		
Wood blocks	-	4,158
Wood discs	-	68
Wood cores	25	7,415
Wood slides	40	4,318
Palm slides (stem, leaf, petiole, root.)	-	3,195
Sporothek		
Polleniferous materials	-	3,016
Pollen slides	20	12,284
Carpothek		
Fruits & seeds	10	4,264
Museum Samples		
Medicinal & food plant	-	91

Visitors:

Dr. C.H. Sujatha, Department of Chemical Oceanography, School of Marine Science, Cochin University of Science and Technology, Cochin

Prof. Dinesh Kumar & Dr. G. Saxena, Department of Botany, Lucknow University, Lucknow

Trainees of Forests Guards, Forest Research Institute, Kanpur

Students of K.V. College, Babina Cantt., District Jhansi (UP)

Electronic Data Processing

Internet Connection with Radio link facility from Software Technology Park of India, Lucknow has been upgraded upto 8 MBPS (1:1) is running in the Institute. Proxy, Mail and DNS Servers are successfully running on Sun V440, Sun V240 having Solaris Operating System. This provides 24 hours Internet facility to the Institute Staff. At present 145 Computers are connected with the LAN.

An Anti Virus Program “Symantec Endpoint Protection 11.0” has been renewed with 150 user license to protect the systems from viruses and worms. This year Institute has procured 15 Laser Printer. Institute has

renewed the license of Cyberoam CR100i Unified Threat Management (UTM) to stop the spamming, virus and unauthorized access at the Gateway level.

Institute's web site (<http://www.bsip.res.in>) is running on the Institute's Server. Computer Section is maintaining web's day to day updation. Wireless Internet Connectivity has been running within the campus.

Payroll, Form16 and Pension packages are also modified as per the requirements. Computer Section is providing help to the scientists in preparing the Multimedia presentations, charts, graphs, lithologs and diagrams for their scientific publications and documentation.

Scanning Electron Microscopy

The prime objective of the unit is to provide a dedicated service to all scientists of the Institute. This well maintained instrument is also providing better services to other universities and research institutions on minimum payment basis. The unit has two scanning electron microscopes available for staff and research student uses– i) Leo 430, and ii) Philips 505. The Leo 430 is equipped with Back Scattered Electrons (BSE) mode of imaging with mapping and the line scanning at 180° rotation. The elemental analysis of the object is possible through energy dispersive x-ray analysis EDAX (Energy

Dispersive System/EDS). Both microscopes are fitted with digital image system allowing high resolution, high magnification imaging of a wide range of specimens applied to various disciplines, e.g. plant and animal tissues; plant and animal fossils; earth, material, leather and chemical sciences; pharmacy; microbiology; plastic and metallurgical materials; dental and textile researches, etc. These electron microscopes require specialized preparative procedures. In addition to the standard techniques, the unit also offers sample freeze-drying at the critical point for analysis of delicate material.

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 in Group 'A', 'B', 'C' and 'D' as per Govt. of India Orders.

Status of Official Language

The Institute is constantly striving to attain the set target for official language implementation. The institute participated in the meeting of Nagar Rajbhasha Kaaryaanvayan Samiti (NRKS) during the year 2010-11. Scientists and Technical Officers/Employees of the Institute also took active part in science communication in Hindi through various media.

Hindi Workshop

Hindi Workshops were organized on the following subjects. The workshops were followed by lively discussions related to the topics of talks and related terminology.

Vijnan ka Arthashastra [by Prof. Md. Muzammil, Lucknow University, Lucknow] on 28.9.2010.

Vaiyaktik Nivesh [by Mr. Santosh Kumar Singh, Financial Advisor] on 29.3.2011.

Deputation to Workshops

Dr. Alpana Singh, Dr. Anju Saxena, Mrs. P.

Thomas, Mrs. Swapna Mazumdar and Mr. J. Bhaskaran participated in the *Training Workshop* organized by the Commission for Scientific and Technical Terminology during February 03-04, 2011 at CDRI, Lucknow.

Miscellaneous

The computers of the Institute have access to multi-lingual Software. The process of making forms bilingual is near completion. Annual Report of the Institute was published in Hindi also. Abstracts in Hindi were also published of all the research papers in the international journal of the Institute- The Palaeobotanist. In adherence to the under section 3(3) of the Official Language Act 1963, efforts are continued to improve correspondence in Hindi.

The Quarterly, Half yearly and Annual Reports to DST and NARAKAS were prepared and regularly sent. Thus, the Institute is continuously abiding by the rules and direction of the Official Language *in extenso*.

Hindi Fortnight

Hindi Pakhwara was organized from September 14-28, 2010. The Director encouraged the competitors during the competitions too. 69 staff members participated in the series of competitions on Noting, Find the Errors, Hindi Typing (Computer), Antyaakshari and Quiz competitions. Kavi Sammelan was also organized on 17th September in which 6 guest poets participated. Prize distribution was held on 28th September in the auditorium, in which Hindi books of reputed authors were given away by Prof. Md. Muzammil, Lucknow University, Lucknow. Results of various completions are given below:

Noting : I - Dr. (Mrs) Chanchala Srivastava, II - Mr. V.K. Nigam, III - Mr. Avaneesh Kumar

Find the Errors : I - Mr. P.K. Mishra, II - Dr. (Mrs) Anju Saxena, III - Mr. S.R. Ali & Ms Deepa Agnihotri

Typing : I - Ms Manisha Tharu, II - Mrs. Sudha Kureel

Antyaakshari : I - Dr. (Mrs) Rajni Tewari & Dr. C.M. Nautiyal, II - Mr. R.K. Awasthi & Ms Sandhya Sharma, III - Mr. S.R. Ali & Dr. Madhabi Chakraborty

Quiz : I - Dr. (Mrs) Anju Saxena & Mr. G.K. Singh, II - Dr. Mukund Sharma & Mr. S.R. Ali, III - Mr. Suman Sarkar & Ms Sandhya Sharma



A view of Hindi Pakhwara celebrations

Staff

Director

Dr. Naresh C. Mehrotra

Scientists

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

Scientist 'G'

Dr Ashwini K. Srivastava (retired w.e.f. 31.01.2011)

Scientist 'F'

Dr (Mrs) Usha Bajpai (retired w.e.f. 31.05.2010)

Dr Rahul Garg (retired w.e.f. 30.11.2010)

Dr Jaswant S. Guleria (retired w.e.f. 31.05.2010)

Dr (Mrs) Neerja Jha

Dr Ramesh K. Saxena

Dr (Ms) Vijaya

Dr Ram R. Yadav

Scientist 'E'

Dr Rupendra Babu

Dr Samir K. Bera

Dr Amalava Bhattacharyya

Dr Mohan S. Chauhan

Dr (Ms) Asha Gupta

Dr Madhav Kumar

Dr Rakesh C. Mehrotra

Dr Mahesh Prasad

Dr (Mrs) Jyotsana Rai

Dr Annamraju Rajanikanth

Dr Ram Awatar

Dr Mulagalapalli R. Rao

Dr Dinesh C. Saini

Dr Omprakash S. Sarate

Dr Samir Sarkar

Dr Rakesh Saxena

Dr Mukund Sharma

Dr (Mrs) Alpana Singh

Dr Bhagwan D. Singh

Dr Kamal J. Singh

Dr Rama S. Singh

Dr (Mrs) Chanchala Srivastava

Dr (Mrs) Rashmi Srivastava

Dr (Mrs) Rajni Tewari

Dr Surya K.M. Tripathi

Scientist 'D'

Dr (Mrs) Anjum Farooqui

Dr Amit K. Ghosh

Dr Bhagwan D. Mandaokar

Dr Kindu L. Meena

Dr Chandra M. Nautiyal

Dr (Mrs) Neeru Prakash

Dr (Mrs) Vandana Prasad

Dr Anupam Sharma

Dr Gyanendra K. Trivedi

Scientist 'C'

Dr. Ratan Kar

Dr (Mrs) Binita Phartiyal

Scientist 'B'

Mr Sadhan K. Basumatary

Mr Krishna G. Misra

Dr Srikanta Murthy

Mr S. Suresh K. Pillai

Dr Parminder S. Ranhotra

Dr (Mrs) K. Pauline Sabina

Dr (Mrs) Anju Saxena

Dr Santosh K. Shah

Dr Hukam Singh

Dr (Ms) Vartika Singh

Mr Veeru K. Singh

Mr Biswajeet Thakur

Scientist 'A'

Dr Anil K. Pokharia

Birbal Sahni Research Associate

Mr. Om Prakash (tenure completed w.e.f. 02.04.2010)

Birbal Sahni Research Scholar

Mrs Neha Aggarwal

Ms Deepa Agnihotri

Mr Mohamad Firoze Quamar

Mrs Anumeha Shukla (tenure completed w.e.f. 29.03.2011)

Mrs Abha Singh

Mr. Gaurav Kr. Singh

Ms Shilpa Singh

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



Technical Personnel

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

Technical Officer 'D'

Dr B. Sekar

Technical Officer 'C'

Mr P.K. Bajpai

Dr (Mrs) Madhabi Chakraborty (retired w.e.f. 31.03.2011)

Mrs Indra Goel

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

Mr Avinash 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

Technical Assistant 'D'

Mr S.R. Ali

Mr D.S. Bisht

Mr Sumit Bisht

Mr. S.K. Bisht (resigned w.e.f. 20.08.2010)

Mr. Nilay Govind

Mr D.K. Pal

Mr Dharendra Sharma

Ms Kirti Singh

Dr S.K. Singh

Mr C.L. Verma

Dr 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. J. Baskaran

Mr Pawan Kumar

Mr Om Prakash

Mr. A.K. Sharma

Ms Richa Tiwari

Mr. Ram Ujagar

Administrative Personnel

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

Registrar: Dr Suresh C. Bajpai

Accounts Officer: Mr Dipak K. Dutta (on lien)

Mr. Nanda Ballabh Tewari (on deputation)

Private Secretary: Mrs M. Jagath Janani

Section Officer

Mr R.K. Kapoor (retired w.e.f. 30.09.2010)

Mrs V. Nirmala

Stenographer: Sri Murukan Pillai

Assistant

Mrs Ruchita Bose

Mr Hari Lal

Mrs Swapna Mazumdar

Mr Gopal Singh

Mr K.P. Singh

Mr Koshy Thomas

Mrs Pennamma Thomas

Hindi Translator: Mr Ashok Kumar

Upper Division Clerk

Ms Chitra Chatterjee

Mr Mishri Lal

Mr S.S. Panwar

Mr Rameshwar Prasad

Mrs Shail S. Rathore

Mr Avinash K. Srivastava

Mrs Renu Srivastava

Mr N.Unni Kannan

Lower Division Clerk

Mrs Sudha Kureel
Mr. Rajesh K. Mishra
Ms Manisha Tharu

Driver

Mr Nafis Ahmed ('IV')
Mr D.K. Mishra ('III')
Mr M.M. Mishra ('III')
Mr V.P. Singh ('III')
Mr P.K. Mishra ('II')

Attendant 'IV' (Technical)

Sri K.C. Chandola

Attendant 'III'

Sri Kesho Ram
Sri Haradhan Mahanti
Smt. Munni (retired w.e.f. 31.10.2010)
Sri Prem Chandra
Sri Ram Deen
Sri Ram Singh
Sri Shree Ram

Attendant 'II'

Sri K.K. Bajpai
Smt. Maya Devi
Sri Hari Kishan
Sri Kailash Nath
Sri Dhan B. Kunwar
Sri Mani Lal Pal
Sri Ram Dheeraj
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
Km. Nandani
Smt. Ram Kali
Sri Ramesh Kumar
Sri Ravi Shankar

Mali

Sri Rameshwar Prasad Pal ('III') (retired w.e.f. 31.08.2010)
Sri Ram Chander ('I')
Sri Ram Kewal ('I')
Sri Mathura Prasad ('I')

Sponsored Project Personnel

Mr Kamlesh Kumar, SRF
Mr. Mayank Shekhar, JRF (tenure expired w.e.f. 31.03.2011)
Ms Sandhya Sharma, JRF
Ms Jyoti Srivastava, JRF
Ms Swati Dixit, JRF
Mr Suman Sarkar, JRF
Mr Gaurav Srivastava, Project Assistant
Ms Archana Singh, Project Assistant



A view of farewell to retired administrative personnel

AUDIT REPORT

**to the
Governing Body
of the
Birbal Sahni Institute of Palaeobotany
Lucknow**

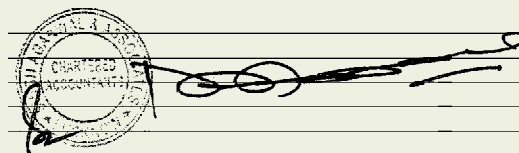
We have audited the attached Balance Sheet of Birbal Sahni Institute of Palaeobotany, Lucknow, as at 31st March 2011 and also the Income & Expenditure account and Receipt & Payment account for the year ended on that date annexed thereto. These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these financial statements based on our audit.

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

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

- (i) We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our audit;
 - (ii) In our opinion, proper books of account as required by law have been kept by the Institute so far as appears from our examination of those books;
 - (iii) The Balance Sheet and Income & Expenditure account and Receipt & Payment account dealt with by this report are in Agreement with the books of account;
 - (iv) In our opinion and to the best of our information and according to the explanations given to us and the said account give the information, in the manner so required, and give a true and fair view in conformity with the accounting principles generally accepted in India;
- a) In the case of the Balance Sheet, of the state of affairs of the Institute as at 31st March, 2011;
 - b) In the case of the Income & Expenditure Account, of the surplus/deficit for the year ended on the date, and
 - c) In the case of Receipt & Payment Account, of the receipts & payments of the Institute for the year ended on that date.

For Singh Agarwal & Associates
Chartered Accountants



Mukesh Kumar Agarwal
FCA, DISA (ICAI)
Partner
Membership No. 073355

Place : Lucknow
Date : 10th November, 2011

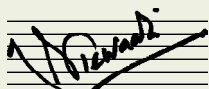
ANNEXURE - 'A'

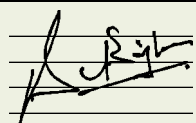
(Annexed to and forming part of the Audit Report for the year ended 31st March, 2010)
Comments/Audit observations on accounts of Birbal Sahni Institute of Palaeobotany- Lucknow
for the year ended 31st March, 2010

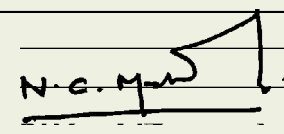
S No	Comments/Observations by the Chartered Accountants	Actions taken by the Institute																					
01.	<u>ACCOUNTS:</u> <i>The Institute is getting separate grants for Plan & Non-Plan expenses based on the budgets approved by the DST. During the year under report, the Institute has allowed to use Plan head funds for Salary etc instead of Non-Plan budget.</i>	Since all the Scientific and Technical and staff members are involved in the Plan activities, as per Governing Body's resolution, their salary and allowances are debited to the Plan Head with the prior approval of the GB.																					
02.	<i>Advances (capital head) unsettled and pending for recovery / adjustment as on 31.03.2011 under different heads, since long, are to be properly taken care of at the Institute level for early adjustment. Details of which are as under:</i> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th><u>PARTICULARS</u></th><th><u>YEAR</u></th><th><u>AMOUNT</u></th></tr> </thead> <tbody> <tr> <td>WORKS & BUILDING (CPWD FOR CNR BUILDING)</td><td>Before FY 2007-08</td><td>12,15,805.00</td></tr> <tr> <td>RESEARCH APPARATUS & EQUIPMENTS</td><td>Before FY 2007-08</td><td>24,36,558.00</td></tr> <tr> <td>BOOKS & JOURNALS</td><td>2007-2008</td><td>6,246.00</td></tr> <tr> <td></td><td>2008-2009</td><td>1,953.00</td></tr> <tr> <td></td><td>2009-2010</td><td>34,918.00</td></tr> <tr> <td></td><td>2010-2011</td><td>25,70,724.00</td></tr> </tbody> </table> <i>Adjustments/Recovery of Advance related to Research Apparatus and Equipments is responsibility of Stores and Purchase Section. No explanation was given to us regarding follow up for adjustment of such advance. We noticed that no attempts were made to adjust such advance. This amount should be adjusted at earliest.</i>	<u>PARTICULARS</u>	<u>YEAR</u>	<u>AMOUNT</u>	WORKS & BUILDING (CPWD FOR CNR BUILDING)	Before FY 2007-08	12,15,805.00	RESEARCH APPARATUS & EQUIPMENTS	Before FY 2007-08	24,36,558.00	BOOKS & JOURNALS	2007-2008	6,246.00		2008-2009	1,953.00		2009-2010	34,918.00		2010-2011	25,70,724.00	The efforts are being made to settle the advances.
<u>PARTICULARS</u>	<u>YEAR</u>	<u>AMOUNT</u>																					
WORKS & BUILDING (CPWD FOR CNR BUILDING)	Before FY 2007-08	12,15,805.00																					
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	2009-2010	34,918.00																					
	2010-2011	25,70,724.00																					
03.	<i>The Institute made all desired efforts and implemented much awaited 'Double entry system of accounting at the institute during the year 2010-11. However due to certain circumstances beyond control and due to lack of spirit and determination among persons involved at institute level the same is not expected to give desired results. For the current financial year 2010-11 final accounts have been prepared and compiled on the basis of 'Single Entry System of Accounting' and no efforts made to reconcile the same with Final Accounts with 'Double entry system of accounting. Due to this possibility of Errors and Omission in the final account is there which could have been avoided at 'Double entry system of accounting' if implemented</i>	The double entry system of accounting is being implemented. However, the administrative division is suffering from shortage of manpower and hence, the delay in completing the double entry system of accounting.																					
04.	<i>Maintenance of Accounting records, Cash / Bank Book, Ledgers (including stores records) etc need to be strengthened and cutting & over-writings must be duly authenticated. Reconciliation of Ledger balances is required to be made on regular basis.</i>	The suggestions of the Chartered Accountants are noted for compliance.																					

S No	Comments/Observations by the Chartered Accountants	Actions taken by the Institute																																								
05.	The Institute has invested most of the funds in to the Term Deposits with Banks and financial institutions. Institute is following cash basis of accounting. However, Institute is advised to account for TDS on these investments, if any, yearly basis on the basis of TDS certificate issued by such Bank and Financial Institutions and claim with the Income Tax Department accordingly. Misc Income of the Institute is shown as net of TDS. It is emphasized that it would be prudent to show the same Gross of TDS & TDS amount be shown separately. Due to improper accounting of TDS in the earlier years huge amount of TDS amount Rs. 14,76,323.00 is pending for refund with Income Tax Department. No efforts has been made by the institute to recover such amount. <u>Fund wise TDS Details are as under:</u> <table><tr><th>Financial Year</th><th>GPF</th><th>CPF</th><th>Pension</th><th>Total</th></tr><tr><td>2010-11</td><td>354,549.00</td><td>18,167.00</td><td>475,352.00</td><td>848,068.00</td></tr><tr><td>2009-10</td><td>125,377.00</td><td>2,238.00</td><td>108,904.00</td><td>236,519.00</td></tr><tr><td>2008-09</td><td>116,654.00</td><td>-</td><td>2,223.00</td><td>118,877.00</td></tr><tr><td>2007-08</td><td>21,033.00</td><td>-</td><td>2,880.00</td><td>23,913.00</td></tr><tr><td>2006-07</td><td>28,916.00</td><td>-</td><td>71,663.00</td><td>100,579.00</td></tr><tr><td>2005-06</td><td>86,188.00</td><td>-</td><td>62,179.00</td><td>148,367.00</td></tr><tr><td></td><td>732,717.00</td><td>20,405.00</td><td>723,201.00</td><td>1,476,323.00</td></tr></table>	Financial Year	GPF	CPF	Pension	Total	2010-11	354,549.00	18,167.00	475,352.00	848,068.00	2009-10	125,377.00	2,238.00	108,904.00	236,519.00	2008-09	116,654.00	-	2,223.00	118,877.00	2007-08	21,033.00	-	2,880.00	23,913.00	2006-07	28,916.00	-	71,663.00	100,579.00	2005-06	86,188.00	-	62,179.00	148,367.00		732,717.00	20,405.00	723,201.00	1,476,323.00	Most of the investments of GPF, CPF and Pension funds are in Banks. The Banks deduct TDS from the deposits at the time of maturity. Efforts are being made to get the refunds from the Income Tax Department.
Financial Year	GPF	CPF	Pension	Total																																						
2010-11	354,549.00	18,167.00	475,352.00	848,068.00																																						
2009-10	125,377.00	2,238.00	108,904.00	236,519.00																																						
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	732,717.00	20,405.00	723,201.00	1,476,323.00																																						
06.	<u>LIBRARY AND PUBLICATION:</u> On scrutiny of records of the priced publication of the Institute, it has been observed that during last several years, the Institute had brought-out publications on different subjects with an objective to sell-out the same, in the market. Looking at the stock position of these priced publications as on 31.03.2011 including the reserved stock; it appears to be on higher side. A practical assessment has to be made for the quantity to be got printed together with its economics etc so that wastage and blockage of Institute funds can be avoided.	Institute is making efforts to reduce the price publications stock. There has been some progress in this direction.																																								
07.	<u>STORES AND WORKS & BUILDING:</u> The Fixed Assets register & Stores register are NOT being maintained properly	The Chartered Accountants comments have been noted for proper maintenance of fix asset register and stores register.																																								
08.	Physical Verification of the assets is not being done on time. Physical verification of Non-Consumable assets for the year ended 31.03.2010 was done in October, 2010. While verification no summary of Fixed Assets were being prepared. Only a certificate has been issued that “Physical Verification has been done as per books and no discrepancies have been notice”. No Checking Marks were available on fixed assets register.	The Chartered Accountants comments have been noted for physical verification of assets.																																								
09.	Physical Verification of the Consumable Items for the year 2008-09 has been done on 18.10.2010. While verification no Summary of Assets/Working Sheet were being prepared. Only a certificate has been issued that “Physical Verification has been done as per books and no discrepancies has been notice”. No Checking Marks were available on Assets Register.	The Chartered Accountants comments have been noted for physical verification of assets																																								
10.	No Physical Verification has been done for the year 2010-11 till the date of Audit	Physical verification of non-consumable assets is starting very soon for the year 2010-2011.																																								
11.	No Record/Stock Register is being maintained in any department for items issued to them from stores.	The records/ stock registers are maintained by the stores and purchase section.																																								
12	No TDS has been deducted while making payment of Labour Rs. 1,24,000.00 to M/s Shreeji Switchgear & Control System, Ahmedabad.	Necessary efforts shall be made to recover the TDS amount from the firm.																																								
13	An Asset worth Rs. 78,000.00 was purchased from M/s Shreeji Switchgear & Control System, Ahmedabad. For Which Only Rs. 7,800.00 CNR has been created. Balance amount Rs. 70,200.00 has been taken as expenditure. For Such Asset 90% advance Rs. 70,200.00 was given from Miscellaneous and such amount was taken as expenditure. Correction should be made	Corrections as pointed out by the Chartered Accountants are being made.																																								

S No	Comments/Observations by the Chartered Accountants	Actions taken by the Institute
14	<i>Non consumables item purchased during the year Rs. 5897045.00 for the year 2010-11. Our Comments in this regard are as under:</i> a. <i>Authorized Dealer's Certificate has not been taken while purchasing computer, scanner, printers etc.</i> b. <i>Most of the items have been purchased on the basis of DGSD Rate List of 2009.</i> c. <i>2 Laptop purchased worth Rs. 83900.00. No Requirement/Quotations/Sanction has been found regarding the same. This Amount includes RS. 2000.00 cost of installation which are not applicable in case of Laptop</i> d. <i>3 split AC of 2Ton & 3 Window AC of 2Ton were purchased during the year, whereas requirements were 2 split AC and 2 window of AC 2Ton and 1 split AC and 1 Window AC 1.5Ton as per details attached in the file.</i>	Authorised Dealers Certificates are being taken in purchasing store items. DGS&D rate list is being followed for small purchases. The Laptops were purchased for two senior scientists. Unfortunately the concerned file is misplaced and that is why it was not available for Chartered Accountants inspection. The purchases were made as per the modified requirements.
15	<i>Small Consumables items such as crokery, bottles etc are shown as non consumables items in books.</i>	Necessary corrections as pointed out by the Chartered Accountant are being made.
16	<u>EMPLOYEES PROVIDENT FUND (GPF / CPF):</u> <i>The investment of GPF includes Rs. 1,24,800.00 unadjusted amount of premium paid on RBI Bonds, which were redeemed in the year 2006-07 & remains pending for suitable adjustments.</i> <i>Finance & Building Committee of the Institute vide its meeting held on September 09, 2007 makes no objection on this matter. After decision of Finance & Building Committee and Chartered Accountants comments in the their report during the year 2009-10 actions was taken by the institute to transfer such amount to Expenditure Account. Even after such decision the said amount is not yet adjusted.</i>	The adjustment is under process.
17	<i>CPF funds are kept invested by the Institute at par with GPF funds and requires to be dealt with according to the rules in this regard by depositing the same with concerned Statutory Authorities. Institute must make effective efforts / steps in completing the remaining formalities for the same.</i>	Formalities for transfer of CPF funds to Statutory Authorities will be completed soon.
18	<u>LEGAL CASES AND CONTINGENT LIABILITY:</u> <i>List of Legal Cases were not provided to us where as Legal Fees is being paid in Lacs of Rupees. In absence of List we are unable to comments of genuineness of such expenses and assessment of Contingent Liabilities.</i>	The Convenor of the Legal Cell was outside the country for visit under INSA exchange programme. Hence, the list of legal cases was not provided in time.
19	<i>Management has taken Contingent Liability as NIL.</i>	No Comments.
20	<u>TAX EXEMPTION CERTIFICATE:</u> <i>Income Tax Exemption has been lapsed in the year 2003. After that no proper follow up regarding the renewal of such exemption certificate. Such Certificate is very important for the organization. In absence of such, huge tax liability on Interest Income may incur on the Institute.</i>	Efforts are being made to renew Income Tax Exemption Certificate.


(N B Tiwari)
Accounts Officer


(Suresh C. Bajpai)
Registrar


(Naresh C. Mehrotra)
Director

Form of Financial Statements (Non-Profit Organizations)

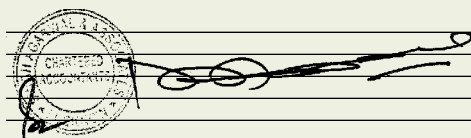
Birbal Sahni Institute of Palaeobotany, Lucknow

Balance Sheet as at March 31, 2011

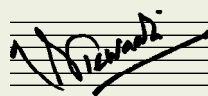
Fig. in Rupees

CORPUS/CAPITAL FUND AND LIABILITIES	Schedule	Current Year	Previous Year
CORPUS/CAPITAL FUND	1	145197686	149043685
RESERVES AND SURPLUS	2	36460903	25960903
EARMARKED/ENDOWMENT FUNDS	3	157239725	127975744
SECURED LOANS AND BORROWINGS	4	0	0
UNSECURED LOANS AND BORROWINGS	5	0	0
DEFERRED CREDIT LIABILITIES	6	0	0
CURRENT LIABILITIES AND PROVISIONS	7	139119	149119
TOTAL		339037433	303129451
ASSETS			
FIXED ASSETS	8	106369494	117067458
INVESTMENTS-FROM EARMARKED/ENDOWMENT FUNDS	9	157160828	127739216
INVESTMENTS-OTHERS	10	54381108	31019444
CURRENT ASSETS,LOANS,ADVANCES ETC.	11	21126004	27303333
MISCELLANEOUS EXPENDITURE (to the extent not written off or adjusted)			
TOTAL		339037433	303129451
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

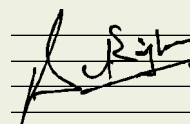
For Singh Agarwal & Associates
Chartered Accountants



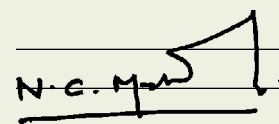
Mukesh Kumar Agarwal
(Partner)



(N B Tiwari)
Accounts Officer



(Suresh C. Bajpai)
Registrar



(Naresh C. Mehrotra)
Director

Form of Financial Statements (Non-Profit Organizations)

Birbal Sahni Institute of Palaeobotany, Lucknow

Income and Expenditure Account for the period / year ending March 31, 2011

INCOME	Schedule	Current Year	Previous Year Fig. in Rupees
Income from Sales/Services	12	864958	712649
Grants/subsidies (OB, Deposit A/C and Transfer from Cap. Fund)	13	186778000	198222158
Fees/Subscriptions	14	1331963	252831
Income from Investments (Income on Invest. From earmarked/endow. Funds transferred to Funds)	15	2361664	1617044
Income from Royalty, Publication etc.	16	102202	196961
Interest Earned	17	2043299	1467354
Other Income/adjustments	18	603772	510609
Increase/(decrease) in stock of Finished goods and works-in-progress	19	0	0
TOTAL (A)		194085858	202979606
EXPENDITURE			
Establishment Expenses	20	129159290	144552125
Other Administrative Expenses etc.	21	22022104	23609039
Expenditure on Grants, Subsidies etc.	22	0	0
Interest	23	0	0
Depreciation (Net Total at the year-end-corresponding to Schedule 8)		17250463	19417735
TOTAL (B)		168431857	187578899
Balance being excess of Income over Expenditure A-B		25654001	15400707
Transfer to Special Reserve (Specify each)		10500000	5000000
Transfer to/from General Reserve to Pension Fund		19000000	14000000
BALANCE BEING SURPLUS/DEFICIT CARRIED TO CORPUS/CAPITAL FUND		(3845999)	(3599293)
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

For Singh Agarwal & Associates
Chartered Accountants

Mukesh Kumar Agarwal
(Partner)

N B Tiwari

(N B Tiwari)
Accounts Officer

Suresh C. Bajpai

(Suresh C. Bajpai)
Registrar

N.C. Mehrotra

(Nareesh C. Mehrotra)
Director

Form of Financial Statements (Non-Profit Organizations)

Birbal Sahni Institute of Palaeobotany, Lucknow Receipts and Payments Account for the period / year ended March 31, 2011

Fig. in Rupees

RECEIPT	Current Year	Previous Year	PAYMENTS	Current Year	Previous Year
I. Opening Balances			1) Expenses		
a) Cash in hand	446	102	a) Establishment Expenses (Corresponding to Schedule 20)	129159290	144552125
b) Bank Balances			b) Administrative Expenses (Corresponding to Schedule 21)	22022104	23609039
i) In current accounts	0	-73993			
ii) In deposit accounts					
iii) Endowment deposits					
iv) Salary Account	2760232	138131			
II. Grants Received					
a) From Government of India	186778000	198222158	II) Payments made against funds for various projects		
b) From State Government			(Name of the fund or project should be shown along with		
c) From other sources (details)			the particulars of payments made for each project)		
(Grant for capital & revenue exp.					
To be shown separately)					
d) Deposit Account					
III. Income on Investment from			III. Investments and deposits made		
a) Earmarked/Endow. Funds			a) Out of Earmarked/Endowment funds		
b) Own Funds (Utilized)			b) Out of Own Funds (Investments- Others)	29500000	19000000
IV. Interest Received			IV. Expenditure on Fixed Assets & Capital Work-in-Progress		
a) On Bank deposits	1281134	683816	a) Purchase of Fixed Assets	5897045	3805989
b) Loans, Advances etc.	762165	783538	b) Expenditure on Capital Work-in-Progress		
V. Other Income (specify)			V. Refund of surplus money/ Loans		
i) Sale proceeds of Publications	102202	196961			
ii) Miscellaneous Income	334790	492157	a) To the Government of India		
iii) Sale of Services (Consultancy)	864958	710831	b) To the State Government		
iv) Group Insurance	320736	0	c) To other providers of funds		
VI. Amount Borrowed			VI. Finance Charges (Interest)		
VII. Any other receipts (give details)			VII. Other Payments (Specify)		
(Pension Contribution)	18000	0	i) Advances to Staff	1735837	1836633
			ii) Earnest Money Refunded	20000	11500
			iii) Advances to Parties	2570724	838780000
			iv) Group Insurance	254567	0
I) Recovery of Advances	2842154	2784933			
ii) Earnest Money Deposit	10000	25170	VIII. Closing Balances		
iii) FDR Matured	0	0	a) Cash in hand	0	446
iv) Recovery from Parties	0	0	b) Bank Balances	0	0
			i) In current accounts	0	0
			ii) In deposit accounts		
			iii) Saving account	4915250	2760232
			iv) Endowment deposit account		
			v) Excess Expenditure		
TOTAL	196074817	203963804		196074817	203963804

For Singh Agarwal & Associates
Chartered Accountants



Mukesh Kumar Agarwal
(Partner)

(Signature)

(N B Tiwari)
Accounts Officer

(Signature)

(Suresh C. Bajpai)
Registrar

(Signature)

(Naresh C. Mehrotra)
Director



