Annual Report

2008-2009

1946

Birbal Sahni Institute of Palaeobotany, Lucknow

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

Contents

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Front Cover : An epishelf lake, near NOVO, Russian Base, Schirmacher Oasis, showing connection with the shelf ice and has tidal influence (see Project 13.1, Quarternary)

Back Cover: : A cluster of Ediacaran *Cyclomedusa* on Sonia Sandstone Formation (See Project 1.1 Precambrian)

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October 2009

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

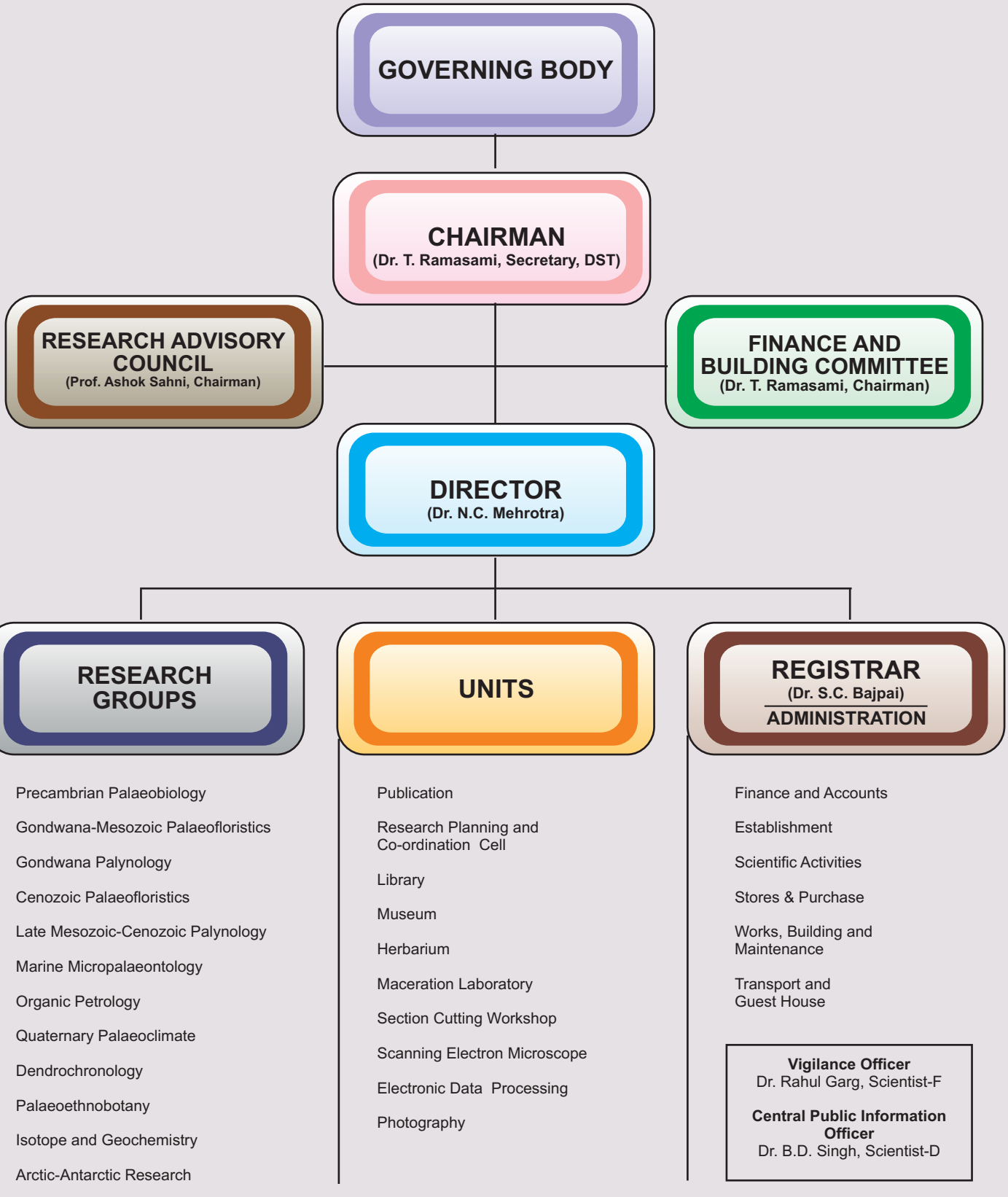
With Best Compliments

N. C. Mehrotra

Naresh C. Mehrotra
Director

Organization Structure

Department of Science & Technology
Autonomous Institute



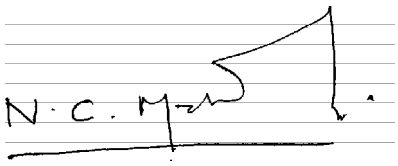
Foreword

The Birbal Sahni Institute of Palaeobotany, Lucknow, is a nodal Research Centre dedicated to both basic and applied aspects of Palaeobotany. During the year 2008-2009 the Eleventh Plan Research Activities have been formulated under six Thrust Area Programmes focused on topical research themes - Early life; Fossil land plant communities; Integrative Micropalaeontology, Biopetrology and Organic facies; Integrated climate change researches; Polar Sciences and Frontiers in Palaeobotanical Research.

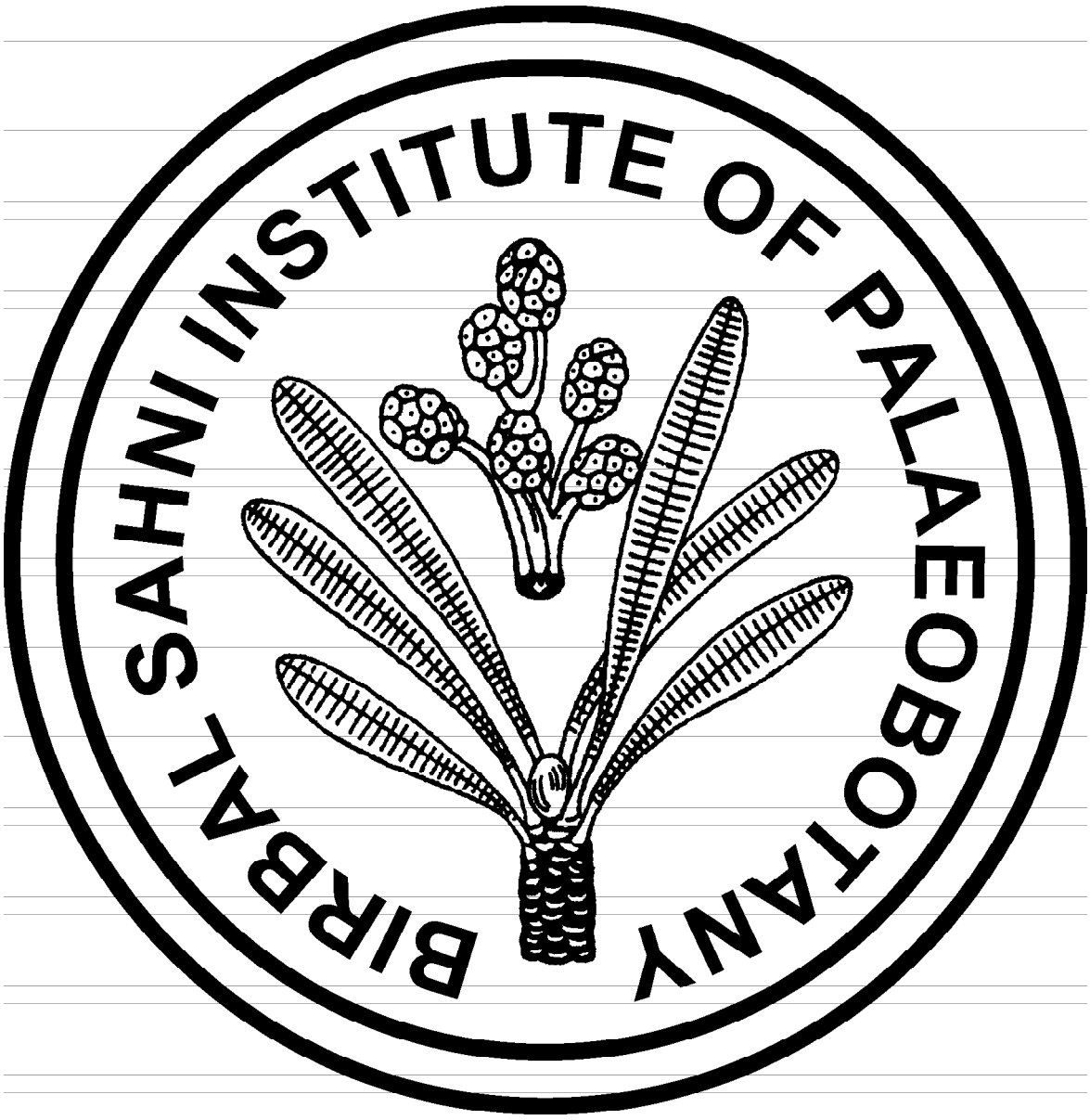
The outcome of researches has resulted in accumulation of significant data which is helpful in solving various aspects of geological and botanical challenges. The accrued data has been incorporated in the research publications, reports, news material and other scientific and technical documents. The outreach of research has been enhanced through various popular science programs, science meets, training and interactive sessions, exhibitions, competitions, awards, popular lectures and event celebrations. The Institute has organised In-house Lecture Series to motivate newly recruited young scientific staff. The Institute has the distinction of organising *Indo-China International Conference: Biotic and Climatic Changes in the Indo-China Region* during November 14-15, 2008 and *Conference on Plant Life through the Ages* during November 16-17, 2008. In the forthcoming year we propose to hold a Conclave on Evolution to commemorate bicentennial of Sir Charles Darwin and Sesquicentennial of the his book *Origin of Species*. A National Conference on Quaternary Climate Changes in the Polar Regions is also envisaged in collaboration with NCAOR, Goa.

I am happy to forward this Annual Document of the Institute with the guidance of Governing Body and Research Advisory Council members. Inputs from Scientific, Technical and Administrative staff have helped to make this document more relevant.

Efforts of staff placed in different units - Publication, RPCC, Museum, Administrative and Technical have culminated in detailing out year long activities.



(N.C. Mehrotra)
Director



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RESEARCH HIGHLIGHTS

Continuing the five year plan targets , research projects for the year 2008-2009 have been organized under the umbrella of six identified Thrust Areas: *Early life, atmosphere and oceans: Evidences from Indian Craton (Bio-Geosphere interactions in the Precambrian); Fossil land plant communities: Morpho-structure, Evolution, Systematics with applications to Biostratigraphy and Palaeoecology (Plant evolution, Anatomy, Taxonomy and Stratigraphy); Integrative Micropalaeontology, Biopetrology and Organic facies: Relevance to fossil fuel characterization and exploration (Integrated approach to realizing economic potential in prospective basins); 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); Polar and Major Planetary Events (Polar research and record of events such as Tsunami, Earthquakes and Volcanism)* and *Frontiers in Palaeobotanical Research (Reconnaissance Projects to aid in development of future research direction).*

Important outcome of scientific research in BSIP during the year 2008-2009 is as under:

- Palaeobiology of the Sonia Sandstone Formation of the Jodhpur Group reveal occurrence of sedimentary structures unique to Ediacaran Period. Closely comparable forms to Ediacaran mollusk also confirm such possibility.
- Recovery of Organic-walled microfossils (OWM), acritarchs, and cyanobacteria in the limestone of Chhuipali Formation, Singhora Group (Chhattisgarh) and cyanobacteria in Charmuria Limestone of Raipur Group constitutes new knowledge to early life records.
- Investigations on plant fossils of Bijori Formation, Satpura Gondwana Basin suggest existence of transitory flora of Late Permian and Early Triassic.
- Coiled and irregular shaped trace fossils from the sandtone facies of Barakar Formation of Mohpani and Pench valley coalfields suggest ichno-fossil affinity. Floristics of Bansa Formation, South Rewa Gondwana basin indicates existence of flora akin to Neocomian-Albian flora of Europe, Moscow Basin, Western Siberia, and North America.
- Comparative floral studies on the early Cretaceous flora of Palar, Krishna-Godavari and Pranhita-Godavari basins indicate homotaxial associations and paralic deposition.
- Seven palyno-assemblage zones ranging from in Early Permian to Late Permian were established from coal-bearing horizon bore-holes in Rajmahal Basin.
- An earliest Early Cretaceous palyno-assemblage within the Intertrappean sediments (181.40- 215.00 m) was recognized for the first time in the Raniganj Coalfield.
- Xylotomocal investigations on Tertiary woods of Bikaner and Jaisalmer suggest prevalence of angiosperms belonging to Lythraceae (*Lagerstroemia*), Ebenaceae (*Diospyros*), and Myrtaceae (*Eucalyptus*). Recovery of *Eucalyptus* from Eocene of Rajasthan confirms its wide spread occurrence in India in early Tertiary.
- Growth of *Melanorrhoea (*Anacardiaceae) and *Aglaia* (Meliaceae) during the deposition of Lignite mines of Rajpardi (Bharuch district) and Vastan (Surat district) in Gujarat has been established.
- Investigations on the fossil woods of Intertrappeans (Bhutera, Chhindwara, Madhya Pradesh) reveal abundance of dicotyledons.
- Rich assemblage of legume fruits from the Oligocene sequence of Makum and Dilli-Jeypore coalfields indicates a warm and humid climate in the region during the deposition of the sediments
- Leaf remains of Dafla Formation, West Kameng District, Arunachal Pradesh (Middle-Upper Miocene) were studied in conjunction with the distribution of modern counterparts which denote tropical vegetation components.

- Two new fossil woods resembling extant taxa, *Hopea sulcata* Sym. and *Duabunga grandiflora* (Roxb.ex DC.) Walp. (Dipterocarpaceae and Lythraceae) show extinction trends during Miocene in the Himachal Pradesh.
- CLAMP (Climate Leaf Analysis Multivariate Program) calibration using Global Gridded Meteorological Data and PHYSG3BR physiognomic data calibrated with the climate station based MET3BR opened new way to include natural vegetation anywhere in the world irrespective of the proximity of a meteorological station.
- Freshwater influence in the marine depository basin, Pynursla Plateau, Khasi Hills is marked by the presence of aquatic freshwater ferns and indicative of a marginal deposition.
- Palynofacies and palynology on various lithotypes (coal, carbonaceous shale, siliciclastic clay) distributed in Bapung Coalfield, Mikir Hills and Upper Assam Basin reflect impact of rapid climatic warming as evidenced by pan-tropical mega-thermal angiosperms.
- Multiproxy data (dinocysts, palynofacies, clay mineralogy, carbon isotope) was used to interpret climatic scenario across PETM interval in Jathang section and sudden increase in the diversity pattern of terrestrial palynomorphs was observed.
- Middle Albian nanno-fossil assemblage from the Pariwar Formation, Rajasthan Basin constitutes first chronologic inference.
- FTIR studies on resins of Ratnagiri and Neyveli lignites establish their genesis to polycadinene structures and diagnostic biomarker of the dammar resins suggest terrestrial input in the form of angiosperms.
- Non-pollen microfossils recovered from the sedimentary sequence of the Kargil and Tharumsa formations (Late Oligocene-Miocene), Ladakh Molasse Group was suggestive of humid moist conditions.
- Discovery of dinoflagellate cysts in the split lignite seam inter burden Neyveli lignites associated with marine sedimentary structures indicate Middle Eocene age and coastal to marginal marine environment of deposition.
- Three cenozones have been recognized on the basis of first appearance, acme and decline of palynotaxa in the deposits studied from the Vastan Lignite,Cambay Basin, Gujarat which reflect changing palaeo-depositional environments.
- The petrological evidences substantiate predominance of huminite and features of macerals/fossils and their correlation to modern plant equivalents in the Neyveli (Miocene), Cauvery Basin and Panandhro (Eocene), Kutch Basin support contribution of mangrove-mixed angiospermic vegetation to the lignite formation.
- Two transgressive /regressive cycles have been recognised at level 278 cm and 40 cm in sediment profile CHI-31., Chilka Lake, Orissa dated back to 1575 ±35 yrs. B.P.
- Organic matter studies on soil-core of Andhra Pradesh indicate fresh water fluvial energy and abundance of allochthonous woody charcoal debris, blackish cuticular fractions and identifiable plant tissues and chytridiales.
- Gonyaulacoid and Peridinoid investigations of dinoflagellate cyst and palynofacies studies from the upper 1m profile of the GC – 1 core (Karawar Coast) revealed significant variation in their vertical distribution.
- Occurrence of tree-savannahs comprising grasses with scanty trees was established through pollen analytical investigations from Nitaya Lake, Hoshangabad district (6650 to 5780 yrs B.P). Forest history of open mixed deciduous forests has been traced. (Between 5780 and 3000 yrs B.P).
- Pollen analysis of moss cushion and forest humus procured from Dirpai and Singrijan forest, Assam depicts the existence of vast low land forest with marshy swamp.
- Phytolith studies on Sambhar lake sediments and high resolution paleo-monsoonal history indicate brief dry phase before Early Holocene (~10,000 yrs BP) followed by high precipitation during 9490 yrs BP.
- Changing relative frequencies of major arboreal and non arboreal pollen taxa, in the Kusumelli Swamp corresponds to climate fluctuations. Vegetational diversity during 11,900 yr BP to 8490 yr BP under warm and humid climate was suggested.

- Based on palynofacies, magnetic, textural and loss on ignition parameters a model was proposed using Holocene profiles from Mujhpur and Dabka localities Baroda Window, Mainland Gujarat.
- OSL chronology suggests that lake deposits in the Spiti valley were formed in two episodes influenced by tectonic movement along the Kaurik-Chango fault
- An elemental analyzer (HCNS- O) has been set up along with necessary accessories to measure relationship of carbon to nitrogen ratios in vegetations
- Rich assemblage of spores, pollen, dinoflagellates, diatoms, thecate amoebae, micro-foraminifers, scolecodont fragments, radiolarians, copepod egg-shells, tintinnids, etc. was recovered from the sediments collected during 1st Indian Expedition to the Arctic (2007). Diverse ecological niches such as freshwater, oligosaline, mesosaline, oligohaline, mesohaline, eurysaline and dry ecosystems have been ascertained.
- Studies on cyanobacterial mats from lakes near the Russian base, NOVO Arctic helped to understand the present day lake ecology and the role of cyanobacteria in defining the organic matter distribution pattern.
- Studies on Glossopteris floral elements from Weller Formation (Permian) and the Lashly Formation (Triassic) Allan Hills, Southern Victoria Land, Central Transantarctic Mountains, establishes their close similarity to Barakar and Raniganj flora of India.
- Palynology of Guling Formation, Guling Area, Pin Valley reveals presence of zonate/apiculate triletes, leiosphaerids and achritarchs along with characteristic pollen-spores.
- Cross-dating of 20 tree core samples of Himalayan pencil juniper (*Juniperus polycarpos*) and 35 tree core samples of Himalayan cedar (*Cedrus deodara*) collected from different sites in Lahaul, Himachal Pradesh

A view of Research Advisory Council Meeting

Prof R.A. Spicer delivering a talk during Conference on Plant Life through the Ages held at BSIP

helped to develop the ring-width chronologies of respective species. The chronology of Himalayan pencil juniper extends back to the early 10th century AD and Himalayan cedar to 15th century.

- Temporal variation of radiocarbon (C^{14}) in annual rings of Teak tree (*Tectona grandis*) from two sites– Hoshangabad (22° 302 N:78°E) Madhya Pradesh, and from Thane (19° 122 N:73°E) Maharashtra were studied. Peak values have been used to estimate the local emission of fossil fuel CO_2, which is approximately 2.3% of the background atmospheric CO_2 concentration.
- The record of neem (*Azadirachta indica*) seed/fruit remains, medicinally valuable tree taxa from Sunga-Kushana levels (200 B.C.-300 A.D.) is significant in archaeological lexicon of Ganga Plain.

Publication profile of the institute has been improving through encouraging *collaborations* and a good number of research inputs have been published in high *impact journals*. International collaborations with Institute of Botany, Chinese Academy of Sciences, Beijing, China, GINRAS, Moscow, Russia, ILTP, Institute of Geosciences, University of São Paulo and Guarulhos, Brazil have helped to expand scientific knowledge.

Efforts are in progress to arrange visit of Eminent Overseas scientists to establish scientific collaboration with institute scientists and publish results jointly in high impact journals.

Contributions by individual scientists and identified scientific teams resulted in 76 published papers, 125 conference/symposia abstracts, 25 articles / reports, besides 36 research papers accepted for publication. Seven scientists were deputed abroad (Czech Republic, Spain, Germany, Norway, USA, China and Russia). One scientist participated in the 28th Indian Scientific Expedition to Antarctica. Fifty one scientists, three Administrative personnel and seven Technical staff were deputed to attend various national and international conferences / seminars / workshops/ training programs/study/ consultancy visits. One hundred and seven research papers were presented in these meetings at different centers of India. Sixteen scientists from BSIP were deputed to attend the *Indo-China International Conference: Biotic and Climatic Changes in the Indo-China Region* held at BSIP, Lucknow during November 14-15, 2008, and all the scientific staff were deputed to attend *Conference on Plant Life through the Ages* held at BSIP, Lucknow during November 16-17, 2008.

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(w.e.f. **20.12.2006** to **19.12.2009**)

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(w.e.f. **20.12.2006** to **19.12.2009**)

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Dr. S.C. Bajpai
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Foundation Day

The Institute celebrated its 62nd Foundation Day on September 10, 2008. On this occasion Sir Peter R. Crane, FRS, Professor in the Department of Geophysical Sciences, University of Chicago, USA delivered '12th Jubilee Commemoration Lecture' on the topic *Fossils and Angiosperm Evolution: Lessons from Fagales and Prospects for the Future*.

On the same evening, Dr. (Mrs.) Suman Keshari, Deputy Secretary and Head of a Department of Department of Science and Technology, New Delhi delivered a popular lecture in Hindi on *Motivation in Working Place: Some Thoughts (Karyakshetra mein Abhiprerana: kuchh vichar)* to mark the beginning of Hindi Pakhwara.

Professor A.S. Brar, Vice-Chancellor, University of Lucknow, Lucknow presided over the function. Many guests and scientists from outside the Institute attended the function.

Founders' Day

The Institute celebrated its Founder– Prof. Birbal Sahni 117th birth anniversary on November 14, 2008. On November 14, 2008— 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 in the evening two memorial lectures were organized.

On this occasion, following Memorial Lectures were organized:

Dr. B.R. Arora, Director, Wadia Institute of Himalayan Geology, Dehradun delivered the '54th Sir Albert Charles Seward Memorial Lecture' on the fascinating topic *Geodynamic Evolution of Himalaya*.

Prof. Song Ge, Director, Institute of Botany, Chinese Academy of Sciences, Beijing delivered the '38th Birbal Sahni Memorial Lecture' on the topic— *Plant Diversity in China and current researches at Institute of Botany.*

Sri Rasik Ravindra, Director, National Centre for Antarctic and Ocean Research, Goa presided over the function. Many guests and scientists from outside the Institute and several symposium delegates attended the occasion.

Diamond Jubilee Lecture

Sri D.K. Pande, Director (Exploration), Oil and Natural Gas Corporation Limited, New Delhi delivered the '3rd Diamond Jubilee Lecture' on the theme *R&D in High Impact Palynological Research as applied in Hydrocarbon Exploration.*

Indo-China International Conference

India and China, the two neighbouring countries of Asia, having the treasure of living material, i.e. the tropical forests. In India, these forests are found in the Western Ghats, Andaman & Nicobar Islands and in northeast, while in China they occur in south Yunnan, Hainan, Taiwan, Guangdon, Guangxi and Tibet etc. As most of these occur near the sea, they are under the influence of monsoon responsible for the growth of these forests. Both the countries enjoy enormous biological diversity comprising a rich flora and fauna. It has been observed that many tribal communities live in these forests and utilize a large number of plants for medicines, oils, timbers, fibres, dyes, perfumes, resins, etc. Therefore, the ethnobotanical study in these areas would be helpful not only in tracing the history of agriculture in both the countries but also for the commercial development. Unfortunately, in the name of development, many of these rain forests are being destroyed. As a result many plants have disappeared and some of them are at the verge of their extinction. The destruction of forests would have an adverse effect on the climate causing increase in the green-house gases and global warming.

Keeping in view, the Institute hosted the Indo-China International Conference on *Biotic and Climatic Changes in the Indo-China Region* during November 14-15, 2008 following the Founders' day function. It was jointly organized by the BSIP, with the kind support of Wadia Institute of Himalayan Geology (Dehradun) as well as Agharkar Research Institute (Pune) from the Indian side and Institute of Botany, Beijing as well as Institute of Earth Environment, Xi'an. from the Chinese side. It was sponsored by the DST & INSA, Govt. of India, Chinese Academy of Sciences, and National Science Foundation of China. Though this Conference was first of its kind in India, the credit goes to Prof. Song Ge and his team for becoming pioneer in organizing a Sino-India International Conference held at Sanya of the Hainan Province, China from March 28- April 01, 2007.

The experts have been invited to deliver their talk on various themes, such as taxonomy, dendrochronology, archaeobotany, biodiversity, palaeoclimate, radiometric dating etc. The registration for the conference was made on 14th November, while the inaugural function was held on 15th morning. Total 25 abstracts were received and the Abstract Volume was released at the time of inauguration. The welcome address was given by Dr. NC Mehrotra, Director, BSIP, while the speakers on dais were introduced by Dr. RC Mehrotra, Convener of the Conference. At the occasion Prof. De-Yuan Hong, the Academician in the Chinese Academy of Sciences and President of the Botanical Society of China emphasized the significance of the global climate change. Dr. AK Sood, Adviser in the International Cooperation Division of DST, New Delhi spoke on the government policy for the long term cooperation in research between India and China. Dr. BR Arora, Director, WIHG, Dehradun, Prof. Song Ge as well as Prof. Cheng-Sen Li, Institute of Botany, Beijing and Prof. Yu Liu, Director, Institute of Earth Environment, Xi'an also delivered their presidential address.

Academic Session

Just after the Inaugural Function, 3 Technical Sessions were held. The 1st one was chaired by Prof. Ashok Sahni in which 6 presentations had been made. The 2nd session was chaired by Prof Song Ge in which 5 presentations had been made, while the 3rd technical session was chaired by Prof Yu Liu in which 4 presentations were made. In the evening a poster session was held and chaired by Prof. KPN Kumaran. A pre-conference field trip was also organized, with the kind support of WIHG, Dehradun. In this trip 8 Chinese and 5 Indian scientists (3 from BSIP and 2 from WIHG) took part and collected many samples from and around Nainital.

Total 13 Chinese scientists attended the Conference. Besides, Prof. RA Spicer of the Open University, UK was a guest delegate. Delegates from

various organizations, namely Lucknow University, Kolkata University, Punjab University, Wadia Institute of Himalayan Geology, Dehradun, Agharkar Research Institute, Pune and National Botanical Research Institute, Lucknow participated in the conference. After the conference, the Chinese delegates visited the Botanical Garden, NBRI and Lucknow University for scientific discussion in the areas of mutual interest.

Outcome of the Conference

- All the delegates emphasized the need to hold such meetings at the regular intervals preferably annually/ once in two years. The Chinese delegation promised to hold one such meeting in China next year.
- The conference provided an opportunity to the delegates to interact with each other for the future collaboration.
- The pre-conference field trip provided an opportunity to the delegates to make detailed discussion on the future expedition in the area.
- The radiocarbon workers of the two countries discussed problems of common interest. There is good scope of cooperation in target preparation for AMS in the Institute of Earth Environment by the BSIP scientists and carrying out AMS measurements there to understand palaeoclimate from samples of the Himalayan sites.
- The Chinese scientists showed interest in the dendrochronological work being carried out at BSIP.
- The Tertiary megafossil workers of India are already in touch with their Chinese counterparts and this meeting enabled them to chalk out their future programme.

Conference on Plant Life through the Ages

The Conference on *Plant Life through the Ages* was organized by BSIP and Palaeobotanical Society during November 16-17, 2008 and it was inaugurated by Sri DK Pande, Director Exploration, Oil & Natural Gas Corporation Limited. One of the senior most palaeobotanists of the country– Dr RN Lakhanpal, Founder Member of the BSIP and the Palaeobotanical Society blessed the organizers for the success of Conference. The Conference was presided over by Prof. Ashok Sahni, Chairman, RAC and INSA Senior Scientist, Panjab University, Chandigarh and he delivered the presidential address on *Indian Raft: On Collision Course*. Prof De-Yuan Hong, Academician expressed greetings on behalf of the Chinese delegation. The conference was sponsored by DST (New Delhi), ONGC (Dehradun) and Western Coalfields Limited (Nagpur).

There was overwhelming response from all over the country and even contributions from outside the country were received. The contributions were organized under 15 themes and there were 8 oral and 2 poster sessions. Over 140 research contributions from different research institutes, universities, colleges and industrial organizations and UNESCO South Asia office and US-India Educational Foundation (New Delhi) were presented and discussed.

Special Session on Fossil Fuel

In view of importance and bearing of Palaeobotanical researches in the exploration of fossil fuels (coal and oil), a special session on Fossil Fuel was organized which was presided over by Prof. RA Spicer of Department of Earth Sciences, Open University (Keynes, UK). For the first time in the platform of Palaeobotany the representatives of two big industrial organizations, Oil and Natural Gas Corporation Limited and Western Coalfields Limited came together to present their views on the Relevance of Palaeobotany in Fossil Fuel Exploration. Sri DC Garg, Chairman-cum Managing Director, WCL inaugurated the session and Sri DK Bhowmik, Executive Director and Head, KDM Institute of Petroleum Exploration (ONGC) discussed the application of palynology in dating the oil-bearing strata. The keynote addresses on the significance of Palaeobotany in the exploration of Coal Bed Methane and Hydrocarbon potentiality in India illustrate that Palaeobotany is in motion to play a dynamic role in fossil fuel industry. Prof. Spicer discussed the significance of plant fossils in climatic interpretation and need to protect the fossils in natural condition.

Academic Session

During two days deliberations the conference proceedings dealt the classic aspects of Palaeobotany, i.e. morphology, taxonomy, origin, evolution, survival, extinction and continuation of plant characteristics through their extinct and extant representatives. As per tradition the conference discussed the antiquity of life, significance of coal forming vegetation, coal characteristics, giant gymnosperms of Mesozoic, emergence and evolution of Angiosperms, Quaternary vegetation and forest history, palynology and palynostratigraphy of different sedimentary basins of India, micropalaeontology and sea level changes and Palaeoethnobotany and Dendrochronology. Themes were also aligned to include the modern and relevant topics of the competitive world of science, like the biotechnological advancement, insect-plant interaction, microbial association and factors responsible for the disturbance of present and past ecosystem dynamics.

The impact and significance of the conference can be recognized with the fact that number of research scholars, students and their senior professors attended the conference to know the latest trend in the Palaeobotanical researches and to advise the young generation to take part in Palaeobotany as career and to popularizing the Palaeobotany at university and college levels. Prof Manju Banerjee of Botany Department, Calcutta University presided the valedictory session and highlighted the immense potentiality of Palaeobotany.

During the conference BSIP and the Palaeobotanical Society as responsible custodian of Palaeobotanical researches in India and abroad decided to get reaction from palaeobotanists, experts of related disciplines, academicians and research oriented industries about the Relevance of Palaeobotany in modern context and encouraging responses were received to make the Palaeobotany exciting in the modern world of Science.

Outcome of the Conference

- Contributions on different aspects of Palaeobotany highlighted the vibrant and dynamic characters of Palaeobotanical researches in tune with the modern disciplines of science.
- The participation of high officials of ONGC and WCL signifies the role of Palaeobotany in prognostication and hypothecation of Coal Bed Methane in different

coalfields and in understanding the hydrocarbon potentiality in the oil bearing strata.

- The records of well preserved plant fossils with different morphotypes and relationship advocate the need to undertake field work and to discover plant fossils from new areas.
- The morphotaxonomical study of plant fossils is useful to understand the evolution, biostratigraphy and climatic interference of past and present floras.
- It was suggested to provide technical knowledge to protect and preserve the fossils and sites in different parts of the country.
- The suggestion to have University-Institute Interactive programme was appreciated for the dissemination of Palaeobotanical knowledge at university and college levels.

Outreach Programme & National Science Day

Keeping in with the tradition, the outreach efforts at BSIP such as the Science Day progressed through the year and touched many people through a number of programmes for the students of the city, general public, staff and scientists. BSIP received a group of 150 students along with their teachers from Madhya Pradesh in the month of December under a joint programme of NCSTC (DST) and the MP Council of Science and Technology. These students were addressed by the Director at Regional Science City, Lucknow and also welcomed at BSIP. The students also interacted with Drs. AK Srivastava, SKM Tripathi, Mukund Sharma and CM Nautiyal at BSIP and were then escorted to the museum. The Institute participated in the Pride of India Exhibition at Shillong during the 97th Science Congress and exhibited a number of posters introducing the activities and achievements of the Institute. The simultaneous display of a variety of fossils attracted a lot of people.

During the SCIENCE EXPO–2009 at Regional Science City, during January 28- February 01, the Institute put up an exhibition which was visited by a large number of people. Introduction to BSIP was included in the EXPO booklet. Dr. NC Mehrotra, Director was a patron and Dr. CM Nautiyal a member of the organising committee for the EXPO. Dr. Nautiyal also delivered an invited lecture on *How Old is Old*.

The Science Day celebrations were spread over a period of February 13 to 28, and were inaugurated on the 13th of February with a lecture by Dr. Bhushan K Jain, Adviser, International Division, DST. Dr. Jain talked on *International S&T Collaborations: Need, Relevance and some Approaches*. In his very informative yet interesting lecture, Dr. Jain stated that science has become international in nature and hence international cooperation is the order of the day. There are about 12 countries with whom our collaboration programmes are very vibrant. The session was followed by interaction with the audience. Dr. PN Kapoor, from Keshav Deo Malaviya Institute of Petroleum Exploration, ONGC, Dehradun, delivered two lectures on 19th and 20th of February at the Institute on *Organic Matter Maturation Studies in Hydrocarbon Exploration* and *Fluorescence Microscopy in Palynology*' and followed with interaction.

On Science Day, several science-based films were shown and competitions were organized for the students. Essay competition on 'Significance of Science in Societal Welfare' elicited 97 responses, while 157 posters were drawn by students of Class V-VIII in the campus. Science Quiz for students in two groups (Class VI-XI and X-XII) had 198 entries and was coordinated

by Dr. Rashmi Srivastava. The essays in Hindi as well as English were evaluated by Shri VK Joshi, Former Director, Geological Survey of India, and the posters by Prof. YN Yogi, Former Principal, College of Arts and Crafts and Shri AK Deb, Secretary, Rashtriya Lalit Kala Akedemi, Lucknow. The day was also observed as Open House and people visited the laboratories, museum, and the herbarium.

The prize distribution was held on the Science Day during the Valedictory programme. The Director welcomed the guests and dwelt on the history of Science Day and Raman's achievement. The highlight of the Valedictory programme was a very interesting and illustrated lecture by Dr. KK Dwivedi, Adviser, International Division, DST on *A Curious Walk through Time*. Dr. Dwivedi, also quoting extensively from the ancient texts like *Bhagavat*, stated that the concept of time or even time-dilation is not new. He said that an object doesn't exist if it has only length, breath and thickness but not time dimension. So time, he said, is an essential fourth dimension. He traced the evolution and accuracies of different types of clocks like sun dial, water, mechanical, quartz and atomic clocks. Elaborating on the

concepts of time, he stated that time moves slower with increasing velocity leading to the well known twin-paradox. In the presidential address, Shri Ravi Shankar, former Director General, GSI, said that our ancient scripture were richer than is generally thought. Dr. AK Srivastava highlighted significance of the celebrations. Dr. CM Nautiyal, convener of the Science Day Celebrations, elaborated on the idea behind Science Day and activities undertaken.

Over fifty medals and prizes were given away on National Science Day at BSIP which included medals for excellence in scientific, technical and administrative work and prizes to BSIP staff under the scheme of encouragement for working in official language. The 28 winners out of 442 participants from over 40 schools of the city also received prizes and certificates for their performance in the essay, science- quiz and poster competitions from the two guests and the Director.

Distinguished Visitors

Dr. Shailesh Nayak, Director, Indian National Centre for Ocean Information System, Hyderabad

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

Shri D.K. Pande, Director (Exploration), Oil & Natural Gas Corporation, New Delhi

Shri Dinesh Garg, Chief General Manager, Western Coalfields Limited, Nagpur

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

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

Sir Peter R. Crane, University of Chicago, USA

Prof. De-Yuan Hong, Academician and President, Botanical Society of China

Prof. Song Ge, Director, Institute of Botany, Chinese Academy of Sciences, Beijing, China

Dr. (Mrs.) Suman Keshari Agarwal, Deputy Secretary, AT Cell, DST, New Delhi

Prof. A.S. Brar, Vice-Chancellor, University of Lucknow, Lucknow

Dr. A.K. Sood, Adviser, International Cooperation Division, DST, New Delhi

Shri P.K. Bhowmick, Executive Director-Chief, KDMIPE, ONGC, Dehradun

Dr. K.B. Jain, Advisor International Division, DST, New Delhi

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

Prof. Yu Liu, Director, Institute of Earth Environment, Xi'an, China.

Dr. Steven R. Manchester, Florida Museum of Natural History, Gainesville, Florida, USA

Dr. K.K. Dwivedi, Adviser, International Division, DST, New Delhi

Shri N.K. Verma, GM-Basin Manager, Frontier Basin, KDMIPE, ONGC, Dehradun

Shri V.K. Joshi, Former Director, Geological Survey of India

Prof. Y.N. Yogi, Former Principal, College of Arts and Crafts

Shri A.K. Deb, Secretary, Rashtriya Lalit Kala Akademi, Lucknow

Officials of ONGC visiting Institutes' Museum

Research

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

Samples collected from different units of Marwar Supergroup were studied. The Sonia Sandstone Formation of the Jodhpur Group has yielded variety of globular or disc-shaped organisms possibly within the *Nemania-Beltanelloides-Chuaria* complex and also is comparable to some other simple taxa, such as the *Twitya* disc. Also occur in the Sonia Sandstone Formation, the mat-like structures which are similar to *Arumberia banksii*. These are microbially bound sedimentary structures which are unique to Ediacaran Period. A number of oval and circular impressions have been recorded in the Middle Sonia Sandstone. The oval impressions are closely comparable to Ediacaran mollusk *Kimberella*. The casts of circular impressions are reminiscent of the Ediacaran *Cyclomedusa*. In addition, fresh collections have been made from Sursagar locality in Jodhpur district and Chhoti and Bari Khatu localities in Nagaur district of Rajasthan. Thin sections studies of the samples collected from the Vindhyan Supergroup are continued.

Ediacaran Mollusk *Kimberella* on Sonia Sandstone Formation

Mukund Sharma

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

Structurally, three/two dimensional, cellularly preserved 23 organic-walled microfossils (OWM) genera of two types– i) 9 genera of acritarchs, and ii) 14 genera of cyanobacterial remains have been recovered both in petrographic thin sections as well as in macerated residues of the silicified chert lenses intercalated in limestone of Chhuipali Formation, Singhora Group exposed in and around Pajhrapali area of Mahasamund district (Chhattisgarh), and cyanobacterial remains only in Charmuria Limestone of Raipur Group exposed in Dungri mines, Bargarh district (Orissa). 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 Chroococaceae and Oscillatoriaceae families. The recorded acritarchs are sphaeromorphs (simple and ornamented in nature) and rarely acanthomorphs (spinated) belonging to Sphaeromorphida and Sphaerohystrichomorphida subgroups. Low frequency of cyanobacterial remains in Charmuria Limestone of Raipur Group might be due to natural episodic changes during sedimentation.

Ten distinct taxa of varied shaped megascopic tapic carbonaceous films are being recoded from the middle part of Saraipali Shale Formation, Singhora Group exposed in Surangi Nadi section at Toshgaon village (Mahasamund district). The main characteristic features of the preserved biotic realm are simple thalli, bilateral symmetry and erect growth. The identified taxa include 3 species of *Tuanshanzia*; single of *Changchengia, Phascolites, Proterotaenia, Tyrasotaenia, Eopalmaria*, along with known *Chuaria* and *Tawuia*. The assemblage is compared with known carbonaceous films of eukaryotic remains known from the Knob Lake Group, Canada; Negaunee Iron Formation, Michigan USA and Changcheng Group, China.

The preliminary studies of recorded biotic communities from the Singhora and Raipur groups shows an evolutionary trend ranges from Palaeoproterozoic to Neoproterozoic age in ascending order and two types of environmental setting for these deposits. Two provisional drafts on microbiotic assemblages have been prepared. In addition, visited different localities of Sarangarh-Mahuadhora-Timarlaga sections situated in and around

Sarangarh tehsil of Raigarh and Saraipali tehsil in Mahasamund districts for the collection of palynological samples (shales, siltstones and cherts), carbonaceous mega-remains preserved on the bedding plane of the shales and limestones, and stromatolites belonging to the Singhora, Chandarpur and Raipur groups of Chhattisgarh Supergroup.

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 fossil assemblages from the samples collected from New Sethia ocp, Shivpuri ocp, Vishnupuri u/g, Thisgora u/g, Mathani u/g and Naheria u/g mines of Pench Valley Coalfield; Ghorawari ocp (5 and 6), Ghorawari incline, Borkuhi ocp, Mohan u/g, Ambara ocp, Tandsi u/g 1 and 2, Tandsi u/g 3 and 4 mines of Kanhan Valley Coalfield; and Shobhapur mine, Satpura mine-2, Pathakhera mine-1 and Pathakhera mine-2 of Pathakhera Coalfield were undertaken for study. Morphotaxonomical study of glossopterid and cordaitalean remains has been finalized. The glossopterid is represented by 17 species of G*angamopteris,* 15 species of *Glossopteris, Arberia, Ottokaria*-type fructification, cordaite is known by 2 species of *Noeggerathiopsis,* 1 species of *Cordaites,* 4 species of *Cordaicarpus* and 3 species of *Samaropsis*-types dispersed seeds. Observation, description and morphotaxonomical studies of plant fossils are under progress.

Detail description of plant fossil assemblages from the Bijori Formation was carried out for the first time. The flora is known by the presence of *Santhalea bansloiensis, Neomariopteris* sp., *Trizygia speciosa, 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. longicaulis, G. stricta, G. retifera, G. conspicua, G. tortuosa, G. browniana, G. communis, G. indica, Vertebraria indica,* dispersed seed of *Cordaicarpus*-type and axes with or without nodes and inter nodes. Floristically Bijori bed represents the transitory flora of Late Permian and Early Triassic of Indian Gondwana.

Additionally, well preserved plant fossils were collected from different open cast and collieries of Pench, Kanhan, Pathakhera and Mohpani coalfields of the basin. Plant fossils were recovered for the first time from the Bijori beds exposed in Denwa River and Dantphori nadi sections near Sangakhera village. Sitarewa River near Mohpani village situated 20-22 km away from the Gadarwara town of Narsinghpur district, M.P. Well exposed Talchir Formation shows the sequence of Tillite beds, needle shales, sandstones and silt stones. There are no plant remains, however samples for palynological analysis were collected. Carbonaceous shales of Barakar Formation show the preservation of plant fossils in Sitarewa river and near Nayakhera and Bhouradhar villages. Different types of *Glossopteris* and *Gangamopteris* leaves, axes, seeds and doubtful conifer remains were collected.

A.K. Srivastava & Deepa Agnihotri

Systematic description, morphotaxonomical analysis, identification, photodocumentation and comparison of plant fossils from open cast mines of Pench East, Rawanwara (14/15) and underground mine of Rawanwara (pit-3) of Pench Valley Coalfield were carried out. The fossils are preserved as impressions and coalified compressions. The assemblages are known by the species of *Glossopteris, Gangamopteris, Noeggerathiopsis, Buriadia, Vertebraria,* Equisetalean axes, variety of seeds belonging to *Samaropsis, Cornucarpus, Cordaicarpus, Alatocarpus*, and Scale leaves. The cuticular study of *Cordaites* – leaves indicates the stomatal apparatus in linear rows comparable with the cuticles of *Noeggerathiopsis,* morphologically leaves are distinct in having interstitial veins/fibres in between major veins of leaves.

A.K. Srivastava & S.S.K. Pillai

The Upper Permian Bijori Formation of Satpura Gondwana Basin is the succession of large lacustrine environment with high tectonic subsidence and freshwater

deposition, however, its northern part contains some marine signatures. Sedimentary features *vis á vis* fossil preservation undertaken for study reveals the presence of well preserved insect burrows along with the plant fossil assemblages. Similarly sandstone facies of Barakar Formation of Mohpani and Pench valley coalfields shows the presence of number of elongated, coiled, and irregular shaped traces. These trace fossils belong to horizontal ichnofossil group and are mainly tubular in nature, occurring as positive relief on the sandstone surface. Burrows often show secondary fillings. Morphological description and identification of the fossils are under progress.

A.K. Srivastava & Anju Saxena

Project 2.3: Morphotaxonomy, floristics, biostratigraphy and palaeoecological studies in Hasdo-Arand Coalfield (Son-Mahanadi Basin)

Around hundred megafossils collected from the Rajnagar and Kurasia collieries in Hasdev and Chirimiri areas of Korea district, Chhattisgarh were processed, identified and studied. The assemblage identified from Rajnagar–F colliery includes *Gangamopteris* sp, *Euryphyllum whitianum*, scale leaf, equisetalean stems, stem impressions/compressions, seeds and 7 species of *Glossopteris* viz., *G. tenuifolia, G. communis, G. indica, G. syaldihenseis*, *G. gigas*, G. *major* and *G. stenoneura.* The assemblage identified from Kurasia colliery includes 4 species of *Gangamopteris* i.e., *G. cyclopteroides*, *G. major*, *G. rajaensis* and *G. angustifolia*; 2 species of *Noeggerathiopsis* i.e., *N. hislopi* and *N. elongate*; *Ottokaria transvalensis* Plumstead 1956; *Cardaicarpus* seeds; *Alatocarpus indicus* Lele 1969; *Samaropsis sp;* Equistalean stems and 2 species of *Glossopteris* viz., *G. communis* and *G. stenoneura.* Besides, a manuscript on vertically and horizontally preserved *Vertebraria* axes in Korba Coalfield is being finalized.

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 of Bansa area has been undertaken to document and analyze the palaeofloral assemblage. Carbonaceous shale embodies well preserved and diversified megafloral assemblage comprises of 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 it has been observed that this 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, as both are rich in conifers and pteridophytes. However, the broad-leaved bennettitalean remains are prevalent in quite good number in Gangapur Formation.

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. The occurrence of genus *Weichselia* and *Onychiopsis* in this bed is important as they are known from Neocomian to Albian beds of Europe, Moscow Basin, Western Siberia, North America and India.

Neeru Prakash

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

Megafloral assemblage from Than (Gujarat) reveals the occurrence of *Isoetites*-rich bed at the peripheral region of the hillock in this fossil locality which is followed by fossil like algal mat, *Thallites* bed, *Coniopteris, Onychiopsis, Brachyphyllum,* etc. at different level of the hillock. Occurrence of *Isoetites* at the margin followed by the presence of other fossils indicate that incoming water to the ancient water body were bringing different plant debris from surrounding area and which were ultimately got preserved. At the present location of hillock ancient pond was there and at the margin of it *Isoetites* was growing. Algal mat was preserved which were growing in pockets of water when the shallowing of water body reached the ground level. *Thallites* started growing when a muddy surface was developed. This *Thallites* layer present just below the huge sandstone mass. Thus,

it is assumed at the present location of the hillock there was ancient water body and at its margin *Isoetites* was growing. Gradual shallowing of the pond took place for sedimentation over the years preserving the growing *Isoetites* at the margin of the water body. Sedimentation over the years led the shallowing of water body ultimately to reach ground (surface) level leaving pockets of water here and there for the growth of algal mass which ultimately gave rise to algal mat. *Thallites* grew when a muddy surface was developed which was the favourable strata for the growth of it. Sedimentological study of the sequences exposed at *Isoetites*-rich locality near Than reveals that the gradual coarsening of sediments took place from base upwards. The non availability of plant megafossils in upper sedimentary sequences is probably due to the gradual coarsening of lithologies upwards.

B.N. Jana

Project 2.6: Integrated palaeobiology of East Coast Cretaceous

Plant fossil assemblages of Early Cretaceous Krishna-Godavari and Pranhita-Godavari basins (Raghavapuram and Gangapur formations) have been studied and analysed for palaeoecological inferences. The floral assemblage comprises– stem axes *Equisetites, Allocladus, Coniferocaulon* and unidentifiable stem impressions; leaf taxa *Cladophlebis*, *Taeniopteris*, *Ptilophyllum, Pterophyllum, Elatocladus, Pagiophyllum, Brachyphyllum*, *Desmiophyllum*; wood taxa *Podocarpoxylon* and *Araucarioxylon*; and unidentifiable leaf and wood taxa. A suitable environment for fossil preservation was deduced as evidenced by preponderance of leaf fossils. A fluvial deposition influencing transport of plant parts was indicated taking in to consideration preservation state of leaf fossils preserved in shale and sandstone deposits (Gangapur Formation). A paralic set up for Raghavapuram Formation is envisaged in view of total fossil occurrence. A close similarity of mudstone preservation in both of these formations is intriguing.

The Early Cretaceous fossil flora of Palar Basin (Sriperumbudur, Avadi and Satyavedu) preserved in the form of fossil leaves represented by the species of *Cladophlebis*, *Dictyozamites, Taeniopteris, Pterophyllum, Otozamites* (Cycadophytes), *Araucarites, Conites* (Coniferales), *Ginkgoites* (Ginkgoales) and petrified wood fossils belonging to conifers *Cupressinoxylon, Podocarpoxylon* and *Araucarioxylon*. Fossil flora in *toto* reported from the Early Cretaceous sequences of the basin was analysed for floristic correlation and geographic implications. The floral assemblage in general is dominated by conifers followed by cycadophytes and ferns. Pteridosperms and Ginkgoales are poorly represented. A paralic depositional environment was envisaged considering total biotic evidences. In addition, field excursion to East Coast sedimentary basins (K-G and P-G) was undertaken and collected a number of sediments and specimens for laboratory analysis.

A. Rajanikanth

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

A number of cuticles from the carbonaceous shales exposed along the bank of Gopad river, near the Nidhpuri of Sidhi district (MP) have been taken out from bulk macerated samples. The cuticles were sorted out in low power binocular. The silica particles adhered on the surface are removed and macerated in nitric acid and cleaned with dilute potassium hydroxide for examination under the SEM. The cuticles isolated have been assigned to several taxa of fossil foliage, such as *Lepidopteris, Dicroidium, Glossopteris*. A variety of stomatal types has been recorded along with specialized structure, such as, surface papillae. Many cuticles showing specialized epidermal out growth, i.e. trichomes which develop from outer surface of layers of plant cells.

Usha Bajpai

Gondwana Palynology Group

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

The palynological data from coal-bearing horizon of 10 bore-holes in Rajmahal Basin is grouped in seven palynological assemblage zones. The chronology of these assemblage zones, in ascending order, is– i) *Parasaccites korbaensis,* ii) *Crucisaccites monoletus,* iii) *Scheuringipollenites barakarensis,* iv) *Faunipollenites*

varius, v) *Densipollenites indicus,* vi) *Gondisporites raniganjensis,* and vii) *Densipollenites magnicorpus.* The first four assemblage zones indicate Early Permian and last three indicate Late Permian age. Lithologically it is difficult to recognize the Late Permian coal horizon. The palynology evidenced definite Late Permian age for the part of coal-bearing strata in the basin.

In bore-hole RJMC-2, encompassing about 240 m thick rocks of various stratigraphic levels have been identified. The upper up to 42 m of core is palynologically dated as late Late Permian having first occurrence of taxa *Arcuatipollenites pellucidus* at 42 m depth. The rest part is Late Permian in age correlated with the *Gondisporites raniganjensis* and *Densipollenites magnicorpus* Assemblage zones. Also visited areas in Rajmahal and East Bokaro coalfields for collection of rock samples for palynological studies.

Archana Tripathi

The palynodating of samples between 87.00 to 107.00 m depth from bore-hole RJSJ-2 (230.00 m deep) indicates Late Permian age. The Late Permian palynoflora, viz. *Striatopodocarpites, Crescenti-pollenites, Faunipollenites* in association with *Microbaculispora, Microfoveolatispora*, etc. have been recorded.

Archana Tripathi & Ram Awatar

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

Processing of samples from bore-hole SMBS-1 of Singrauli Coalfield has been completed. The yielding samples from bore-hole TRBD-2 (315.00-356.45 m depth) of Tatapani-Ramkola Coalfield is in progress. Palynodating suggests Barakar Early Permian age.

Archana Tripathi & Vijaya

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

Two boreholes SCP-1 (3.75-218.50 m depth) and SCP-9 (34.65-314.30 depth) from Sohagpur Coalfield have been analysed to understand the distribution of palynoflora. In SCP-1, the palynoassemblage indicates Early Permian age from 3.75-218.50 m depth. In SCP-9, Early Permian palynoassemblage (Talchir palynoflora) is recorded within 312.35-314.30 m depth, Upper Barakar palynoflora within 85.85-131.35 m, and Late Permian palynoassemblage (Raniganj palynoflora) between 34.65 and 1.20 m depths. Also finalized the pollen-spores data generated from boreholes HACK-4 (Hasdo-Arand), MSK-1 and MBKW-3, from Mand-Raigarh coalfields. Besides, undertook field work for collection of outcrop and borecore samples from Sohagpur and Mand-Raigarh coalfields.

Ram Awatar

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

Studied palynoassemblage recovered from the bore-hole lBK- A2 (between 7.15-496.00 m depth). The Palynoassemblage- I is designated from 496-301 m, representing the dominance of *Faunipollenites* and subdominance of *Scheuringipollenites* along with the presence of *Striapollenites, Verticipollenites, Rhizomaspora*, *Ibisporities*, *Cyclogranisporites, Cyclobaculspora, Ephedripites,* etc. This assemblage-I shows the affinities with Upper Barakar palynoflora indicating late Early Permian age. The palynoassemblage-II (from 271-7.15 m) has the dominance of *Striatopodocarpites* and subdominance of *Faunipollenites* in the presence of *Diastriates, Distrimonosaccites, Cyclogranisporites, Micro-baculispora, Parasaccites, Inaperturopollenites, Ephedripites Callumspora, Densipollenites magnicarpus, Rhizomophora, Verticipollenites, Navelespoprites, Striatites, Striamonosaccites, Diastriamonosaccites, Leiotrilete, Lophotrilites,* etc. The appearance of *Arcuatipollenites, Densoisporites, Lundbladispora,* etc. in the presence of *D. magnicarpus* shows the younger affinities to Late Permian equal to upper Raniganj palynoflora indicating Lte Permian age. Similar palynoassenblages has also been recovered from the bore-hole IBSK-I. Also visited Ib-Himgir Basin Coalfield, District Jharsuguda and Sundargarh and collected subsurface and surface samples for further work.

K.L. Meena

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

Identified varied palynofloral levels in a 119.90 to 608.30 m thick Mesozoic succession encountered in borehole RRK-1. The earliest Early Cretaceous palyno-assamblage within the Intertrappean sediments (181.40-215.00 m) is recognized for the first time in this part of Raniganj Coalfield. Unproductive strata (263.00-513.00 m) within chocolate shales and sandstones of Supra Panchet Formation support an unfavorable depositional set-up for the plant matter. Further, Upper Permian (Raniganj Formation) strata is identified within 521.80 to 608.30 m that too have many levels of hiatus. Poor presentation of spore-pollen content in the total run infers less of vegetal matter deposition during sedimentation. Also visited Mandro, Dudkol areas in Rajmahal Basin, and Damodar river section, Bokaro Coalfield for collection of samples.

Vijaya

Studied palynological data from borehole EBM-1 between depth 13.00- 1195.35m of aprox. 1185.00 m thick Gondwana sediments of East Bokaro Coalfield revealed 'Barakar Formation' that suggests Early to Late Permian in age. FAD's of *Arcuatipollenites, Playfordiaspora cancellosa* (Lower Triassic taxa) at 51.50,66.70 m depth enhance the end Permian level. Collected outcrop rock samples from the areas nearby Sasaram, (Bihar) and around Pushro area, East Bokaro Coalfield, representing the Permian succession.

Srikanta Murthy

Cenozoic Palaeofloristics Group

Project 4.1: Tertiary floristics of Rajasthan and Gujarat

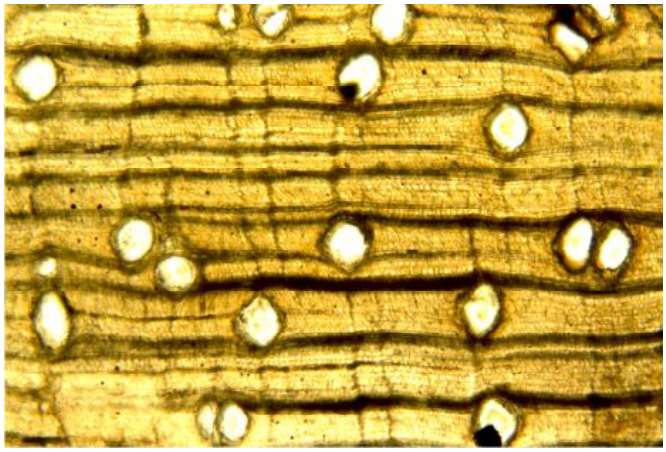
Seventy-five petrified woods from the Tertiary sediments of Bikaner and Jaisalmer were studied. Some of the woods showed poor preservation. The woods belonging to family Lythraceae (*Lagerstroemia*), Ebenaceae (*Diospyros*), and Myrtaceae (*Eucalyptus*) have been identified. The most significant among them is the wood of genus *Eucalyptus* from Eocene of Rajasthan. The record of *Eucalyptus* wood in western India confirms that the genus was wide spread in India in early Tertiary as it has already been reported from the Deccan Intertrappean sediments of central India. Also prepared sections of a number of carbonized woody samples from different lignite mines of Bikaner (Barsingsar), Nagaur (Kasnu-Matasukh) and Barmer (Giral). Unfortunately preservation of the samples was found very poor and only a few of them showed some workable preservation. In addition, finalized a paper on a gymnospermous (*Podocarpus*) wood recovered from the Early Cretaceous sediments of Habur village about 45 km NW of Jaisalmer. The report forms the first record of a fossil wood from the Pariwar Formation (Neocomian) of Rajasthan. The presence of growth rings, wide early wood and narrow late wood indicates mild seasonality and prevalence of favourable climatic conditions for the growth of woody vegetation in the area around 120 My ago.

Investigated some carbonized woods from lignite mines of Rajpardi (Bharuch district) and Vastan (Surat district) in Gujarat. Woods of two important genera have been identified, namely *Melanorrhoea* of the family Anacardiaceae and *Aglaia* belong to the family Meliaceae. Draft of a paper reporting the occurrence of *Aglaia* has been prepared. The wood is infected by *Teredolites* indicating its drift from inland to coastal region of Surat. Also visited various Tertiary localities (including lignite mines) of Gujarat (Bharuch, Surat, Bhavnagar and Kachchh districts) and collected a large number of megafossils for study.

J.S. Guleria & Anumeha Shukla

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

Extensive collections were made from number of Deccan Intertrappean and Infratrappean localities of Madhya Pradesh and Maharashtra. The fossil woods collected from a new locality (Bhutera) in Chhindwara district (MP) lie between III and IV lava flows and are younger than famous Mohgaon Kalan locality, which lies between II and III flow. In Bhutera, dicotyledonous woods are more abundant than palms and all the dicot fossil woods investigated so far belong to single genus *Ailanthus* (Simarubaceae). Rich collections of fossil woods were also made from different localities of Wardha district, Maharashtra, viz. Nawargaon, Palkunda Nala, Sindhi Vihiri and Maragsur. Sectioning and observation is under progress. Fossil plants were also collected from Jhargad near Jhadgaon village in Yavatmal district. The area was explored extensively for the first time.



Alianthoxylon indicum (Simarubaceae) characterised by paratracheal aliform –confluent parenchyma)

Investigated angiospermous fossil woods from Chiraidongri, Mandla district, (MP). Dicotyledonous woods were identified as *Ailanthoxylon indicum* (Simarubaceae), *Grewinium canalisum* (Tiliaceae), *Barringtonoxylon* (Lecythidaceae) and *Lophopetalumoxylon deccanensis* sp. nov. (Celastraceae). Besides two species of palms, namely *Palmoxylon canalosum* Guleria & Mehrotra, *P. chiraidongriensis* sp. nov. have also been investigated and finalized (with J.S. Guleria). Also finalized a paper on endogeneous fungal infection in the fossil wood of *Barringtonia*. Presence of both *Barringtonia* as well as fungus *Epicoccum* indicates that warm and humid conditions were prevailing in the Yavatmal area during the time of deposition of Intertrappean sediments. The present material is also suggesting that the genus *Epicoccum,* which interacted with *Barringtonia* wood during Maestrichtian-Danian times in a manner similar to present day fungi.

Rashmi Srivastava

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

About 10 legume fruits, collected from the Oligocene sediments of Makum and Dilli-Jeypore coalfields, were studied in detail and finalized**.** For the first time such a rich assemblage of legume fruits is described from India. Their presence indicates a warm and humid climate in the region during the deposition of the sediments. In addition, several leaf impressions have been collected from the Tikak Parbat Formation of the Makum coalfield. They have been cleared and photographed for further study.

Some leaf remains collected from the Dafla Formation of the West Kameng District of Arunachal Pradesh have been identified and finalized. The paper deals with the dicotyledonous leaf impressions belonging to the Middle-Upper Miocene in age. They comprise of 7 genera belonging to 6 families, namely *Tabernaemontana precoronaria* Prasad (Apocynaceae), *Salacia miocenica* sp. nov. (Celastraceae), *Millettia koilabasensis* Prasad (Fabaceae), *Actinodaphne palaeomalabarica* sp. nov. as well as *Litsea preglabrata* sp. nov. (Lauraceae), *Memecylon arunachalensis* sp. nov. (Melastomataceae) and *Randia miowallichii* Prasad (Rubiaceae).The distribution of modern counterparts of the fossils indicates tropical vegetation suggesting warm and humid climate during the deposition of the sediments.

R.C. Mehrotra

Project 4.4: Tertiary floristics of South India

Morphotaxonomical study on the plant megafossils from Ratnagiri (Maharashtra), Neyveli (Tamil Nadu), Cochin, Cannanore, Payangadi, Warkala (Kerala), Bahur Basin (Pondicherry) and its adjoining areas has been carried out. Thin sections of twenty four carbonised woods from Ratnagiri, Neyveli lignite, Varkala and Payangadi were prepared and microscopic study was done. The study showed that the preservation is too poor to reveal any structural details. Investigation and photography of some fossil fruits from Payangadi and Neyveli lignite was done. Besides, sectioning and investigation on eight petrified woods from Pondicherry was also done. Additionally, visited CNH and ISIM, Kolkata for the comparative study of collected fossil fruits / seeds / leaves, etc. with their modern counterparts. The identified fossil specimens include *Pandanus* (axis), *Borassus* (leaf), *Terminalia chebula* and *Musa* sp. (fruits) from Neyveli lignite deposits and *Terminalia* and *Randia* (fruits) from Ratnagiri. Other identified fossils include *Melodorum fulgens*, *Bouea oppositifolia*, Ner*ium odorum*, *Biridelia crenulata*, *Garcinia rostrata*, *Diosporos lancaefolia*, *Homonoia retusa*, *Caesalpinia sp.*, *Flacourtia indica*, *Altingia excelsa*, *Daphnogene polymerge*, *Lagaerstroemia*, *Ficus racemosa* (leaves) from Bohemia Basin, Czech Republic.

Anil Agarwal

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

Leaf impressions from Murree sediments of Jammu were studied. Some of them were tentatively identified as *Calophyllum* and *Garcinia* (Cluciacaeae), *Cordia* (Boraginaceae) and *Lagerstroemia* (Lythraceae). Further work is in progress.

J.S. Guleria & Rashmi Srivastava

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

Anatomical study on *in situ* fossil woods collected from the Siwalik of Hamirpur district (HP) reveals the occurrence of two new fossil woods resembling with extant taxa, *Hopea sulcata* Sym. and *Duabunga grandiflora* (Roxb.ex DC.) Walp. of the family Dipterocarpaceae and Lythraceae, respectively. Presently these taxa are distributed in the evergreen forests of northeast India and Malayan regions and not found in Himachal Pradesh. Thus, it has been suggested that climatic changes must have taken place in the area after Miocene times due to which such moist loving species became extinct from the region.

Morphotaxonomical study on the leaf and fruit impressions from Siwalik sediments of Purniyagiri Road section, Uttarakhand has been carried out which reveals the occurrence of about 40 species of dicotyledonous families. The fossil flora is dominated by evergreen taxa (58%) which suggest that a tropical evergreen forest was flourishing under warm humid climate in the Tanakpur area during Middle Miocene times in contrast to mixed deciduous forest under reduced precipitation. In addition, 20 leaf impressions and 2 fruits collected from Siwalik sediments of Uttarakhand and West Bengal have been identified with the following extant taxa viz., *Polyalthia siamearum* (Annonaceae), *Flacourtia* sp. (Flacourtiaceae), *Calophyllum* sp. (Clusiaceae), *Sterculia ensifolia* (Sterculiaceae), *Dipterocarpus turbinatus, Hopea trapizifolia* (Dipterocarpaceae), *Acronychia baurii* (Rutaceae), *Sapindus attenuatus,* (Sapindaceae), *Ziziphus mauritiana, Sabia lanceolata* (Sabiaceae), *Gluta* sp., *Buchanania latifolia* and *Bouea macrophylla* (Anacardiaceae). *Millettia ovalifolia, M. pachycarpa, M. atropurpuria, Pongamia glabra* (Fabaceae), *Terminalia chebula, Combretum decandrum* (Combretaceae), *Diospyros variegata* and *Lagerstroemia flosreginae* (Lythraceae). Also visited and collected plant megafossils (woods, leaf and fruit impressions) from the Siwalik sediments of Oodlabari and nearby area in Darjeeling district (WB) for investigation.

Mahesh Prasad

Late Mesozoic-Cenozoic Palynology Group

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

Carried out field work in Kutch district, Gujarat and collected 152 samples from fifteen localities belonging to various Tertiary formations, exposed near Matanomadh, Dayapar, Kora, Lakshmipur, etc. in western Kutch. Surface samples were also collected from a number of localities. 65 samples from Intertrappean Beds, Naredi and Chhasra formations were macerated and permanent slides of productive samples were prepared. Scanning of these slides is being done. Samples from the Chhasra Formation (Early Miocene) are palynologically unproductive. The samples from other formations yielded a variety of palynofossils. Palynoassemblage recorded from the Intertrappean Bed (ca. 0.6 m thick grey laminated clay, underlain and overlain by the volcanic traps) exposed at a new locality, near Naredi, on Naliya-Narayan Sarovar Road in western Kutch yielded algal and fungal remains, pteridophytic spores, angiospermous pollen as well as cuticles of terrestrial plants. Important palynotaxa recovered are– *Azolla* sp., *Lygodiumsporites lakiensis, Polypodiaceaesporites intrapunctatus, Compositoi-pollenites argutus, C. conicus, Graminidites media, Ladakhipollenites minutus, Lakiapollis ovatus, Matanomadhiasulcites* sp., etc. Besides, a variety of fungal remains belonging to the genera *Dictyosporites, Frasnacritetrus* (*Tetraploa*), *Kutchiathyrites, Palaeomycites* (VAM fungi), *Papulosporonites, Parmathyrites, Phragmothyrites, Polycellaesporonites* (*Alternaria*) etc., have been recorded.

It has been deduced that this Intertrappean Bed was deposited in a shallow depression over the trap during short interval of quiescence in a tropical-subtropical climate. The age of the bed is suggested as Early Palaeocene. This study has been finalized. The study of palynoflora from the Naredi Formation is being carried

out. In addition, remains of fossilized insects have been recovered from the samples of Intertrappean Bed and Naredi Formation. Their study is also being carried out.

R.K. Saxena & P.S. Ranhotra

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

Palynological studies from Marh Formation, exposed in the lignite mine located at about 30 km SE of Nagaur city in western Rajasthan were carried out. The associated lignite seam (3-4 m thick) is intercalated with bands of carbonaceous shale and clay. Lignite and shale samples yielded a rich and diversified palynological assemblage dominated by angiosperm pollen, particularly those belonging to the family Meliaceae. Other significant palynotaxa in the assemblage are: *Dandotiaspora* spp., *Lygodiumsporites* spp., *Tiodisporites* spp. *Lycopodiumsporites* spp., *Arecipites* spp., *Palmidites* spp., *Matanomadhiasulcites* spp., *Dermatobrevicolporites* spp., *Pseudonyssapollenites kutchensis*, *Longapertites retipilatus, Sastripollenites trilobatus, Ratariacolporites plicatus, Proxapertites* spp. and *Meliapollis* spp. The palynological assemblage indicates prevalence of tropical climate during the deposition. Arecaceous pollen grains suggest proximity of the depocentre to the shoreline. The fresh-water swamp and water-edge elements were brought to the sight of deposition by the river channels.

Rich representation of pollen having affinity with the family Meliaceae is indicative of a thick vegetation chiefly constituted by the plants of this family and these mainly contributed to the lignite formation. Present assemblage is not closely comparable with that recorded from Barmer and Bikaner. The most abundant arecaceous pollen in Barmer assemblage showing affinity with *Nypa* are registered in very low frequency in Nagaur assemblage. The Bikaner assemblage is also different from the present one as, the former is dominated by arecaceous and other polycolpate/polycolporate pollen that are absent in Nagaur assemblage. The Early Eocene palynoflora of Kutch Basin is strikingly similar to present assemblage. Many pollen taxa of the families Meliaceae, Bombacaceae and Liliaceae are of common occurrence in palynological assemblages of both the areas. Considering the stratigraphical record of palynofossils in Indian Palaeogene strata, the Nagaur sequence is dated as early Eocene.

S.K.M. Tripathi & Hukam Singh

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

Carried out laboratory processing of samples (40) collected from Ottakovil, Kallankurichi Limestone Mine, Reddiapalem mine and Sindurai railway cutting of the Cauvery basin, Tamil Nadu. Samples from the Ottakovil, Reddiapalem are palynologically unproductive. The study of the remaining samples is in progress. In addition, field work was undertaken to study and collect various rock samples from Cretaceous-Tertiary sediments exposed at Ariyalur, Trichinopoly and adjoining areas in the basin. Sixty samples were collected from Kallamedu, Ottakovil, Kulkalnattumm-Karai road, Niniyur and Sillakudi areas for palynological investigation. Thickness, lithology and contacts of these formations were studied and their contacts with the adjacent formations were located.

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

Thin deposits of arenaceous/clayey bands in between the thick pile of glauconitic arokose were found to be palynologically productive from the Late Cretaceous sediments exposed in the Pynursla Plateau, Khasi Hills. The palynological assemblages recovered include following significant palynotaxa– *Ariadnaesporites intermedius*, *Minerisporites triradiatus*, *Azolla cretacea*, *Triporoletes reticulatus*, *Cyathidites australis*, *C. minor*, *Todisporites major*, *Dictyophyllidites meghalayensis*, *Biretisporites potoniaei, Lygodiumsporites eocenicus*, *Undulatosporites* sp., *Intrapunctisporites pachyexinus*, *Concavisporites concavus*, *Foveosporites* sp., *Lycopodiumsporites speciosus*, *Klukispotites* sp., *Appendicisporites problematicus, A. potomacensis*, *Cicatricosissporites doregensis*, *Contignisporites bellus*, *C. assamicus*, *Microvoveolatisporites mahadekensis*,

Schizaeiosporites sp., *Polypodiisporites tertiarus*, *Podocarpidites ellipticus, Araucaricites australis*, *Palmaepollenites eocenicus*, *Liliacidites variegatus*, *Tricolpites archaius*, *Spinizonocolpites* spp, Normapolles' pollen group (*Oculopollis orbicularis, Nudopollis* spp., *Krutzschipollis spatiosus)* and fungal remains. The assemblage includes *Azolla cretacea* Stanley, *Ariadnaesporites intermedius* Hall, *Triporoletes reticulates* (Pocock) Playford, indicating a Maastrichian age.

The 'Normapolles' pollen *Oculopollis orbicularis* ranges from Santonian to Maastrichtian, whereas *Krutzschipollis spatiosus* is well documented within the middle part of the Maastrichtian and *Nudopollis* spp. are restricted to the Maastrichtian-Danian interval. Thus, the concurrent range of these taxa along with associated palynomorphs indicates an Early Maastrichtian age. The palynoassemblages, in general, are dominated by the pteridophytic spores and fungal remains (spores and fruiting bodies) indicating a warm and humid climate during the time of deposition of these sediments. Freshwater influence in the marine depository basin is marked by the presence of aquatic freshwater ferns (*Ariadnaesporites*, *Azolla* and *Minerisporites*) belonging to Salviniaceae indicating marginal depository sites. The overlying Palaeocene deposits have yielded a characteristic palynological assemblage showing that most of the Late Cretaceous palynomorphs got extinct by then. Also visited areas around Pynursla village and collected Late Cretaceous rock samples for study.

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 recorded from various lithotypes (coal, carbonaceous shale, siliciclastic clay) of the sections– i) Bapung Coalfield (Lakadong Sandstone Formation, Late Palaeocene), Jaintia Hills, Meghalaya; ii) Saru Neuriajan River Section (Mikir Formation, Early Eocene), Mikir Hills; and iii) Late Palaeocene-Early Eocene sequences of Jaintia Group (between 4444-4382 m depths) of Bihpuria Well-A, North Lakhimpur district, Upper Assam Basin have been analyzed to deduce environmental changes across the Palaeocene-Eocene transition. The quantitative and qualitative analyses of the palynoassemblage exhibit an impact of rapid climatic warming which induced development of the pantropical megathermal angiosperm vegetation in the region during this timeframe. A considerable change in floral diversities, their succession and involvement of various factors during the deposition of these sediments were simultaneously affected by global warming events and position of the Indian plate between 20°S- 8°N of the equator. Such events played a significant role in sea level changes, transgressive-regressive cycles and shaping of regional environment, spreading of evergreen thermophillic forests and persistence of huge delta complexes around the continental shelves. Thus, sediments deposited along the marginal shelves contain rich and well preserved sedimentary organic matters. The most noticeable change in palynoassemblage are increase in the abundance of pollen grains belonging to the plants of the families *e.g.*, Arecaceae (Palmae), Annonaceae, Bombacaceae, Euphorbiaceae, Alangiaceae, Meliaceae, Anacardiaceae, Myrtaceae, Gunneraceae, Proteaceae, Pellicieraceae and tropical mangrove fern *Acrostichumsporites* (=*Acrostichum* of the family Pteridaceae). The modern counterparts of these fossil plants occur in low latitude pantropical megathermal habitats.

A rich abundance of dinoflagellate cysts viz., *Apectodinium* complex, *Operculodinium* complex, *Thalassiphora pelagica, Hystrichokolpoma rigaudiae* and *Homotryblim* complex etc., which were widely distributed in northern and southern hemisphere during Early Palaeogene indicate enhanced surface temperature and eutrophic level of marginal sea and its connection with Tethys Sea existed between northerly moving Indian plate and Eurasian main land. Occurrence of such palynoassemblage, which is richest in comparison to other basins of Indian Peninsula, exhibits evergreen thermophilic forests on marginal land surface as well as increased sea surface temperature caused changes in floral diversity in this region during the Late Palaeocene to Early Eocene transition.

Madhav Kumar

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

A rich and well diversified palynofloral assemblage from Middle Bhuban Formation exposed along road section on the northwest side of Mizoram at Bilkhawthlir area has been investigated. The recovery of the palynomorphs belonging to pteridophytic spores, gymnospermic and angiospermic pollen is extremely poor. Preliminary observation indicates that the section consists of rich dinocyst assemblage and shows significant variation in the palynofacies assemblages are helpful in interpretation of palaeoenvironmental changes. The dominant dinoflagellate cysts are *Operculodinium exquisitum, Homotryblium oceanicum, Achomosphaera multifurcata, Cordosphaeridium gracile, Polysphaeridium* sp, *Tuberculodinium vancampoae, Lingulodinium machaerophorum, Achomosphaera ramulifera, Cleistosphaeridium diversispinosum, Chiropteridium galea.* Associated palynofossils recorded from the sediments are *Cyathidites minor, Todisporites major, Pteridacidites vermiverrucatus, Spinizonocolpites echinatus* and *Retitrescolpites typicus*. Typical Late Permian palynoassemblage having dominance of *Striatopodocarpites, Crescentipollenites, Fauni-pollenites, Indospora, Microbaculispora, Densoisporites, Cyclogranisporites* also been recorded from the sediments. The well diversified dinocyst assemblage indicates neritic environment of deposition. On the basis of dinocyst assemblage an early Miocene age has been assigned for the sediments. The depositional facies represent a shallow marine transgressive record reflecting sea level fluctuations. The studies show that the sediment supply is a result of excessive warm and humid climate. Apart from these the stratigraphically reworked Permian palynofossils are also intriguing.

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 on Mahur-Jatinga Road, North Cachar Hills district, Assam. The yield of palynofossils was quite poor. The important spores and pollen grains recorded are: *Cyathidites australis, Lygodiumsporites lakiensis, Striatriletes microverrucosus, Monolites nawkmaensis, Polypodiisporonites repandus, P. tuberculensis, Pinuspollenites crustus, Densiverrupollenites eocenicus, Favitricolpites magnus, Pellicieroipolls langeuheimii, Palmaepollenites ovatus*, etc. The recorded palynoflora suggests that the area enjoyed tropical to subtropical, warm-humid climate and the deposition of sediments took place in the inner shelf environment, close to the shore. Presence of *Pinuspollenites* suggests/ indicates that the topographically elevated areas were not far away from the basin of deposition. The present recorded mioflora is quite similar to Kopili assemblage (Kopili Formation) of Late Ecocene in age. Also undertook field work to the district and collected surface rock samples belonging to Disang Group exposed along Haflong-Silchar Road, Jatinga River Section for palaeopalynological study.

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

Palynofacies studies of upper Maastrichtian-Danian succession of the Um Sohryngkew river shows variable distribution of peridinioid-gonyaulacoid dinocysts and terrestrial organic matter across KT boundary. High diversity and abundance of dinocysts in the uppermost Maastrichtian in general is indicative of open marine shelfal

depositional setting. Increased frequencies of peridinioids and terrestrial organic matter with framboidal pyrite impregnations suggest high nutrient loading possibly leading to environmental deterioration (stressful eutrophic and reducing conditions). Dinocyst assemblages in basal Danian show sudden decrease in diversity and abundance along with an increased influx of terrestrial organic matter dominated at certain levels by black oxidized debris. This indicates fall in the sea level. The high percentage of charcoal in palynofacies assemblages probably indicates arid conditions in the region lying in southern low latitudes, close to the equator at K/T boundary time. The recovery of dinocysts (with calcareous plankton) later in the Danian suggests a rising sea level trend. In addition, documentation of dinocyst/ palynofacies assemblages from Kynrem-Mawsmai section, Cherrapunji area (Cret.-Palaeocene) is continued, besides finalisation of manuscripts from early Palaeogene sections.

Rahul Garg, Vandana Prasad & Khowaja Ateequzzaman

Processing of samples and identification of dinocysts producing levels is done from Laitryngew-Latmawksiang sections, Cherrapunji area (early Palaeogene). Multiproxy data (dinocysts, palynofacies, clay mineralogy, carbon isotope) is used to interpret climatic scenario across PETM interval in Jathang section. The XRD data matches well with the carbon isotope and palynological data. The study shows excessive humid conditions at the time of Paleocene-Eocene Thermal maxima Event as indicated by the predominance of kaolinite content in the clay mineral assemblages. Palynological investigation shows sudden increase in the diversity pattern of terrestrial palynomorphs during post PETM. Palynological assemblages also indicate excessive humid conditions at the onset of PETM event. (jointly with Anupam Sharma)

Vandana Prasad, Rahul Garg & Khowaja Ateequzzaman

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

The Pariwar Formation in the Rajasthan Basin has been precisely dated for the first time as early to 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). Significant nannofossil taxa include *Farhania varolii* (Jakubowski, 1986) Varol, 1992; *Prediscosphaera columnata* (Stover, 1966) Perch-Nielsen, 1984 and *Seribiscutum primitivum* (Thierstein, 1974) Filewicz *et al. in* Wise and Wind, 1977. These forms are zonal or subsequent markers in various zonal schemes (Jakubowski, 1987; Mutterlose, 1992; Bown *et al.*, 1998; Jeremiah, 2001). However, Sissingh's and Mutterlose's zonal classifications of mid-latitude have been followed here while other zonal schemes are tenable to high latitude. *Cyclagelosphaera margerelii* Noël, 1965; *Faviconus multicolumnatus* Bralower, 1989 *in* Bralower et al., 1989; *Tubodiscus jurapelagicus* (reworked) (Worsley, 1971) Roth, 1973 are reworked forms present in the assemblage. Presence of nannoconids in the assemblage indicates Tethyan affinity and *Seribiscutum primitivum* showed bipolar high cold water distribution. The Tethyan nannofossil laden water current appears to have mixed with cold water current during Aptian–Albian time (Kale and Phansalkar, 1992). Record of *B. constans*, *Z. erectus* indicates surface water nutrient rich upwelling conditions.

Profusely bioturbated *Thalassinoides* sp. burrows in variegated coloured nannofossils bearing sandstone of Type section of Pariwar Formation, Jaisalmer Basin, Rajasthan (Elev. 209 m. N 27°15'39.5" E 70°43'36.5")

Subsurface Cretaceous age calcareous nannofossils biostratigraphy from Tanot Well-1, Jaisalmer Basin— a manuscript entitled "Albian age calcareous nannofossils from Tanot Bore- well, Jaisalmer Basin in Rajasthan area, Western India" is prepared. In addition, conducted field work in Jaisalmer Basin and samples from Lathi (Thaiyat, Member), Jaisalmer (Joyan, Fort, Bara Bagh, Kuldhar and Jajiya members) and Baisakhi and Bahdasar formations were collected. Samples from Mataji ka dungar Formation and Lathi Formation from Barmer Basin were also collected for recovery of calcareous nannofossils.

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

Rock samples from Lakhanpur 1 and 2 sections (Neill Island) are proved to be productive in terms of silicoflagellates and sponge spicules. Diatom is less in most of the samples. However, a rich diatom assemblage has been recovered from the West Coast section Sitapur of the Island. Some significant taxa identified in the assemblage are– *Gramatophora* spp., *Thalassiosera* spp., *Coscinodiscus* spp., *Raphoneis* sp., *Rossiela* sp., and *Nitzschia* spp. Some selected diatom taxa were studied under SEM. The recovery of terrestrial palynofossils is extremely poor in all the 3 sections. Detailed morphotaxonomic study of the recovered palynofossils and preliminary data interpretation are now being done.

Morphotaxonomic study of the recovered palynofossils from the Meetha Nala section of the Havelock Island was continued. Photodocumentation of the selected palynotaxa was made. Data interpretation of the recorded palynofloral assemblages from the section and Baratang Formation of Baratang Island were done. Three distinct diatom associations have been recognized in the succession of Meetha Nala section. A comparison of the present diatom assemblage with the one recorded by earlier workers from Nancoory Island reveals close similarity. Palynofloral composition dominated by centric diatoms confirms a deep water marine environment of deposition of the sediments in the area of deposition. A paper on palynological aspect of the Baratang Formation was finalized. Additionally, rock samples collected from 5 measured stratigraphic sections viz., Radhanagar Beach cliff and Vijoynagar forest checkpost road sections, Havelock Island; and South point, Corvin cove and Simighat sections, Portblair were chemically processed for palynofossils. Biostratigraphic potential of the recovered palynofossils from these sections is now being assessed.

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

Thin sections of rock samples (limestones) from the Early Miocene sequence of Inglis Formation (exposed in the Havelock Island), Middle Miocene sediments of Long Formation (exposed in the Hut Bay Island, Little Andaman), Late Pliocene sequence of Neill West Coast Formation (exposed in the Neill Island), Holocene sediments of Chidyatapu Member belonging to Neill Formation (exposed in Chidyatapu and Wandoor areas of Port Blair) have been microscopically analysed for the study of calcareous algae from the Neogene succession of Andaman-Nicobar Basin. The study reveals that the Middle Miocene sediments of Hut Bay Island are rich in coralline algae. The assemblage is dominated by Melobesiod, Mastophoroid and Lithophylloid (belonging to families Hapalidiaceae and Corallinaceae) non-geniculate coralline algal taxa along with geniculate coralline alga *Amphiroa*. Photomicrography, description and identification of the algal taxa have been done and interpretation on palaeoenvironmental significance has been made.

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 on coal seam succession intersected in bore-holes MCP-1, 2 and 3, representing Chintalapudi area of Godavari Valley Coalfield, has been carried out. The study has revealed the existence of vitrinite and inertinite rich coal constituents, besides significantly high proportions of liptinite group of macerals. The reflectance study however, suggests that these coals have attained high volatile bituminous C stage of the rank.

O.S. Sarate

Project 7.2: Organic petrological and geochemical characterization of South Indian lignite deposits

The selective resin materials for the organic geochemical characterization of South Indian lignite were processed for FTIR and Pyrolysis GCMS studies (with the help of Dr. Suryendu Dutta and associate, IIT, Mumbai). FTIR studies of selective resins recorded from the Ratnagiri and Neyveli lignites and associated sediments have shown strong aliphatic CHx (3000-2800 and 1460-1450 cm^{1}) and CH_3 (1377 cm^{1}) absorptions and less intense aromatic C=C (1560-1610 cm^{1}) absorptions. Pyrolysis GCMS have shown cadalene based bicyclic sesquiterpenoids including some C_{13} and C_{31} bicadinenes and bicadinanes. The study has shown that these compounds are derived from polycadinene structure and are diagnostic biomarker of the dammar resins showing the affinity to angiosperm species and indicate the terrestrial input of tropical forest supported by the palaeoclimatic conditions in the genesis of these lignites. Low maturity, i.e. reflectance varying from 0.299-315 in oil of these lignites further support the occurrences of these less degraded biomarkers in these resins of angiosperm affinity. Besides, six lithological sections were plotted and finalized depicting the time and space relationship of the Neyveli, Jayanmokandam, Mannarguddi and Ratnagiri lignites. Neyveli lignites have shown the 2-3 characteristics resin banding patterns as has already been studied in Vastan, Ghogha, Khadsalia, Rajpardeeh, Matanomadh, and Panandhro of Gujarat. Further, the work is in progress.

Rakesh Saxena

Project 7.3: Organic matter characterization of lignite-bearing successions of western India

The petrological studies on lignites from Khadsaliya (Bhavnagar district) and Tadkeshwar (Surat district) mines have been carried out for their microconstituent's characterization. In the studied lignites, huminite is represented by almost all the macerals incorporated in this group. In general, structured telohuminite (textinite + ulminite) is dominant in these lignites followed by detrohuminite (attrinite + densinite). Maceral ulminite normally dominates over textinite. Semifusinite, fusinite, inertodetrinite and funginite represent the inertinite group, though not recorded in all the samples individually. The liptinite group is mainly represented by sporinite (pollen-spores), cutinite (cuticles), and resinite (resins/ wax/ oil, etc.). Observations under blue light excitation show manifold increase in liptinite contents, chiefly constituted by liptodetrinite (detritus) and resinite. Varied fluorescing resinite is observed as globular/ rounded isolated bodies and as cell-fillings. The minerals associated with the lignites are mainly represented by clay, quartz, sulphide and carbonate.

The huminite reflectance ($R_{o\ max}$ % values) suggests that the studied lignites are less mature (of brown coal or lignitic stage) and have not reached the sub-bituminous stage of coalification as those of the lignites from Panandhro field. Overall predominance of huminite indicates the existence of woody forest contributing as the source vegetation and reducing conditions of swamp during the formation of lignites. The individual basin initially experienced relatively higher reducing conditions and faster rate of subsidence with only minor fluctuations in swamp water/ environmental conditions. High pyrite content makes the Khadsaliya lignites not much suitable for combustion purpose, however clean lignites can be used when combined with good quality (high rank/ low mineral) coals.

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

The petrological evidences from extensive investigations on two economically exploitable lignite deposits of India– Neyveli (Miocene), Cauvery Basin and Panandhro (Eocene), Kutch Basin, and palaeofloral evidences gathered from published literature are combined to interpret the genesis of these lignites precisely. Predominance of huminite and certain macerals together with fossils by their correlation to modern plant equivalents, suggest that mangrove-mixed angiospermic vegetation supplied the raw material for lignite formation. The near-shore/ coastal environmental conditions for lignite deposition are evidenced by the habitat of recorded fossil flora and presence of pyrite. High Gelification Index and moderate Tissue Preservation Index suggest high ground water table and undisturbed low-energy conditions during lignite formation. The unbanded/ sparingly banded thick lignite seams got deposited in slow subsiding basins with minor vegetational and environmental fluctuations.

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 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)

A project proposal for palaeobiological studies from the Ganga Basin and their biostratigraphic correlation with Tertiary type section of Garhwal Himalaya for application in hydrocarbon exploration has been formulated and submitted to KDMIPE, ONGC for consideration.

N.C. Mehrotra, Rupendra Babu & V.K. Singh

Processed and studied coal samples received from Essar Oil Limited, Durgapur. The coals from four bore-holes belong to the Raniganj (East) Coalfield of Damodar Basin in the frame of the evaluation of coal bed methane (CBM) potentiality. The coals have been analysed as under–maceral and associated mineral matter composition (31 samples), vitrinite reflectance ($R_{o\ max}$ %, 26 samples) and micro-cleat patterns (10 samples). A report containing these data along with photographs is forwarded to the concerned agency.

Processed and studied coal/ shale samples received from BRGM, France/ MECL, Nagpur. Six polished sections and three samples (of coal/shale) belong to the Ledo-Makum Coalfield 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 analysed as under– maceral contents and vitrinite reflectance ($R_{o\ max}$ %). A report containing these data along with photographs is forwarded to both the agencies.

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

A report on the palynological contents (in 3 coal/ shale samples), e.g. pteridophytic spores, gymnosperm and angiosperm pollen grains, fresh water algal spores, fungal fruiting bodies, recycled Permian saccate grains and characteristics of various types of sedimentary organic matter (palynofacies) and their frequency abundance, age and depositional environments of coal samples in respect to BRGM/MECL´s oil shale project was submitted to BRGM (France) and MECL (Nagpur).

Madhav Kumar

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

The results of sedimentological and palynological investigations of sediment profiles CHI-1 and CHI-10 from north-eastern region of the Chilka Lake dated back to 12, 960 ±130 yrs. B.P. and 3700 ±50 yrs. B.P. respectively, exhibited different dataset of palynomorphs at different levels of sedimentation. The core CHI-1 revealed sedimentary sequences rich mainly in Rhizophora-dominated mangroves at the base and freshwater elements at the upper part of sequence. The other taxa recorded were *Acanthus, Acrostichum, Aegialitis, Avicennia, Barringtonia, Brownlowia, Excoecaria*, Fabaceae, *Heritiera*, *Lumnitzera,* Meliaceae, *Nypa, Phoenix, Sonneratia, Terminalia, Xylocarpus,* etc. Whereas, the core CHI-10 exhibited the poor occurrence of both peripheral and core mangroves. However, the admixture of herbaceous and freshwater elements was recorded all throughout the profile in varying frequencies. This profile is short in depth and can be equated with the upper part of profile CHI-1 which exhibited almost similar type of pollen assemblage. The lake mud samples revealed good assemblage of diatoms belonging to *Amphipleura, Biddulphia, Campylodiscus, Cocconeis ,Cymatopleura ,Cymbella, Diatoma, Diploneis, Nitzschia, Pinnularia, Thalassiosira,* etc.

The foraminiferal studies from two sediment cores (CHI-51 & CHI-31) were carried out at WIHG, Dehradun under the guidance of Dr. D.S.N. Raju. The preliminary investigation of sediment profile CHI-51 collected from eastern region of lake dated back to 11,130 ±90 yrs. B.P. exhibited poorly preserved foraminifera.Whereas, CHI-31 collected near the mouth dated back to 1575 ±35 yrs. B.P revealed good assemblage of foraminifera dominated by *Ammonia*. Moreover, two transgressive/regressive cycles have been recognised at level 278 cm and 40 cm in sediment profile CHI-31. Bimodal/Trimodal distribution of grain size in sediment core CHI-51 may help in recognition of Tsunami or storm deposits.

Asha Khandelwal & Shilpa Singh

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

Geochemical analysis of three sedimentary soil cores (~5 m deep: 300 samples) from Pednapatnam and Machlipatnam (Andhra Pradesh) covering the north-eastern part of the Krishna River delta show high salinity (average 1.8 ppt & max. 4.5 ppt), Total Dissolved Solids (TDS- av. 2177 mg/L) and conductivity (av. 4.2 mS cm^{-1}) throughout in the core. However, the upper 50-70 cm samples in swampy areas inhabited by back-mangrove *Avicennia marina* show low salinity (0.1-0.3ppt) as compared to high salinity (4 ppt) in exposed land inhabited by *Suaeda* species suggesting capillary driven translocation of salts. These two species find conducive habitat in the present situation (unscientific and excess groundwater exploitation) along the Indian coastline due to their biological adaptability. All the studied cores constitute fine sandy clay to silty sediments rich in organic matter (OM) content, iron, titanium, rubidium, manganese, zinc, lead and cobalt. Increased salinity of the surface as well as deeper soil up to 5 m depth and even beyond this is rendering the vast fertile land unsuitable for agriculture favouring salinity tolerant mangroves and is likely to contaminate the freshwater reserve in the coastal areas.

Palynological study was carried out in one core from Pednapatnam (~5 m deep: 100 samples). Although the sediment is clayey to fine sandy silt but the pollen assemblage is quite low. The organic matter sediment dates back to ~8000 +/-250 yrs. B.P. Since OM characterization is the direct measure of productivity-related environmental conditions at the time of deposition in the coastal realm, its temporal variations in the sediment column was used as an aid in palaeoenvironmental and hydrological interpretations. Results indicate series of three phases characterized by high fresh water fluvial energy whereby abundant allochthonous woody charcoal debris, blackish cuticular fractions and identifiable plant tissues, aquatic forms and associated chytridiales were

recorded. Abundance of *Cerealia* pollen and wheat cuticular fractions indicate anthropogenic dominance influenced by strengthened monsoon system. Intermittent reduction in such type of palynofacies and gradual increase in amorphous OM along with marine forms, such as dinoflagellate cysts, foraminifera linings and copepod egg shells indicate sea water ingression for a longer period terminating into dry substrate as evidenced by lack of OM and complete absence of any identifiable debris. Thus, the intermittent sea water ingression in the studied area contaminated the sediment with salts. The clayey to sandy silt sediment favoured the salt accumulation. Therefore, the entire 5 m sediment is highly saline and is attributed to lateral as well as vertical salt water intrusion and accumulation creating enormous risk for fresh water aquifers in coastal areas which may be vulnerable to vegetation. Due to increased salinity, the present day vegetation is dominated by *Avicennia* and *Suaeda* plants.

Anjum Farooqui

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

The dinocyst assemblage comprises of more than 20 species along with variable organic matter distribution. Gonyaulacoid and Peridinoid investigations of dinoflagellate cyst and palynofacies assemblages from the upper 1 m profile of the GC–1 core (Karawar Coast) revealed significant variation in their vertical distribution pattern. *Bitectatodinium spongium* is found to be abundant throughout. Predominance of *Tuberculodinium vancampoae* and *Lingulodinium machaerophorum* at certain levels indicates lower salinities due to precipitation related freshwater terrestrial runoff, while dominance of *Selenopemphix nephroides* and *S. quanta* at intermediate levels points towards normal salinities. These results demonstrate periodic monsoon related fluctuation in the dinocyst populations during Late Holocene times. The TOC values of the same shows approx. 20% organic matter content with minor fluctuaions.

Vandana Prasad, Rahul Garg & Biswajeet Thakur

The surface samples (uppermost 2 cm) of transect from Bhatkal region (station no 43, water depth 34mt to station no 50 water depth 2546 mt) were macerated for the preparation of smear slides (nannofossils and calcareous dinoflagellate cysts), diatoms and organic matter distribution. The slides were studied for the variation of diatoms along the transect from shallow marine to deep sea in three different regions, i.e. along the coast, from 102 to 1500 m depth in the oxygen minima zone (OMZ) and in deeper waters in the slope region. The TOC values were also carried out to correlate the organic matter content and diatoms assemblage in these samples. The results of the study proved to be significant. The station along the coast near Bhatkal shows high diversity in pennate diatoms. Most of the diatoms were mainly fresh water indicating their transport through runoff and monsoonal precipitation. The pennate diatoms include *Navicula* spp., *Nitzchia socialis, Pseudoeunotia doliolus, Pinnularia, Mastogloia, Synedra, Cocconeis, Gyrosigma*, etc. The marine pennate forms are marked by the presence of *Nitzchia marina, Nitzchia kerguelensis, Diploneis nitescens, Diploneis bombus, Diploneis crabro*, etc. The fresh water centric forms are low in this region and are marked by *Cyclotella minighiniana*. The marine centric forms include *Coscinodiscus, Thallasiosira lineata, Triceratium favus, Hemidiscus, Actinocyclus, Actinoptychus,* etc.

At 102-1500 m water depth profile the assemblage shows low diversity diatom community with *Thallasiosira* and *Coscinodiscus* occurring in traces. However, the deep sea sediments from 1500-2546 m (outer slope region) shows increased diatom population dominated by *Coscinodiscus* spp., *Thallasiosira lineata*. The study shows differential primary productivity behavior pattern related to the salinity changes and nutrient supply. The correlation of TOC values with the diatom in the OMZ region shows high TOC values but low in diatom populations. This gives evidence that the high organic matter content may be due to some other reasons rather then the diatom population. Further study related to palynofacies, dinoflagellate cysts and calcareous nannofossil are under progress and is going to reveal valuable information related to primary productivity and OMZ conditions in this region.

Biswajeet Thakur, Vandana Prasad & Rahul Garg

Field work was carried out in the Vembanad Lake. Surface sediment grab samples were collected from 17 stations. Surface and bottom water samples were collected using Niskin kit from these stations and taken in a manner to carry out the geochemical processing and elemental analysis of these samples. 12 cores of one meter length were collected along the Vembanad Lake, 4 of which were collected from the mudbanks of Cochin back water.

Biswajeet Thakur

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

Pollen spectra from the forest area at Shahganj-Kishanpur, Sehore district and Itarsi-Nagpur Highway, Hoshangabad district have shown the dominance of non-arboreals and relatively low frequencies of arboreals (trees and shrubs), except at Amjhera, Hoshangabad district, where the arboreals are much better represented than non-arboreals, because of much higher frequency of *Madhuca indica* alone with the highest value of 85.5%, which could be attributed to its local abundance around the sampling sites. In general, the consistent occurrence of *Madhuca indica* as compared to other forest constituents could be inferred to its frequent occurrence in the forest. *Tectona grandis* (teak) is also recorded in appreciable values in the teak dominated forest at Shahganj-Kishanpur and Itarsi-Nagpur Highway. The meager presence of *Lagerstroemia*, *Mitragyna*, *Adina cordifolia*, *Aegle marmelos*, *Emblica officinalis*, etc., despite being the common forest elements, could be ascribed to their low pollen productivity as they are entomophillous.

Pollen analytical investigation of 2.4 m deep sediment profile from Nitaya Lake, Hoshangabad district has unraveled that around 6650 to 5780 yrs B.P., tree-savannahs comprising grasses with scanty trees viz., *Acacia*, *Emblica officinalis*, *Madhuca indica*, etc. occurred in the region under a cool and dry climate. Between 5780 and 3000 yrs B.P., open mixed deciduous forests were established with the invasion of a large number of arboreals viz., *Maytenus*, *Aegle marmelos*, *Tectona grandis*, *Symplocos*, etc. due to onset of warm and moist climate. Subsequently, between 3000 and 800 yrs B.P., mixed deciduous forests turned diversified with improvement in most of the trees. This transformation in the vegetation composition implies a relatively more-moist climate than before. From 800 yrs B.P. to Present, the mixed deciduous forest turned sparse due to reduction in precipitation. The expansion of agricultural land might have also been the reason for depletion in the forest cover.

Pollen analysis of 2 m deep sediment profile from Kachhar, Sehore district has shown the presence of open mixed deciduous forests in the region since ca. 2000 yrs B.P. under a warm and moist climate. *Madhuca indica*, *Lagerstroemia*, *Acacia*, *Syzygium*, members of Sapotaceae, etc. were the major forests constituents. The construction of pollen diagram and its interpretation in terms of past vegetation and climate is in progress. The partial pollen analytical investigation of another 1.25 m deep core from Kachia-Jhora has also depicted the presence of mixed tropical deciduous forests in the region since last 1,300 years or so. Additionally, undertook field excursion to southwestern MP and collected 6 sedimentary profiles comprising Badwani, Dhanpada and Pokharni from Harda district; Khedla Lake and Sapna Lake from Betul district and Manjharkui from Sehore district for Quaternary palynological investigation. Besides, surface (moss cushions and surface soils), spider webs and honey samples were also picked up from various forest stands to study the pollen deposition pattern in the region.

M.S. Chauhan & Md. Firoze Quamar

Project 9.5: Studies on Quaternary vegetation and Climate from Himalaya

Pollen analysis of Liverwort patches from subtropical-temperate zones of Kumaun Himalaya opens a new frontier to develop the knowledge of modern pollen deposition. The palynodebris recovered consist palynomorphs of variety of taxa existing in the area, though certain of them show over/false representation (due to animophilly, etc.) and certain remain under represented/ unrepresented (because of entomophilly/ biodeterioration, etc.). Despite unavoidable disturbances, pollen spectra from different climatic zones show characteristic elements of their own, as *Pinus* is chief element in subtropical zone, *Quercus* in temperate, and transitional areas show admixture of both. Thus, pollen deposition broadly reflects existing vegetation of the area.

Documented two papers which deal with geochemical analysis of lacustrine sediments from Kumaun Himalaya– i) on total organic matter (TOM) and climate from a couple of profiles from Saria Tal, since Middle Holocene, and ii) on TOM and climate from Sukha Tal, since Early Holocene. In Early Holocene, investigated area had high representation of TOM and low carbonates contents; reflecting humid climate existed at the region during that tenure. Subsequently (near onset of Middle Holocene), OM became low and carbon contents high; indicating deterioration in climatic conditions. Thereafter (around Late Holocene), OM again became high and carbonate contents low; reflecting restoration of humid conditions at the region. Generated data broadly

corroborates to that of from pollen analysis. Further, carried out geochemical analysis of sedimentary profiles TT-I (400 cm thick) from Talli Tal and MT-II (100 cm deep) from Malli Tal, Naini Tal district, which has revealed the knowledge of past OM and climate of the region since Middle Holocene and Late Pleistocene, respectively.

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

Pollen analysis of ten moss cushion and forest humus procured from Dirpai and Singrijan forest, Assam depicts the existence of vast low land forest with marshy swamp. High values of exotics up to 35% signify the high wind activity in study area. Abundance of ferns spores along with adequate fungal remains mostly of grass pathogen especially Microthyriaceae, *Glomus*, *Alternaria*, etc. signify the moist climatic conditions. The air catches both in and outskirt of the forest indicates the strong wind activity supporting the long distance pollen transport (thermophillic) in the study area. Palynoassemblage from two sedimentary profiles (1.5 m) one each from Dirpai and Singrijan forest areas, predicts the existence of moist tropical forest under relatively cool and humid to warm and humid climate in recent past. The occurrence of Cerealia, Caryophyllaceae and *Xanthium* pollen in high value may be attributed due to the anthropogenic impact causing deterioration of the forest. Due to low carbon content age of sediment is not available.

Pollen analysis of 1.2 m. sedimentary profile from Subansiri reserve forest reflect three vegetation succession under relatively cooler and dry, onset of warming and increasing warm and humid climatic regime since 3200 yrs B.P. From the change of vegetation sequences in the pollen diagrams it may be inferred that some degree of climatic fluctuations did occur since 3200 yrs B.P. The forestation phenomena were generally associated with the decrease and increase of grasses, herbs and other certain arborescent taxa under different climate regime. Succession of vegetation even in short span of time evident in the study perhaps indicate that the climatic condition deteriorated resulting into deforestation first and restoration of forest under favorable condition in subsequent phases. However, the nature of vegetation recorded during 3200 to 2400 years BP could have been influenced by altitudinal factors or cooling impact from the neighboring Himalayan belt as evidenced by the presence of specific taxa.

S.K. Bera & S.K. Basumatary

Dendrochronology Group

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

Completed crossdating of 20 tree core samples of Himalayan pencil juniper (*Juniperus polycarpos*) and 35 tree core samples of Himalayan cedar (*Cedrus deodara*) collected from different sites in Lahaul, Himachal Pradesh and measured ring widths of crossdated samples to develop the ring-width chronologies of respective species. The chronology of Himalayan pencil juniper extends back to the early 10th century AD and Himalayan cedar to 15th century. Tree-growth climate relationship using regional climate data is being studied. Both the chronologies have shown potential to develop precipitation and temperature reconstruction. However, multiple site chronologies covering wider geographical area in the region are still required to develop robust climate reconstruction. Besides, collected 44 tree core samples of *Juniperus polycarpos* and 94 of *Cedrus deodara* from various sites around Udaipur in Lahaul, Himachal Pradesh.

R.R. Yadav

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

A manuscript on 'Reconstruction of May precipitation during AD 1590-2000 based on tree ring data of Teak and its correlation with other global climate parameters' is under finalization. In addition, finalized the paper (jointly with S. Chakraborty) dealing with temporal variation of radiocarbon (C14) in annual rings of Teak

tree (*Tectona grandis*) from two sites– Hoshangabad (22° 302 N:78°E) Madhya Pradesh, and from Thane (19° 122 N:73°E) Maharashtra. The 14C peaks in both the sites are recorded around 1964–1965AD which matches to the peak value of Northern Hemisphere. But the peak Δ14C at Thane is somewhat less (630 ± 8‰) probably due to the dilution by fossil fuel CO_2 free of 14C emanating from the neighboring industrial areas. This depletion of peak values has been used to estimate the local emission of fossil fuel CO_2, which is approximately 2.3% of the background atmospheric CO_2 concentration.

Amalava Bhattacharyya & S.K. Shah

Palaeoethnobotany Group

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

Morphological investigation of seed and fruit remains' samples carried out from ancient site at Naimisharanya, district Sitapur (UP) from cultural horizon of Sunga and Kushana Periods (approx. 200 B.C. to 300 A.D.) to build up plant economy practiced by the ancient settlers and the ecological conditions in this region in the past. The site exhibits ancient plant economy comprising of the field-crop finds belonging to cereals- barley, rice; minor crops like sawan and Italian millet; pulses- lentil, field pea, green-gram, black-gram; seeds of cucurbit/vegetable crop; along with seeds of fibre crop cotton (*Gossypium* sp.) and silk-cotton (*Salmalia malabarica*) tree taxa. Seeds of custard apple, fruit remains of neem (*Azadirachta indica*) and jujube fruit-stones have also been encountered. The record of neem (*Azadirachta indica*) seed/fruit remains, a medicinally valuable tree taxa, from Sunga-Kushana levels (200 B.C.-300 A.D.) is significant in archaeological lexicon of Ganga plain.

Weeds and wild taxa have also been encountered in association with field-crop remains, belonging to wild grasses viz., *Andropogon* sp. (Blue stem grass), *Dactyloctenium aegyptium* (Crow-foot grass), *Eleusine indica* (Goose grass), *Panicum* sp. (Panicum grass), *Poa* sp. (Blue or Meadow grass); *Trianthema portulacastrum* (Lalsabuni) and *Indigofera hirsuta* (Hairy Indigo). *Dactyloctenium aegyptium* and *Trianthema portulacastrum* may have been the weeds in summer group crops like rice; whereas *Indigofera hirsuta*, represent the weed components in winter crops like wheat and barley in the ancient agriculture at the site.

Chanchala Srivastava

Further investigations taken up on the botanical remains from the ancient Harappan site at Kanmer in Kachchh district (Gujarat) added considerably to our understanding of the exploitation of botanical resources by ancient settlers at the site from 1800-1500 B.C. In addition to the crops already reported, the remains of *Lathyrus sativus* (Grass-pea) and *Linum usitatissimum* (Linseed) were new finds. Remains of weeds and other wild taxa were also encountered reflecting the ecological condition and ground vegetation. Two agricultural approaches have been reported at the site. One approach involves crops sown in winter and the second approach based on plants sown in summer. The summer approach developed later than winter approach. Also analysed carbonized remains from Neolithic Hetapatti, Allahabad (UP). A rich assemblage of cereals, pulses and fibre-crops is evocative of an advanced state of agriculture practiced. Besides, undertook field work at archaeological sites under excavations and collected botanical remains from Kanmer (Kachchh district) and Ahichchhatra (Bareilly district, UP).

A.K. Pokharia

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

Identified about 187 plant species belonging to 138 genera and 86 families among the plant specimens collected from Anuppur. Ethnobotanical data on food plants (13), medicine (64), Fibre (4), fuel (15), oil (3), gum and resin (3) were collected from Baiga tribe residing in different localities of Anuppur district. It has been noticed that oil extracted from the seeds of *Ferula foetida* and *Guizotia abyssinica* is being largely used by tribals and other local people for cooking purpose. Further ethnobotanicl information is being analysed. Identified 6 plant species (*Myosoton aquaticum, Sagina apetala, Portulaca pervula, Talinum paniculatum, Rumex hastatus* and *Solanum americanum*) as new record for flora of MP. *Solanum diphyllum* collected from Rajendragram of Anuppur district is a new record for flora of India.

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

Geomorphological studies of the Spiti valley were taken up for understanding the fluvio-lacustrine sedimentary deposits distribution and sedimentary architecture of the valley. On the basis of OSL chronology, it is established that the lake deposits were formed in two episodes wherein the older deposits lying in the lower valley are older and lying at higher elevations due to tectonic movement along the Kaurik-Chango fault. The deposits of upper valley are younger and formed due to damming of the river due to land slides associated with higher monsoonal precipitation. A paper on same theme has been finalized. The discrepancy in dates obtained from conventional C^{14} and AMS radiometric techniques for Ladakh and Spiti regions were discussed. It is established that relatively much older ages obtained by conventional C14 techniques is a result of hard water effect. A paper on same theme has also been finalized.

The water samples collected from the Indus and the Shyok-Nubra river valleys were analyzed for their physical and chemical parameters. The data is discussed in view of the weathering processes and the relation with tectonics and climate of the region. High resolution mineral magnetic data was generated on the Quaternary sediments of the Spiti valley. Interpretation of data shows several warm and cold climatic phases between 12-8 ka BP. The four warm phases are also comparable to the W-1 to W-4 warm spells reported by Sangode & Mazari (2007). Geochemical and mineralogical data was also generated for bed and suspended load of the Indus and the Shyok-Nubra rivers. Sand dune and the Quaternary deposits of these valleys were also analyzed for similar parameters. Interpretation of the data is completed and a paper on the same is almost finalized.

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

The activities have been centred around developing/ adopting geophysical and geochemical methods for a multifarious approach towards palaeoclimatic records. Considering the relationship of carbon to nitrogen ratios in vegetations and their aquatic or land- affinity, an elemental analyzer (HCNS- O) has been set up along with necessary accessories to measure these elements in the sediments. The focus has also been on producing more and better dates as well as combining different methods to understand late Quaternary climatic changes with better control. In the radiocarbon section, the system was maintained and run so that, in all, 167 benzene preparations were done and a total of 127 samples for archaeological and palaeoclimatic research counted (about half of them for Institute work) and the radiocarbon ages calculated for them catering to the need of Quaternary workers. In addition, standards and backgrounds were run for control and corrections. The samples included shells, sediments, wood, charcoal, etc. Considering the waiting period for counting, a new ultra sensitive liquid scintillation counter has been procured and assembled. The performance is under testing. For the older samples' age- calculation, we have switched over to the use of modified calibration programmes (CalPal, Koln University), which allows handling older than 26000 yr.

Considering the potential of lake sediments for proxy climatic data and with the aim of understanding the climatic evolution in the Himalayan region, a field trip was undertaken to Nachiketa and Mardunga lakes in Uttarkashi (Uttarakhand). Two other lakes were also spotted, viz. Chhadkya (dry) and Baamanya (with water) close to but higher than Mardunga Tal. Eighteen sediment samples were collected from trenches at the shore of Nachiketa Tal and from the peripheral part of Maradunga Tal by digging trenches for dating, elemental and other studies.

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

Around 56 samples, collected during the 1st Indian Expedition to the Arctic (in 2007), were received courtesy NCAOR, Goa and were processed for palynological studies. The samples, from varied depositional settings, yielded a rich assemblage of spores, pollen, dinoflagellates, diatoms, thecate amoebae, microforamenifers, scolecodont fragments, radiolarians, copepod egg-shells, tintinnids, etc. Based on the percentage frequency of different microfossil assemblages, ecological and climatic inferences were made. The samples belonged to diverse ecological niches such as freshwater, oligosaline, mesosaline, oligohaline, mesohaline, eurysaline and dry ecosystems. Further studies are continuing.

Anjum Farooqui & Vartika Singh

Participated in the 2nd Arctic Expedition during June-July 2008 and sampling was done from two Quaternary sites– one cliff section between two glacial streams Stupbekken and Strypbekken, and the other a core was raised south of the Brandalpynten Lake in the Kolhamna lagoon. The samples would be studied to generate multi-proxy data for palaeoclimatic interpretations. Three sections of the pre-Quaternary deposits were also sampled.

Anupam Sharma & Binita Phartiyal

Proposal regarding Institue's participation in the 3rd Indian Expedition to the Arctic was presented at NCAOR, Goa. The project was further revised as per the reviewers' suggestions and was reformulated as 'Multi proxy Geological studies in Svalbard area and surrounding Ocean: Implications to Quaternary palaeoclimate and Pre-Quaternary biostratigraphy'.

Ratan Kar

Participated in the XXVIII Indian Expedition to Antarctica and during the period of traverse to Larsemann hills work was undertaken at various islands and during the stay at Maitri station, Schirmacher oasis water and sediment samples were collected from the inland fresh water lakes as well as some epi-shelf lakes. Southern ocean water samples were collected at 45° S, 50° S and 65° S latitude to study surface water productivity in terms of phytoplankton and organic matter distribution pattern. Surface sediment samples and water samples were collected from the lakes of Bharti, Fisher, Broknes, Stornes and Sandercock islands. Cyanobacterial mat samples from the lakes were also collected in order to understand the present day lake ecology and the role of cyanobacteria in defining the organic matter distribution pattern.

Surface sediment samples were collected from the lakes. Water and sediment samples were collected from the lakes near the Russian base, NOVO to study the effect of human induced changes on the lake ecology. Cyanobacterial mat samples from the lakes were also collected in order to understand the present day lake ecology and the role of cyanobacteria in defining the organic matter distribution pattern. Analysis of the collected sediment, water and algal mat samples will be done for final data generation and to understand the present day trophic state of the fresh water lakes in East Antarctica. Comparison of the data of the samples collected from Larsemann hills region having no human disturbance will be done with the samples collected from the lakes near the Maitri station of India and NOVO

Russian station at Schirmacher Oasis region and Chinese station and Progress II Russian station at Broknes Island of the Larsemann hills region having high human activity. Antarctica has long been considered as a continent having no human direct influence on its climate and ecosystem.

Vartika Singh

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

Systematically analysed a well preserved *Glossopteris* floral assemblage collected from Lower Barakar Formation, Makardhokra Open Cast Project and Umrer Open Cast Project, Umrer Coalfield, Nagpur district, Wardha Basin, Maharashtra. The assemblage consists of Glossopterid leaves, fructifications, equisetalean axes, platyspermic and radiospermic seeds and is represented by *Gangamopteris clarkeana* , 18 species of the genus *Glossopteris* viz.- *G. arberi, G. browniana, G. communis, G. conspicua,G. damudica, G. feistmantelii, G. indica, G. intermedia, G. longicaulis, G. rhabdotaenioides, G. recurva, G. searsolensis, G. spathulata, G. stenoneura, G. subtilis, G. syaldiensis, G. tenuifolia, Glossopteris* sp., fructification *Scutum leslium,* a number of leaves belonging to the genus *Noeggerathipsis* i.e. *N. hislopii,* branched and unbranched equisetalean axes and a variety of seed taxa including *Palaeocarpus birsinghpurensis, Cordaicarpus* sp.a, *Cordaicarpus* sp.b, *Samaropsis ganjrensis, S. feistmantelli, Rotundocarpus ovatus* and a new species of *Rotundocarpus.* The work is under progress.

A preliminary investigation based on photographs of the Gondwana floral elements from Weller Formation (Permian) and the Lashly Formation (Triassic) Allan Hills, southern Victoria Land, Central Transantarctic Mountains, Antarctica has revealed presence of a number of species of the genus *Glossopteris* viz. *Glossopteris indica, G, damudica, G. subtilis, G.nautiyalii, G. stenoneura, G. browniana, G. tenuifolia, G. taenioides,* G. *intermittens* and *G. tortuosa, Phyllotheca indica, Ginkgoites huraensis* and *Vertebraria indica* from the Weller Formation. The flora is comparable with that of Barakar and Raniganj formations of India. Similarly, *Dicroidium odontopteroides* recorded from the Lashly Formation (Triassic) is comparable with that of Indian Triassic.

Rajni Tewari

Processing and preparation of slides form bore cores MLG-24 and MLG-23 from Gundala area of Godavari Graben. Photography and counting of samples from bore cores MMK-19, MLG-24, MLG-23, MGK-6. Prepared litholog of MMK-19 and MLG-24. Finalization of paper on palynological dating and correlation of coal bearing horizons from Satrajpalli and Gundala areas.

Neerja Jha & Neha Goel

Approximately 25 samples from bore-hole 1008 from Manuguru area, Godavari graben have been macerated and slides have been prepared for palynodating and depositional environment studies is in progress. Slide observation of macerated samples from Durgapur OCP, Hindustan Lalpeth mine and Kawadi borehole of Wardha Valley Coalfield has been completed and the results have been documented in the form of a paper entitled 'Palynodating of some boreholes from Wardha Valley coalfield, Maharashtra, and their correlation'. The samples have been dated to belong to Early Permian age based on the *Parasaccites* and *Scheuringipollenites* palynoassemblage and *Scheuringipollenites* and *Faunipollenites* palynoassemblage recorded in these samples.

Neerja Jha & Pauline K. Sabina

A field trip was undertaken to Bhopalpalli and surrounding areas including Kakataya Khani, Venkatapur Area near Mulug, Srirampur Colliery in Bellampalli Area and Jaipuram Area Godavari Graben, Andhra Pradesh for collection of plant megafossils and rock samples for recovery of microspores, seeds and megaspores and scientific discussions with the geologists of Singareni Collieries Company Limited, Kothagudem.

N.C. Mehrotra, Neerja Jha, Rajni Tewari, K.G. Mishra & Pauline K. Sabina

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

About 20 megafossil specimens have been collected from the sediments of the Kuling group (Permian) exposed at three locations in a road section near Guling village in Pin Valley. The specimens are in the form of impressions as well as compressions and are poorly preserved. They are tentatively identified as conifer axes with two kinds of organization. One group includes shoots with short broad leaves and obtuse apices. Conifers of the second group have narrower, longer and more crowded leaves. Additionally, about 50 megafossil specimens were also collected from the Carboniferous sediments exposed near Poh, Nadang, Tabo and Lari villages in the Kaza district of Spiti Valley. The fossils are again poorly preserved. The tentatively identified specimens include conifer axes, axes with longitudinal striations, poorly preserved lycopod stems, *Triphyllopteris* sps., ? bryophytes and some seeds.

Bulk maceration of samples collected from Guling Formation, Guling Area, Spiti has yielded a variety of microfossils including green and blue green algae i.e. *Ulothrix, Oscillitoria, Nostoc,* algal sheath, trilete spores, cuticles with simple stomata without organised subsidiary cells and animal remains of uncertain affinities. Work is under progress.

Rock samples collected from Guling Formation, Guling Area were processed for recovery of palynomorphs. Zonate trilete, apiculate triletes, leiosphaerids, achritarchs have been reported. Taxa viz. *Densosporites*, *Retispora, Raistrickia, Lycospora, Cristatisporites* have been identified. The study is in progress.

N.C. Mehrotra, Neerja Jha, K.J. Singh, Rajni Tewari & K.G. Mishra [& S.K. Parcha (WIHG)]

Project 14.2: Megaflora and Palynology of the Kargil Molasse

Macerated 42 samples for palynological analysis collected from various outcrops around Kargil-Batalik road and Wakha River sections (jointly with Ram Awatar). These samples yielded gymnospermous pollen grains of the Family Pinaceae (*Pinus* and *Cedrus*), non-pollen microfossils and rich Permian–Triassic miospores. The non-pollen microfossils recovered from the sedimentary sequence of the Kargil and Tharumsa formations (Late Oligocene-Miocene) belonging to the Ladakh Molasse Group are represented by colonial green algae *Pediastrum*, (Family: Hydrodictyaceae) as well as *Lecaniella* (Family: Zygnemataceae), fruiting bodies of the fungus *Glomus* (Glomeraceae), stromata of the Ascomycetes Group (Microthyraceae) along with fungal hyphae. These non-pollen microfossils are significant for assessing the palaeoecological conditions and depositional environment of the Kargil and Tharumsa formations.

In addition, gyrogonites of charophytes have also been recorded from the Kargil Formation. The charophytic assemblage is dominated by *Chara globularis* var. *globularis, C. globularis* var. *aspera, C. hispida, Sphaerochara tewarii, S. prolifera, Lychnothamus sahnii, L. breviovatus, L. barbatus* and *Nitellopsis helvetica.* Among the megaremains a few fragmentary leaves were collected from the Kargil and Tharumsa formations and their study is in progress. One of them has been identified as of Moraceae and indicates the advent of temperate conditions during the Miocene in the Ladakh Himalaya due to upheaval.

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

The yield of palynological content in Intertrappean beds of Rajmahal Formation is very meagre. The palynoflora from IT at Moti Jharna yielded long ranging taxa *Auracariacites, Callialasporites* and *Podocarpidites*. All these taxa are long ranging occur from Jurassic to Early Cretaceous. No significant age marker taxa could be observed. Hence precise age could not be defined. However, the acritarch taxa *Numus* Morgan 1975 is recorded in abundance together with above mentioned palynomorphs. This taxon has an age range from Valanginian to Albian. Thus, Early Cretaceous age could be assigned to this bed. Additionally, visited different localities of Rajmahal Basin and collected samples from intertrappean beds of Rajmahal Formation.

Archana Tripathi & B.N. Jana [& Kanchan Pande (IITB) & G.V.R. Prasad (Jammu)]

Project 14.4: Neyveli lignites: biostratigraphy and palaeoecology

Analysis of samples from the Neyveli lignites and associated sediments revealed a diversified assemblage of palynomorphs and dinoflagellate cysts along with rich and varied organic matter. Discovery of dinoflagellate cysts in the split lignite seam inter burden and occurrence of marine sedimentary structures provide a new insight into the age and depositional environment of this enigmatic lignite succession which have remained controversial for nearly six decades. The new data set indicates Middle Eocene age and coastal to marginal marine environment of deposition.

Rahul Garg & M.R. Rao [& Ashok Sahni (Chandigarh) & R. Nagendra (Anna Univ, Chennai)]

Prof. M.P. Singh, Member, Governing Body paying tributes to late Dr. B.S. Venkatachala, Former Director, BSIP on January 02, 2009

Additional Research Contributions

Recovered dark brown to black, polydeformed organic-walled microfossils both in thin sections and macerated residues of subsurface semi-metamorphic rocks exposed at Zangareddigudem area in the east of Chintalpudi sub basin, Andhra Pradesh. The yielded microbiotic assemblage represents 4 taxa of prokaryotes- *Huroniospora microreticulata* Barghoorn & Tyler, *Myxococcoides minor* Schopf, *Siphonophycus robustum* Butterfield *et al.,* and *Primaevifilum minutum* Schopf. Seven vesicular forms (acritarchs) are of varied in morphologies, i.e. spherical, flaks, triangular and boat shaped- *Leiosphaeridia maica* Yan, *L. laminarita*, Jankauskas, *L. minutissima, Angumorpha crassa* Sun & Zhu, *Pterospermopsimorpha insolata* Timofeev and *Schizofusa aperta* Yan, *Diplomembrana producta* Yan. Explored data on microfossils is preliminary and closely resembled with those earlier known reports in Palaeoproterozoic stratum of world like Australia, China, Arizona and India. The comprehensive studies both quantitative and qualitative of the recovered OWM indicate Orosirian age and normal marine salinity, Photic zone, tidal environment and highly tectonic zone setting of this sub basin.

N.C. Mehrotra, R. Babu, Neerja Jha, Rajni Tewari & V.K. Singh

Finalized a paper on the carbonaceous mega remains from the two formations, viz. Nagod Limestone and Sirbu shale of Bhander Group, Vindhyan Supergroup exposed in Son Valley (MP). The present assemblage of multicellular metaphytes comprises 18 taxa along with 2 taxa, viz. *Sitaulia minor* gen. et. sp. nov. and *Palaeochorda vindhyansis* gen. et. sp. nov. cf, with modern Rhodophyta, Phaeophyta, Xanthophyta and Chlorophyta divisions. This finding suggests shallow water containing low nutrients and congenial stable environment for these deposits. This incredible finding is closely resembled with known assemblages of the equivalent sediments (Cryogenian to Early Ediacaran age) with Miaohe biota of China and White Sea Biota and central Ural.

V.K. Singh & Rupendra Babu

A paper entitled 'Climatic reflections during Permian and Triassic in Talcher Basinal region, Orissa, India– an integration of palynological and Carbon Stable Isotope data' is being finalized.

Archana Tripathi

Sectioned twenty Tertiary wood fossils procured from Dirpai and Singrijan river bed, Dhemaji and North Lakhimpur District and morphological studies are in progress.

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

The morphotaxonomical study of well preserved leaf impressions from Siwalik sediments of Thuligad-Purniya Road section, in Champawat district, Uttarakhand revealed the occurrence of 4 taxa viz., *Mallotus japonica, M. phillipinensis, Baccaurea tetrandra* and *Bridelia ovata* of the family Euphorbiaceae. The present habit and habitat of recorded taxa suggests that they occur in the tropical evergreen forests of northeast and south India, Bangladesh, Myanmar, Malaya and adjoining area which receive higher rainfall. Thus, it may be concluded that a tropical evergreen forest was flourishing under warm humid climate in the vicinity of fossil locality in contrast to mixed deciduous forest under reduced precipitation. (jointly with Shashi & S.M. Pandey, Balrampur).

Mahesh Prasad

Study on the fossil woods collected for the first time from the Lower Miocene sediments of Kolodyne area, Mizoram revealed the occurrence of a new species of *Anisopteroxylon* Ghosh & Kazmi, resembling the modern evergreen taxon *Anisoptera brunnea* Foxw. of the family Dipterocarpaceae. The finding of this taxon suggests that an evergreen forest was flourishing in and around the Kolodyne area under warm humid climate with heavy rainfall during the Lower Miocene times.

Mahesh Prasad, Anil Agarwal & B.D. Mandaokar

Anatomical study of a fossil wood collected from the Holocene sediments of Purniyagiri area near Tanakpur, Champawat district, Uttarakhand have been carried out in detail and the study showed that the wood belongs to *Anogeissus latifolia* Wall of the family Combretaceae. The present finding suggests that this taxon entered in the Himalayan foot hills before 600 Cal. BP and flourished luxuriantly throughout India and Nepal.

Mahesh Prasad, E.G. Khare, B. Sekar & Anil Agarwal

Palynological investigation of the Lower Siwalik sediments exposed at Nahan-Ponta Saheb road, Himachal Pradesh has revealed the occurrence of algal, fungal, pteridophytics spores, gymnosperm and angiosperm pollen The qualitative and quantitative analyses indicate that the fungal spores are dominant followed by spores/ pollen of pteridophyte, gymnosperms and angiosperms respectively. The important spores-pollen belonging to the

genera *Cyathidites*, *Lygodiumsporites, Lycopodiumsporites*, *Inaperturopollenites*, *Pinuspollenites*, *Cycadopites*, *Palmaepollenites*, *Polycolpites*, *Polyporites* have been recognized. On the basis of their affinities with modern equivalents, a humid tropical to subtropical climate have been suggested during the deposition. It suggests that the prevailing flora was mainly wet and mixed nature. The gymnosperms (*Abies*, *Pinus*, *Araucaricites*) possibly derived from the nearby high mountain area. (jointly with K. Ambwani)

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

The study based on the leaf impressions from the Upper Tertiary sediments of Mahuadanr valley revealed the occurrence of some more taxa belonging to the genera *Sterculia* (Sterculiaceae), *Grewia* (Tilliaceae), *Aegle* (Rutaceae), *Desmodium*, *Millettia* (Fabaceae), and *Lagerstroemia* (Lythraceae) of dicotyledonous families. Present day distribution of all the modern comparable species of the fossils indicates that almost all the 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

A paper entitled 'Palynological investigation of the Kopili Formation (Late Eocene) in North Cachar Hills, Assam, India' was finalized for publication.

R. K. Saxena & G. K. Trivedi

Palynological investigation of Vastan Lignite Mine of Cambay Basin, Gujarat has been completed. The total assemblage consists of 85 genera and 104 species, comprising of algal remains (7 genera & 7 species, including dinoflagellate cysts), fungal remains (7 genera & 8 species), pteridophytic spores (15 genera & 17 species) and angiosperm pollen (56 genera & 72 species). Reworked elements (3 genera & 3 species) have also been recorded. The assemblage consists of palm pollen (Arecaceae) dominant at the base but present throughout the sequence. On the basis of first appearance, acme and decline of palynotaxa, three cenozones have been recognized and broadly reflect changing palaeodepositional environments. These are in ascending order: i) *Proxapertites* Spp. Cenozone, ii) *Operculodinium centrocarpum* Cenozone, and iii) *Spinizonocolpites* Spp. Cenozone. The basal sequence is lagoonal, palm-dominated and overlain by more open marine conditions with dinoflagellate cysts and benthic foraminifers. At the top, mangrove and bioturbated hardgrounds are predominant. The extensive development of lignite sequences in South Asia just prior to the collision process probably reflects high equatorial biomass productivity, higher levels of oceanic anoxia as the circumglobal neotethys fragmented into shallower epicontinental seas and a response to thermal events (principally PETM and EECO in the early Eocene).

M.R. Rao & Poonam Verma

Three months visit (in March-June) to Natural History Museum and University College of London proved extremely beneficial for studying topotypic Lower Jurassic samples of London Basin, Lower, Middle and Late Jurassic samples of various localities of Paris Basin, Toarcian age famous Posidonia Shale sample of Germany for comparing the assemblage with Middle Jurassic nannofossils from classical Kutch and Rajasthan basins, western India. The coeval occurrences in the western Indian sector and Europe were highlighted in discussions.

Jyotsana Rai

A Late Cretaceous palynofloral assemblage has been recorded from the base of the Subathu Formation exposed at Jhameria, about 3.5 km from Nahan on Nahan-Shimla Road, Sirmaur district (HP). The palynofloral assemblage consists of 19 genera and 26 species of dinoflagellate cysts, fungal spores, pteridophytic spores and gymnospermous and angiospermous pollen. Significant palynotaxa recorded are– *Veryhachium morniensis, Dinogymnium* sp. cf. *vozzenikova, D. acuminatum, D. sahnii, Lanternosphaeridium licium, Gonyaulacysta* sp., *Polysphaeridium* sp., *Classopollis* spp. *Graminidites media, Monocolpites medius, Cycadopites* sp., *Osmundacidites wellmanii, Tricolporopollenites triangulus,* and *Araucariacites* sp. Well preserved dinoflagellate cysts and acritarchs are found in association with rich and diversified land derived elements, viz. pteridophytic spores, gymnospermous and angiopsermous pollen, fungal remains, tracheids and cuticles. The palaeogeographic significance of this mixed palynofloral assemblage in the base of the Subathu Formation have been critically analysed and interpreted. The abundance of *Dinogymnium* and *Classopollis* has also provided palynological confirmation of the presence of Late Cretaceous sediments in the Nahan area. It also supports the earlier view on the occurrence of a Late Cretaceous transgressive event along the Lesser Himalayan rift zone probably in response to coeval Deccan volcanism in peninsular India. A paper entitled 'Discovery of Late Cretaceous palynofossils from the Nahan area of Himachal Pradesh: Palaeogeographic implications' was finalised.

Samir Sarkar & O.P.Thakur

Thin section analysis of carbonate rocks from Prang Formation, exposed in the Bholaganj Limestone quarry near Therria Village of Um Sohryngkew River Section (South Shillong Plateau) yielded a fairly rich assemblage of coralline red algae. The coralline algal assemblage comprises both non-geniculate and geniculate forms. The non-geniculate forms belong to families Hapalidiaceae (Subfamily: Melobesioideae), Corallinaceae (Subfamily: Mastophoroideae) and Sporolithaceae. The geniculate corallines are represented by the Subfamily: Corallinoideae. Diversity, growth form analysis and taphonomic aspects of the algal assemblage indicate that in all probabilities the deposition of Prang Formation occurred in shallow, warm, shelf environment of normal salinity within the transgressive phase.

A.K. Ghosh

An inter-laboratory calibration exercise was set up in order to test the comparability of results obtained in the laboratories, each using its own preparation method. Each of the 23 laboratories received the same amount of homogenized splits of four Holocene sediment samples. The samples were from different localities (North Sea, Celtic Sea, Northwest Africa and Beneguela) and consisted of diverse lithology. Dinoflagellate cysts were extracted, counted, and relative and absolute abundances calculated. The relative abundances proved to be fairly reproducible, notwithstanding a need for taxonomic stabilisation. Absolute abundances were not reproducible, and clearly show a dependence of methodology on determination of absolute abundances, as *Lycopodium* spores are excessively lost during preparation. Further testing of the applied methodologies shows that important losses of *Lycopodium* spores can occur through decantation and/or sieving. (23 international research laboratories involved in this study).

Vandana Prasad

An attempt is made to track the affinity of fossil palynoflora of late Paleocene-early Eocene (~55-50Ma), sedimentary deposits of western and northeastern Indian region with the pollen flora of the endemic plants of Western Ghat area. The study shows striking similarity of extant pollen with the 28 most common fossil pollen taxa of early Paleogene. Vast occurrences of coal and lignite deposits during early Paleogene provide evidence of existence of well diversified rain forest community and swampy vegetation in the coastal low lying areas all along the western and northeastern margins of India. Prevalence of excessive humid climate during this period has been seen as a result of equatorial positioning of Indian subcontinent, superimposed by long term global warming phase (PETM and EECO) during early Paleogene. The study presents clear evidence that highly diversified equatorial rain forest vegetation once widespread in the Indian subcontinent during early Paleogene times are now restricted in a small area as a refugia in the southern part of Western Ghat area. High precipitation and lesser periods of dry months seen to have provided suitable environment to sustain lineages of ancient tropical vegetation in this area of Western Ghat in-spite of dramatic climatic changes subsequent to post India-Asia collision and during Quaternary and recent times.

Vandana Prasad, Anjum Farooqui, S.K.M. Tripathi, Rahul Garg & Biswajeet Thakur

Accumulated data on fluorescing macerals in Indian coals and lignites and discussed their significance in relation to hydrocarbon prospects. Good prospects of hydrocarbon generation in the coals/lignites ($R_{o\,max}$: 0.34-0.85%) are evident on the basis of macerals/ kerogen types. It is beyond doubt that liptinites play important role and has significance in hydrocarbon exploration. However, the effect of liptinite in coal bed methane exploration is yet to be realized and ascertained. Besides the type and concentration, liptinite's inter-maceral relationship with other macerals should be taken into account in future hydrocarbon related investigation. The results on H_2-rich macerals (liptinites + perhydrous vitrinite), the progenitors, is found to be significant for future CBM and other hydrocarbon related experiments/ investigations on Indian coals/lignites.

Alpana Singh & B.D. Singh

Co-guiding the Ph.D thesis work of Ms. Komal Verma, CAS in Geology, Lucknow University for her doctoral degree.The field data along with published work accrued has been processed till date.Varied litho sections were plotted to depict their time and space relationship in Cauvery Basin. Samples collected for the study are being processed for petrographic and geochemical studies. Further work is in progress.

Maceral data of Neyveli lignite mines depicts varieties of huminite, liptinite and inertinite group of macerals, besides mineral matter. Huminite group of maceral are formed under reducing environment conditions and are well represented by humocollinite, textinite, ulminite, attrinite, etc. in these samples, so was the case of liptinites constituting of sporinite, cutinite, resinite. Inertinites consisting of fusinite, semifusinite, sclerotinite were formed under oxidizing conditions have also been recorded in these lignites. Mineral matter constitutes mainly pyrites, marcasite, clay minerals and quartz. Typical cross section of root presumed to be of angiospermic affinity were recorded from these lignites for the first time. Qualitative and quantitative characteristics of this group of macerals in lignites suggest

the role of fluctuating oxidative and reducing conditions in the development of Neyveli swamp hence facie controlled. Reflectance (Rank) varies from 0.299-0.315% in oil suggesting low maturity which is further substantiated by intense fluorescence characteristics. (jointly with Komal Verma)

Co-guiding another Ph.D. thesis work of Mr. Ankur Kumar, Lucknow University for his doctoral degree on "Facies control on the formation of coal seams in East Bokaro Basin". The data related to the problem till date has been accrued and collated. Eight sections were delineated for the study of coal seams. In all, 24 coal seams were identified in the basin. The study of the published data has shown a lot of tectonic activity in the area. This has resulted in the development of high grade coal in the area in various blocks. This basin is very important in view of its richness in coal bed methane resources which is the future fuel of India. The necessary collection for coal samples is to be collected for further studies to better understand the impact of facies control in the development of CBM pools in the area.

Rakesh Saxena

Finalized a paper entitled "Holocene vegetation and climate fluctuations in northwest Himalaya, based on pollen evidence from Surinsar Lake, Jammu region, India". Pollen proxy records from 33.21 m deep sediment core from the lake have shown three warm and humid phases dated 9500 to 7700 yrs BP, 6125 to 4330 yrs BP and 800 yrs BP to Present as deciphered by the presence of oak-chirpine forest, alternating with two cool and dry phases dated to 7700 to 6125 yrs BP and 4000 to 2100 yrs BP as marked by chirpine-oak forest in the region. In addition, two pluvial events dated 4330 to 4000 yrs BP and 2100 to 800 yrs BP have also been witnessed in the region, based on the presence of coarse sand layers at 15.4-4 m and 10.18-9.58 m depths. (jointly with Anjali Trivedi, Lucknow)

M.S. Chauhan

Pollen analysis of 12 dry soil samples procured from Sabarmati river section (in Gujarat) predicts the existence of open land/hinter land vegetation. The major plant taxa recovered are *Acacia* sp., *Prosopis* sp., Sapotaceae, *Syzygium cuminii*, *Zizyphus* sp. The cultural pollen like *Xanthium strumarium*, Cerealia and Chenopodiaceae strongly suggest the past pastoral activities in the near vicinity of river beds. The occurrence of *Glomus* sp. is indicative of soil erosion in the study area. The occurrence of fungal fruiting body, hyphae and spores (mostly of grass pathogen in origin) are suggestive of humid depositional condition. The occurrence of vegetative parts like tracheids, epidermal peeling with stomata etc., in good value support the conducive depositional environment. The high input of organic matters in sediments is indicative of good monsoonal rainfall. The presence of *Pseudoschizia* signifies the fluvial depositional condition. The presence of *Pinus* and *Betula* proved long distance transport of microbiota from high elevation and high wind activity. (jointly with Swati Jain)

S.K. Bera, S.K. Basumatary & Swati Dixit

Palynoassemblage of sedimentary profile of Dzuko Valley, indicating existence of subtropical to temperate forest under cool and humid climatic regime since 1640 yrs BP. The occurrence of *Betula*, *Ulmus* and *Pinus* suggest long distance pollen transport. Feature of expanding open land vegetation toward the Hill forest due to fire and dwarf bamboo bushes is evident. Presence of Cerealia and other cultural pollen signify the pastoral activity in recent past. Forest fire causing high damage of *Rhododendron* spp. (among endangered four *R. macabeanum*, *R. ellioti*, *R. addenic* var. *crassum* and *R. johnstoneanum*, the most threatened is red *R. elliti*. Native medicinal plants and dwarf bamboo (*Sinarundinaria rolloana*) is also threatened due to illicit exploitation by visitor in recent time. (jointly with A. Mao & R. Gogoi)

S.K. Bera, S.K. Basumatary, Swati Dixit & C.M. Nautiyal

Twenty modern moss and subsurface soil samples were analysed to assess pollen/vegetation relationships from Siju and Baghmara reserve forests of South Garo Hills, Meghalaya. The first comprehensive study has reflected predominance of nonarboreals over arboreals, signifying the existence of an open lowland forest. A good correlation between plant cover and pollen assemblage has been experienced in the scenario. However, trace occurrence of pollen from *Nepenthes khasiana* and *Artocarpus chaplasha* in spite of its luxuriant growth in the study area needs further investigation. The occurrence of exotic plants is suggestive of long distance transportation of pollen from high altitude. The abundance of both monolete and trilete fern spores along with fungal remains especially Microtheriaceae and *Nigrospora* are suggestive of humid climatic condition. In addition, phenology and palynological studies of 40 tropical tree taxa were also conducted from South Garo Hills.

S.K. Basumatary & S.K. Bera

Supervised dissertation of Mrs. Jyoti Sharma entitled "Palaeoclimatic Analysis since Late Pleistocene from Monsoon and Non-Monsoon Climatic Zones of Himalayan Region" submitted for the PhD award to the Lucknow University.

Amalava Bhattacharyya

Co-supervised M.Sc. dissertation of Mr. Narayan Prasad Gaire, CDES/Tribhuvan University, Nepal entitled "Ecology and Dendroclimatology of Treeline Forest in Langtang National Park, Nepal Himalaya".

S.K. Shah

A report on palaeo-ethnobotanical investigations of test samples collected from Chalcolithic Ghorakatora excavation, District Nalanda, Bihar during 2007-08 by Archaeological Survey of India, Excavation Branch-III, Patna was prepared to find the potentiality of the site. The samples comprised of rich organic content of many small sized wood charcoal pieces along with, carbonized seed and fruit remains belonging to mainly cereals-rice, legumes/pulses-horse gram, black- gram and a number of weeds and wild taxa belonging to members of Acanthaceae, Apiaceae, Euphorbiaceae and Solanaceae. The samples investigated have proved productive, revealing advanced agricultural practices in the ancient times.

Chanchala Srivastava

The Geochemical Laboratory establishment in the institute is in progress. Recently the ultra pure water purification system has been installed and it would help in wet chemical digestion of the samples to be run on ICP-MS at different national laboratories. The clay separation process and grain size analysis has been standardized wherein all the chemical pretreatment processes for separation and subsequent treatments for differentiation of individual clay minerals have been followed according to the protocol of Jackson (1975).

Anupam Sharma

Aerobiological samples collected en route from Chandigarh to entire Spiti valley by smearing glycerin on glass slides and exposed for certain time at regular intervals were collected. The pollen recovery is very promising. Identification, interpretation and documentation are being taken up.

A 2 m trench samples collected from Son Valley (MP) for palynological investigation was worked out for mineralogical, geochemical and magnetic parameter studies. The entire section is divided broadly into two parts and this division has critical palaeoclimatic significance indicating enhanced and regular monsoon supporting the Sal forest.

Anupam Sharma, Binita Phartiyal & M. S. Chauhan

The joint work with several other groups from within and outside Institute has been initiated on palaeoclimatic and archaeological problems connected through radiocarbon and geochemical measurements. A site of archaeological interest in Khajanawar, (Saharanpur) was visited along with an NGRI scientist. Five samples from the site were dated, and the work (with NGRI & HNB University, Srinagar) has progressed to draft paper stage and indicates an earthquake and two phases of human settlement during 600 BC and 1200 AD, with an earthquake having occurred in between. Besides, a paper on palaeoclimate from Dzuko Valley samples (with SK Bera and group members- along with BSI, Nagaland co-workers) was finalized. In addition, two articles related to science communication were also documented. Joint work has been initiated with Dr. JN Malik, IIT, Kanpur on Andaman and Kuchchh samples.

C.M. Nautiyal

SEM studies of fine thin sections prepared of fruits of Verbenaceae and Sapotaceae for investigation of crystals. Crystals are found in mesocarp layer. Micromorphological data of crystal structure is characteristic and is species specific. The data may be considered for taxonomy.

Usha Bajpai

Systematically analysed megaspores from Late Permian sediments of Kuraloi Area, Ib-River Coalfield, Mahanadi Basin, Orissa.The assemblage is represented by 7 genera and 17 species viz. *Bokarosporites rotundus*, *Banksisporites indicus, Banksisporites utkalensis, Biharisporites spinosus, Biharisporites* sp.a, *Biharisporites* sp.b, *Jhariatriletes baculosus, J. srivastavae, J. damudicus, Manumisporites distinctus, Singhisporites baculatus, S. radialis, S. surangei, Ramispinatispora indica, R. nautiyalii* and *Ramispinatispora* sp. Additionally, a new species belonging to the genus *Ramispinatispora* has been recorded.

Rajni Tewari, N.C. Mehrotra, K.L. Meena & S.S. K. Pillai

Carried out field work along with International Collaboration team in Vastan, Tarkeshwar and Rajpardi lignite mines and surrounding areas of Gujarat and collected varied samples. This collaboration is running with scientist from India, USA & Germany.

Hukam Singh

Work related to the study of the pollen/ spore of the Tertiary periods were done (along with Vandana Prasad). Remote Sensing and GIS techniques were applied to establish to the link of the runoff direction along the Bhatkal region for the transport of the freshwater during monsoons. The study is under progress.

Biswajeet Thakur

Collaborative Work

Structural Engineering Tool and Micro-FTIR studies have been carried out on *Chuaria-Tawuia* assemblage of Suket Shales Formation of Vindhyan Supergroup and Halkal Formation of the Bhima Supergroup to know the relationship between these carbonaceous remains.

Mukund Sharma [& **Sanjay Mishra**, Queensland University, Australia & **Santanu Banerjee & Suryendu Dutta,** IIT, Bombay, Mumbai)

Finalized the results on well preserved 41 taxa of OWMs comprising 15 prokaryotes, 22 acritarchs, 2 Rhodophyta, and single VSM and multicellular tubular forms of unknown affinities from the shales/cherts of different formations belonging to Baliana-Krol groups of Eight Synclines of Krol belts exposed in extreme eastern and western ends of Lesser Himalaya in Uttarakhand and Himachal Pradesh. The recovered assemblages have close affinities with those microfossils known from the Ediacaran sedimentaries exposed elsewhere in world. The microbiotic assemblage indicates that Nainital syncline is older than Pachmunda synclines and tidal flat conditions during sedimentation.

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

Samples collected from South Karanpura (Damodar Basin) and Singrauli (South Rewa Gondwana Basin) coalfields have been analysed for palynodating of coal-bearing strata.

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

A paper was finalized on the carbonised wood samples from Late Holocene sediments of Kerala. The assemblage consists of six genera, viz. *Artocarpus*, *Calophyllum* 2 spp., *Canarium*, *Holigarna, Spondias* and *Sonneratia. Spondias* and *Sonneratia* are inhabitant of coastal area and indicate near shore conditions particularly the last one. *Sonneratia* is a mangrove tree that occurs in the tidal creeks and littoral forests. *Calophyllum inophyllum*, a comparable species is found all along the coast above high water mark and in the evergreen forests of Western Ghats along the river banks. Likewise, *Artocarpus* (the jack fruit tree), *Holigarna* and *Canarium* are found in the evergreen forests of Western Ghats including Kerala. The assemblage indicates that the area was covered by dense forest and witnessed high rainfall and the prevailing conditions must have been warm and humid at the time of deposition. Further the occurrence of *Sonneratia* specially indicates the proximity of sea in the area at the time of deposition. Obviously, the sea level was much higher at the time than at present. Evidently, the sea had receeded since then. Thus, the carbonised woods have provided evidence about the prevailing environmental conditions and sea level fluctuations in the area.

J.S. Guleria & Rashmi Srivastava [& A.B. Kumar & R. Satheesh

(School of Environmental Sciences, Mahatma Gandhi Univ., Kerala)**]**

Finalized a manuscript on the new developments in CLAMP (Climate Leaf Analysis Multivariate Program) calibration using Global Gridded Meteorological Data. CLAMP is a versatile technique for obtaining quantitative estimates for multiple terrestrial palaeoclimate variables from woody dicot leaf assemblages. To date it has been most widely applied to the Late Cretaceous and Tertiary of the mid to high latitudes because of concerns over the relative dearth of calibration sites in modern low latitude warm climates, and the loss of information associated with the lack of marginal teeth on leaves in paratropical to tropical vegetation. One of the reasons for the lack of CLAMP calibration samples from warm environments is the paucity of climate stations close to potential calibration vegetation sites at low latitudes. To attempt to overcome this we have utilised a 0.5° x 0.5° grid of global interpolated climate data based on the data set of New et al. (1999) supplemented by the ERA40 re-analysis data for atmospheric temperature at upper levels. When CLAMP analyses using the PHYSG3BR physiognomic data calibrated with the climate station based MET3BR was compared to analyses using the gridded data at the same locations (GRIDMET3BR), the results were indistinguishable in that they fell within the range of statistical uncertainty determined for each analysis. This opens the way to including natural vegetation anywhere in the world irrespective of the proximity of a meteorological station.

R.C. Mehrotra [& Prof. R.A. Spicer (Open University, UK)**]**

Monsoon intensification and Neogene-Quaternary Siwalik biodiversity— processed 40 samples of Siwalik sediments exposed at Takli, Ranital and adjoining areas; Nurpur and Haritalyangar and

adjoining areas (HP); and recorded an assemblage consisting of algal and fungal remains, pteridophytic spores, gymnosperm and angiosperm pollen. Some of the important palynotaxa are: *Zygnema, Cyathidites, Lygodiumsporites, Lycopodiumsporites, Todisporites, Leptolepidites, Pinuspollenites, Abiespollenites, Lakiapollis, Retitrescolpites* and *Graminidites*. Data interpretation has been taken up and continued.

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

Palynological studies were carried out on Miocene sediments from the southern part of the Carpathian Fore deep of Moravia, Czech Republic. The studied successions yielded brackish to marine palynofossils indicating warm-subtropical vegetation. Pollen grains belonging to families Sapotaceae, Arecaceae, Castanaceae were profusely recorded in the assemblage. Besides these, pollen grains of the families Araliaceae and Rutaceae, though low in frequency, occur regularly. Palynotaxa representing *Alangium* and *Neogenisporis* are recorded sporadically. Practically all the palynospectra are strongly influenced by sedimentological facies. This fact is reflected in the proportional changes between the palaeotropic and arctotertiary elements and it is very difficult to specify any trends in the climatic development from these data. Palaeoenvironment of the studied part of Carpathian Fore deep was extraordinary variable during the Miocene. The marine transgression invaded the sea coast with highly differentiated relief configurations. In the studied part of the Carpathian Basin marine facies interchanged rapidly with those of lagoons and deltas. Palynological and sedimentological evidences indicate rapid changes in salinity, depths, light and evaporation. The palynospectra reflected many of these changes. The Carpathian sedimentation began by gradual transgression on the coast which was under the influence of anoxic conditions. The frequent alteration of palynomorphs was probably caused by precipitation and growth of pyrites. Later on, fully marine conditions developed.

Fungal remains from a Neogene succession of Israel were also studied. Various kinds of dispersed fungal spores, fruiting bodies and mycelia were observed in the assemblage. Studies indicated that sediments showing these fungal remains were deposited in a deltaic regime.

S.K.M. Tripathi [& Nela Dolacova
(Brno, Czech Republic)**]**

Integrative sedimentological, mineralogical, geochemical, biostratigraphic and palynofacies studies of the Um Sohryngkew Cretaceous-Tertiary (K-T) transition in the Khasi Hills of Meghalaya, India reveal biotic and environmental changes about 800 km from the Deccan volcanic province. Upper Cretaceous sedimentary succession indicates deposition in a shallow marine environment with high detrital influx from nearby continental terrains. High kaolinite and illite in clay mineral assemblages indicate high humidity and high runoff. In the Danian, sandy shale is replaced by marly limestone, indicating decreased detrital influx and a rising sea level. Kaolinite increases beginning about 40 cm below the K-T boundary and is dominant in the Danian, suggesting humid climatic conditions in the Meghalaya area. In contrast, semi-arid climate conditions prevailed in the cotemporaneous Deccan Traps province, which appears to be linked to 'mock aridity'.

Microfossil assemblages (calcareous and organic walled phytoplankton) define the K-T boundary and suggest stressful eutrophic conditions and sea level fall, followed by a rise as indicated by increased diversity. Planktic foraminifera show disaster opportunist *Guembelitria cretacea* dominating (98%) in the uppermost Maastrichtian. Strong carbonate dissolution marks the 0.3 m below and 1 m above the K-T boundary. The K-T rust-colored layer is characterized by major PGE anomalies in Ir (11.8 ppb), Ru (108 ppb), Rh (93 ppb) and Pd (75 pbb). The first occurrences of Danian species *Parvularugoglobigerina extensa, P. eugubina* and *Globoconusa daubjergensis* are observed within 10 cm and 25 cm above the PGE anomalies. Marly limestone deposition and the first diverse nannofossils, dinoflagellates and planktic foraminiferal assemblages occur in zone P1c and mark the biotic recovery in the Danian correlative with the recovery after the last Deccan volcanic pulse in C29N. These results clearly link the K-T mass extinction, high pre-K-T biotic stress, delayed biotic recovery, and anomalous PGE concentrations to Deccan volcanic activity. A poster entitled 'The K-T transition in Meghalaya, eastern India' by Gertsch, B. *et al.* was prepared for AGU Meeting, USA.

Rahul Garg, Vandana Prasad & Khowaja Ateequzzaman

[& Gerta Keller & collaborators
(Princeton University, USA)**]**

Fresh water dinoflagellate cysts are documented from the late Cretaceous (Maastrichtian) Intertrappean lacustrine sediments of Nand-Dongargaon basin of Central India. The assemblages show blooms of monospecific forms at different stratigraphic levels at the three intertrappean localities. This record of dinoflagellate cysts of peridinioid affinity in the intertrappean sediments is

not only significant because it is first record of fresh water dinoflagellate cysts from the Late Cretaceous sediments but also for the exceptional record of bloom of fresh water monospecific dinoflagellates assemblage from the pre-Tertiary sediments. These dinoflagellate cysts are described in detail under a new genus and two new species.

Rahul Garg & Khowaja Ateequzzaman [& Bandana Samant (BHU, Varanasi)**]**

A manuscript on the sequence stratigraphic framework based on palynofacies, dinoflagellate cysts and field based sedimentological data set of the Vastan Lignite succession, Gujarat has been finalized.

Vandana Prasad, Rahul Garg & S.K.M. Tripathi [& I.B. Singh (Lucknow University) **& S. Bajpai** (IIT, Roorkee)**]**

Phytolith studies were conducted on 8 m profile of Sambhar lake sediments. Sub sampling was done at 2 cm interval in order to achieve high resolution paleo-monsoonal history. The study shows brief dry phase before Early Holocene (~10,000 yrs BP) followed by high precipitation during 9490 yrs BP. Phytolith fossil records indicate enhancement of winter monsoonal activity during early Holocene that continued till 2730 yrs BP with brief fluctuations in-between. The study provides evidence of anthropogenic influence during mid Holocene as indicated by slash and burn activity and domestication of wheat and other crop plants.

Palynological study in 2-8 m samples (300 samples) in general reveal rich pollen taxa along with burned charcoal and poaceae, cyperaceae. An enormous influx of plant cuticular fractions along with tree taxa and shrubby to herbaceous palynotaxa indicate humid climate and strengthened monsoon. Abundance of *Artemisia* pollen and *Cerealia* pollen along with epidermal microscopipc fractions of *Triticum* (wheat) in association with *Plantago* indicate dominance of north-east monsoon and weak summer monsoon during middle Holocene and early part of Late Holocene. Anthropogenic activity is indicated by domesticated variety of wheat epidermal fragments during Late Holocene. The study is under progress.

Vandana Prasad & Anjum Farooqui [& Rajiv Sinha (IIT, Kanpur)**]**

Work is going on to contribute nannofossil data in a DST- Sponsored Project (No. SR/FTP/ES- 48/2003) entitled 'Ichnology of the Jurassic rocks of the Jara Dome of Western Mainland Kachchh, India'.

Jyotsana Rai [& B.G. Desai (Inst. of Petroleum Technology, Gandhinagar)**]**

Work is under progress dealing with nannofossil data with isotopic studies of K/T section of Cauvery Basin.

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

A field work was conducted in Jaisalmer and adjoining areas and samples from various members of Jaisalmer, Baisakhi and Pariwar formations were collected. An integrated ammonite–nannofossil studies in a sequence stratigraphic framework of Mesozoic of western Indian basins is under progress.

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

Detailed morphotaxonomic study of the recovered palynofossils from the Kalapathar section of Havelock Island, Andaman Sea was carried out. The recovered palynofloral assemblage is mainly composed of angiosperm and gymnosperm pollen, pteridophytic spores and fungal spores and ascostromata. Algal zygospores and diatoms have also been recorded in abundance. Some of the important constituents of the palynofloral assemblage are: *Polypodiisporites* spp., *Pinuspollenites* spp, *Malvacearumpollis* spp., and *Compositoipollenites* sp. Sponge spicules are predominant in most of the samples. The diatom assemblage is represented by *Diplones* sp., *Biddulphia* spp., *Coscinodiscus* spp., and *Mastogolia* spp. Palynofloral composition suggest an Early Miocene age to the assemblage. Detailed data interpretation is now being done.

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

Palynofacies analysis of Middle Siwalik sediments of Adibari area inYamunanagar district (Haryana) was carried out. The lower part of the Middle Siwalik sequence in this area shows the dominance of black debris and biodegraded terrestrial OM along with fungal remains thereby indicating the prevalence of oxidizing conditions during its deposition. The occurrence of fungal remains in these sediments however, is indicative of fungal degradation in warm and humid climate. The upper part of the sequence has revealed the dominance of grey amorphous OM, which suggests that the depositional conditions were transformed to a reducing environment during the deposition of the upper part of the sequence. The Upper Siwalik sediments at Bikram Bagh area of Sirmaur district (HP), located in the NW vicinity of Adibadri were also investigated to study the stratigraphic variations and spatial distribution of sedimentary OM in the sediments of the region. Sedimentary OM recovered

from the latter section represents the dominance of black debris, which suggests oxidizing conditions in the basin during the deposition of these sediments. Presence of algal spores of Zygnemataceae along with fungal remains from the section points towards fresh water ponding conditions in warm and humid climate during the deposition of Upper Siwalik sediments in the Bikram Bagh area.

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

Finalized two manuscripts on the bio-facies analysis based on the study of calcareous algae from the Lakadong and Prang Limestone members of Shella Formation (Jaintia Group, Meghalaya). The microfossils of this unit are very poorly preserved and show local variation in fossil population. The formaminifers recorded from the study are represented by *Miscellanea miscella, Ranikothalia nuttalli, Glomalveolina* sp., *Discocyclina ramaraoi, Aberasphaera gambanica, Idalina sinjarica* etc. in various proportions. The calcareous algae identified from the study area are delineated by species of the genera *Lithothamnion*, *Lthothoprella*, *Lithophyllum*, *Distichoplax, Sporolithon, Corallina*, *Subteranniphyllum, Ovulites* and *Halimeda*. The Lakadong Limestone shows the dominance of geniculate forms (*Corallina* and *Subteranniphyllum*). Relative abundance of *Sporolithon* in the Lakadong Limestone indicates variation of temperature in the sea water. The presence of Udoteaceae (*Ovulites* sp.), Halimedaceae *(Halimeda* sp.) implies low energy condition and agitation of water was very little in a shallow marine set up. The foraminiferal assemblage indicates shallow marine environment of deposition. The diagenetic fabric of the carbonates also indicates deposition in a shallow water under low energy condition.

Preponderance of melobesioid and mastophoroid forms is the characteristic feature of the algal assemblage of the Prang Limestone Member. Melobesioids and mastophoroids frequently occur in encrusting condition with orbitoid foraminifera and sometimes form rhodoliths. From the microscopic study of thin sections it is evident that this limestone is compositionally mature, highly fossiliferous (21 % vol. to 70 % vol.) with predominantly foraminifers and algae as allochems. High frequency of larger *Nummulites* are very conspicuous as framework grains. Microstylolites and calcite veins are also very common and sometimes deposition of opaque minerals of unknown composition is seen along the boundary of fossils. As a whole, Prang Limestone shows the dominance of wackstone, and packstone towards the lower part and those grades to grainstone towards the topmost part as evidenced in the study area.

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

Fresh water diatoms and desmids collected from the Burdwan district of West Bengal have been microscopically analysed. Light microscopic as well as SEM studies have been done. Taxonomic analysis and photo-documentation of the studied specimens have been made. Further work and finalization of the manuscript is in progress.

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

After reviewing the information on coal bed methane (CBM) genesis and its status in Indian context, it is observed that the delineation of more prospective blocks is necessary in order to fully develop country's CBM potential. There are other measures like provision of technical training, promotion of research and development, and transfer of CBM development technologies that can further contribute in the growth of the sector. Coal microconstituents study provides an insight to the coal characteristics responsible for CBM evaluation/ potential. The information on cleats (to assess permeability) in coal is extremely essential for planning CBM exploration and development.

Alpana Singh & B.D. Singh [& A.K. Singh & others (CIMFR, Dhanbad)**]**

A field trip was carried out during November, 2008 in around Shillong plateau, Meghalaya under INSA exchange program. Subsurface sediments were collected from five sediment profile for pollen analysis.

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

Carried a draft of the paper covering Late Quaternary climate changes around upper Baspa valley, Kinnaur, Western Himalaya has been prepared based on Pollen, Chemical (viz., Al, Fe, Mn, Ca, Mg. Ti. Na, K, Ba, Sr, Li, Cr, Co and Cu) and Environmental geomagnetic parameters (viz., Magnetic susceptibility, Induced Remanent Magnetization, Anhysteretic Remanent Magnetization, SIRM, S-ratio) from subsurface sediments collected from Rukti, Kinnaur district, Himachal Pradesh. Finalization of this paper is in progress.

A. Bhattacharyya, Jyoti Sharma, S.K. Shah & P.S. Ranhotra [& V.K. Banakar (NIO, Goa) & N. Basavaiah (IIG, Mumbai)**]**

The ongoing collaborative work carried out under the MoU between BSIP, Lucknow and WIHG, Dehradun. Field observations, sedimentary architecture and chronological results were clubbed together to understand the deposition of fluvial and lacustrine deposits and also nicely linked with the climate and tectonics of the region. The results will be finalized shortly for publication.

Anupam Sharma & Binita Phartiyal [& P. Srivastava & Y. Ray (WIHG, Dehradun)**]**

Palynological analysis of the samples from bore-hole KPK-1 from Pipla Kewalram Block, Kamptee Coalfield, Maharashtra have revealed two palynoassemblages– one belonging to Late Permian (Raniganj) and other belonging to Early Triassic (Panchet Formation). Palynoassemblage-I recorded at 163-183 m shows dominance of *Lunatisporites* and abundance of *Falcisporites, Chordasporites* along with *Klausipollenites, Kamthisaccites, Guttulapollenites, Strotersporites.* Early Triassic age has been assigned to this palynoassemblage. Palynoassemblage-II recorded at 200.28-372.35 m shows dominance of striate disaccates chiefly, *Striatopodocarpites* and *Faunipollenites,* subdominance of *Scheuringipollenites*. Presence of *Chordasporites*, *Falcisporites, Verticipollenites*, *Strotersporites*, *Guttulapollenites*, *Lunatisporites*, *Crescentipollenites*, *Weylandites, Striomonosaccites* indicates Late Permian age has been assigned to this palynoassemblage.

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

Carried out scanning and qualitative study of samples from Itararé subgroup of Campinas, Brazil. Palynomorphs recorded from Campinas outcrop includes cingulate zonate spores *viz. Cristatisporites, Vallatisporites, Kraeuselisporites, Lundbladispora, Spelaeo-zonotriletes, Indotriradites;* monosaccate pollen grains viz. *Virkkipollenites, Potonieisporites, Parasaccites, Plicatipollenites, Divarisaccus,* and *Caheniasaccites.* The work is under progress.

Neerja Jha, N.C. Mehrotra & Rajni Tewari [& M.E.C. Bernardes-de-Oliveira & Sandra Mune (Brazil)**]**

A view of BSIP Pentioners Meeting with Deputy Secretary AT Cell, DST, Dr. (Mrs.) Suman Keshari Agarwal

Sponsored Projects

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

Climatic influence on variation of tree-ring width (radial growth) of Blue Pine (*Pinus wallichiana*) growing in five different sites in and around Ziro valley, Arunachal Pradesh, Northeast Himalaya has been assessed. Inter-site differences in growth pattern of this tree have been evaluated through several statistical analyses viz., Correlation matrices, Principal component and Hierarchical cluster analysis. Analysis of tree-growth and climate relationship suggests that the pre-monsoon precipitation (December-April) is a significant factor influencing the growth of Blue pine in all these sites. Finalization report of the project is in progress.

A. Bhattacharyya & S.K. Shah

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

Based on multiproxy micropalaeontological study (palynofacies, phytoliths, diatoms, dinoflagellate cysts, nannofossils) backed by magnetic susceptibility and clay mineralogical studies, palaeoclimatic interpretations have been made and project report was finalized and submitted to SERC Division, DST.

Vandana Prasad

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

The coal-bearing sequences in Barmer district, Rajasthan and those from Vastan, Surat district, Gujarat were studied with a view to make comparative assessment of palynofloral succession and the environment of deposition. Both terrestrial as well as marine components of the microfossils were recovered. Terrestrial palynofossils have been used to interpret the palaeoecology and establish the biostratigraphy, whereas marine components (dinoflagellate cysts) have been used for the dating purposes only. The environment of deposition in both the areas of study has been interpreted through an added parameter, the palynofacies studies. Both Akli and Vastan assemblages are dominated by angiospermic pollen. Palynotaxa representing the family Arecaceae are most abundant in Akli assemblage. The Vastan assemblage exhibits high frequency of *Acanthotricolpites* spp. Whereas, *Spinizonocolpites* spp. are not very commonly represented in this assemblage. Palynological assemblage from Akli Formation is distinct from that of Vastan lignite in the occurrence of *Kapurdipollenites*, *Retiverrumonosulcites* and *Clavadiporopollenites*. Based on the distribution and abundance of palynotaxa, the Akli succession of Barmer is divisible into three palynozones and the Cambay Shale of Vastan lignite mine into two palynozones.

The Akli flora is rich in pollen having affinity with the family Arecaceae. These palynomorphs have been described under *Arecipites, Proxapertites, Spinizonocolpites, Kapurdipollenites, Retiverrumonosulcites, Clavadiporopollenites* and *Acanthotricolpites*. Of these, *Spinizonocolpites* is affiliated to modern mangrove Palm *Nypa*. Similarly, *Proxapertites,* on the basis of its morphological features, has been interpreted to represent an extinct group of Palms possibly related to *Nypa*. The genus *Acanthotricolpites*, in all likelihood related to *Nypa,* is also profusely recorded in Akli assemblage. *Nypa* is a mangrove Palm and grows in tidal mud flats fringing the tidal reaches of large fresh water rivers. High incidence of these pollen in sediments is suggestive of accumulation of Akli sediments in a costal swamp fringed by thick mangrove vegetation chiefly constituted by *Nypa*. The complete succession of Akli Formation is marked with presence of dinoflagellate cysts, although their occurrence is concentrated in upper part of the sequence. It suggests that the marine influence increased during the deposition of this part.

Composition of the palynoflora recorded from Cambay Shale of Vastan lignite mine is indicative of sedimentation in varied environments. The lower part of the Cambay Shale probably got deposited in a coastal environment. This fact is evidenced by rich representation of Arecaceous pollen. This part of the succession is also rich in pteridophytic spores of the families Osmundaceae and Schizaeaceae. The plants of Osmundaceae grow in swampy conditions, whereas the spores of Schizaeaceae indicate the presence of thick forest in near by areas. Lower part of the Vastan sequence is also rich in pollen of the family Bombacaceae. Of these, *Lakiapollis ovatus*

shows affinity with the modern plant *Durio* which is a member of Indo-Malayan Tropics. These plants grow in swampy evergreen forests. Thus, the accumulation of woody elements in the swamps of deposition site was responsible for creation of anoxic bog conditions resulting into the deposition of organic rich sediments. The signature of marine conditions is evident due to the presence of dinoflagellate cysts. Both in Akli and Vastan successions, the marine influence increased in the upper part. The sedimentation of Vastan mine sequence is interpreted to be cyclic under the coastal influence.

S.K.M Tripathi & Divya Srivastava (till June 2008)

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

Subsurface sediments from two profiles (DP1, DP2) from proglacial lakes close to snout of the Durung Drung glacier (4,100 m- 4400m) Trans-Himalayan region have been analyzed for Diatoms. Among these profiles DP2 has been found productive, but no diatom has been recorded in the other one (DP1). Preliminary identification of these diatoms in the profile DP2 reveals that these are from both Centrale and Pennale group. Several genera under these two groups viz., *Achnanthidium*, *Nitzschia, Hantzschia*, *Cymbella*, *Cymbopleura*, *Enchyonema*, *Reimeria*, *Navicula*, *Stauroneis*, *Pinnularia*, *Gomphonema* and *Amphora* have been reported. Detailed identification towards specific level and their quantitative and qualitative relation with climate changes are in progress. Finalization of progress report on climatic changes vis-à-vis glacial fluctuations based on Pollen, Environmental geomagnetic parameters (viz., Magnetic susceptibility, Induced Remanent Magnetization, Anhysteretic Remanent Magnetization, SIRM, S-ratio) and diatom from subsurface sediments of the area are in progress.

A. Bhattacharyya, Jyoti Sharma & Jyoti Verma

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

Finalized the project on the palynological studies around Chaurabari Glacier vis-à-vis vegetational changes and climatic oscillations during the Late Holocene. Palynological analysis of the samples was undertaken from three trial trenches (KA, KB & KC) that were dug on the outwash plain of the glacier. Of these KA and KC yielded good amount of palynomorphs while KB was found to be barren. The studies indicate a cool and moist phase between 2358 to 1160 BP as evidenced by the abundance of arboreal flora, ferns and aquatic taxa *Potamogeton*. The above C^{14} dates from the outwash plain, which represents the trunk valley of the Chaurabari Glacier, also provides a time frame about the vacation of valley by the glacier. The climate thereafter turned drier which is reflected by the decrease in arboreal taxa and a corresponding increase in steppe elements. The recurrence of arboreal forms in the uppermost part of both the profiles indicates that the climate reverted to warm and moist in the recent past.

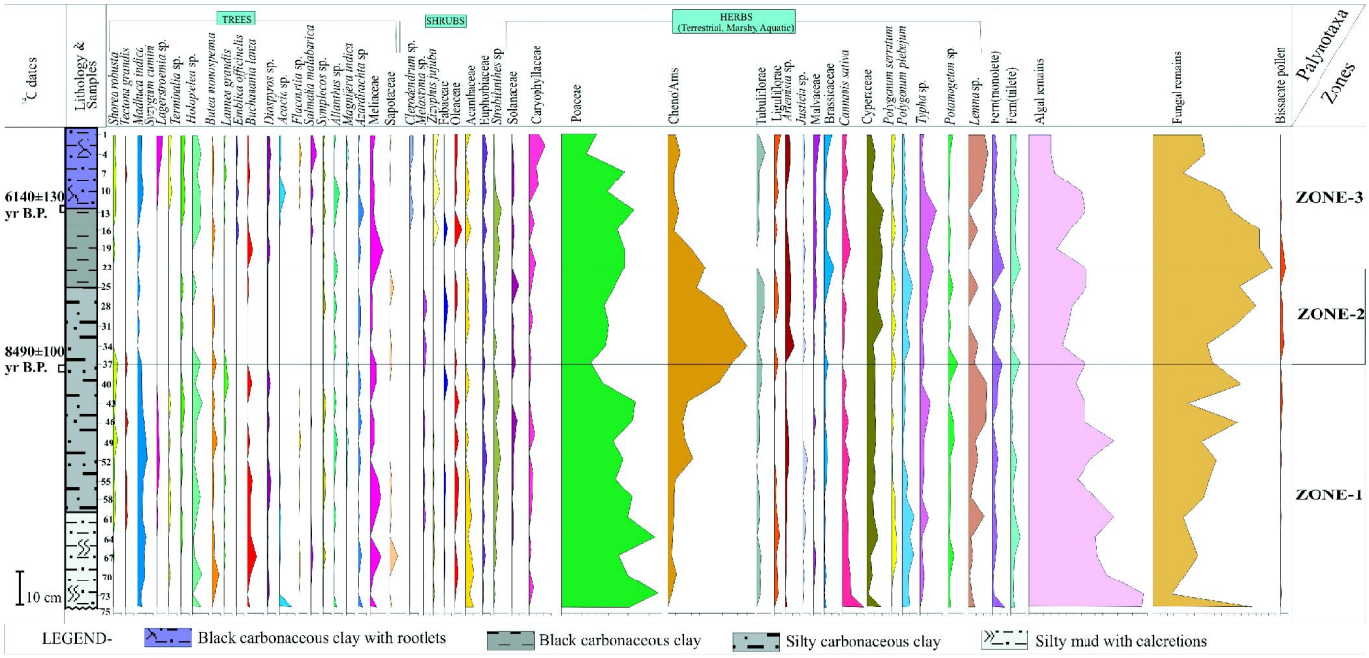
A field trip was undertaken to study the glacial geomorphic features to look into the pattern of recession and to search for potential sampling sites from other depositional regimes around the glacier. In this context, the lake bed of the Chaurabari Tal and the kame-terrace deposits on the left bank of the Mandakini River were found to have excellent fine-grained stratified deposits. These areas can be taken up for detailed palynological sudies if the Chaurabari Glacier is taken up for further work in the future.

Ratan Kar

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 analysis of 1.5 m deep core sediment profile of Kusumelli Swamp (N 25^0 54' 05.5"N: 77^0 48' 39"E), Sehore district, MP has been completed. On the basis of two dates, i.e 8490 ±100 yrs BP (BS 2758), and 6140 ±130 yrs BP (BS 2574), the sediment accumulation rate is determined to 1cm//47 years. The C^{14} dates have been used to calibrate more dates for more precise demarcation of vegetation change and fluctuations of climate on temporal scale in the region.

Based on the changing relative frequencies of major arboreal and non arboreal taxa, the pollen diagram of Kusumelli Swamp has been divided into three zones of vegetation and corresponding climate fluctuations. Zone-I inferred between 11,900 yrs BP to 8490 yrs BP and is characterized by the presence of moist deciduous taxa with some evergreen elements like *Syzygium, Lagerstroemia* and *Salmalia malabarica.* The shrubs are represented by *Melastoma, Strobilianthus, Ziziphus jujuba*, Fabaceae, Oleaceae, Acanthaceae and Euphorbiaceae. Among the herbs, Poaceae is the



Pollen diagram of Kusumelli Swamp near Hathnora, Sehore District, Madhya Pradesh

dominant with relatively low frequency of Cheno/Ams. This condition reflects warm and moist conditions of the region and probably due to intense summer monsoon. Sedges and other wetland taxa such as *Typha, Potamogeton, Cyperaceae, Polygonum* envisage the existence of locally large and highly waterlogged pond in the area. The overall vegetation pattern indicates that maximum vegetational concentration and diversity occurred during 11,900 yr BP to 8490 yr BP under warm and humid climate. This inference is associated with post glacial intensification of SW monsoon, a climate shift also known as 'climate optima', leading a dramatic increase in atmospheric moisture and surface water availability at about 11-10 k yr BP.

Zone-II represents 8500 to 7021 yrs BP and is marked by the disappearance of trees *Syzygium*, *Lagerstroemia, Emblica, Diospyros, Accacia, Flacourtia* and *Salmalia malabarica* and decreased frequency of few trees such as *Shorea robusta*, *Tectona grandis, Madhuca indica*, *Holoptelea, Butea monosperma*, *Buchanania lanza, Terminalia, Lannea grandis, Azardiracta*, Meliaceae. The tree-savannas grew in this zone comprises of grasses with high frequency of Cheno/Ams along with sparsely distributed tress *Shorea robusta, Madhuca indica, Holoptelea, Butea, Terminalia*. This type of vegetational pattern indicates that this region experienced a cool and dry climate condition with an ameliorating trend. The successive depletion in vegetation, relative low frequency of Poaceae with high frequency of Cheno/Ams during 8196 yrs BP also implies the cooler and dryer climate. This climatic change can be related to 8.2 k yr BP global short lived cooling event, which is 'cool poles and dry tropics' pattern of short term and this event was well documented in arid of Africa, China, India and Pakistan.

Zone-III exhibits during 7021 yrs BP to 5160 yrs BP and tree savannahs were occupied by deciduous forest elements such as *Syzygium, Lagerstroemia*, *Diospyros* and *Emblica officinalis* and increased frequency of other tree taxa coupled with thickets of *Zizyphus jujuba, Melastoma*, Fabaceae, Euphorbiaceae, Acanthaceae, etc. Thus, a good representation of arboreal taxa and the diversity floristics reflects the change in the climate. The increased concentration and diversity of arboreal taxa, implies the favorable environmental condition with sufficient precipitation for proliferation of dry to moist deciduous forest under warm and humid climatic conditions. This phase of transformation of tree-savannas in to mixed deciduous forests corroborate with the period of Climatic Optimum which has been witnessed globally around 7000 to 4000 yrs BP. Also field work was undertaken to Quaternary deposits of central Narmada Valley exposed at Baneta, Hathnora, Kusumelli swamp, Makodiya talab, Atola talab, Shahganj swamp, Pilikarar areas and collected 51 samples to generate additional palynological data.

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)

A 20-day A two-week geological excursion was conducted in Mainland Gujarat region. Detailed sampling was carried out from Rayka, Jaspur, Rakhiyal, Kinkroad Chowkdi localities. Quaternary sediment samples were collected by making trenches, pits or by coring methods. Based on the textural parameters the top cover of the Quaternary sediments in the region is of aeolian character, however, to characterize these sediments on geochemical basis and to locate their source, samples were collected from multiple locations (~20 in number). The phytoplankton bearing water samples collected during previous year field work were identified and their abundance is showing very good positive correlation with salinity, temperature and total dissolved solids (TDS). Based on limited data generated so far on geochemistry, environmental magnetism, pollen, palynofacies and phytolith studies, two abstracts were published and work is presented in two national seminars.

Two Holocene profiles from Mujhpur and Dabka localities were studied in detail for palynofacies, magnetic, textural and loss on ignition parameters and proposed a model that the basal section is of marine origin following upward is of fluvial nature and the top section has only charcoal as an organic matter indicating more arid conditions during deposition. Only one date of the basal part is obtained by the conventional C^{14} radiometric dating technique but the other two samples did not contain enough organic matter to get dated, so the samples are given for AMS date and we expect the results soon. The magnetic and biotic proxy data for some more profiles are generated and samples for chemical data are under progress. Besides, 64 water samples collected from the entire stretch of Mahi river along with its major tributaries and few ground-water and pond/lake waters were analyzed for their physical and chemical parameters and the interpretation is in progress.

Anupam Sharma, S. Chakraborty, Vandana Prasad, Binita Phartiyal &

Kamlesh Kumar [& Vivek Prasad (Lucknow Univ.)**]**

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

Tree core samples of *Abies densa,* and *Juniperus recurva* collected from Sikkim were studied to develop ring-width chronology. The ring-width measurement plots of dated samples showed the influence of stand dynamic features on growth of trees. The climate signal in the ring-width chronology is weak as growth suppression and release commonly noticed in tree ring series smears the climatic signal. Tree ring chronology of *Abies densa* extending back to AD 1680 was finalized.

R.R. Yadav, B. Sekar & Harinam Joshi

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

Tree core samples of *Juniperus polycarpos* collected from Lahaul and Spiti were crossdated and ring widths of dated samples measured. The growth pattern of trees using ring-width measurements was studied to select suitable tree series for chronology preparation. A chronology back to AD 940 with sufficient sample replication for climate studies was prepared. The tree growth climate relationship study using ring-width chronology and climate data showed that mean summer temperature plays significant role in regulating the growth.

R.R. Yadav

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

Additional plates and line sketches of the Type Form Genera and Species have been prepared during the year. Information viz. photographs and necessary details regarding the other type species and specimens to be incorporated in the treatise have been obtained. Mukund Sharma visited Geological Institute of Russian Academy of Sciences, Moscow during March-April 2009 to finalize the 4 chapters related with the Treatise. During this visit draft of book has been finalized.

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

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

The pollen assemblage from moss and soil samples

does not cohere with present day vegetation set up and the sedimentary profile from Tipling and Merbil suggest the existence of mixed deciduous forest under two climatic phases, i.e., onset of warm to increasing warm and humid since 1800 yrs B.P. The occurrence of degraded pollen-spores along with adequate fungal remains (grass pathogen) indicates biological degradation of microbiota during sedimentation. Evidence of *Carya alba* and Lauraceae (*Persia* sp.) and *Tsuga* with few temperate fern taxa during 1800 years BP from Merbil lacustrine sediment is significant which is not growing presently around the study area. Possibility of migration of the said taxa from Arunachal Himalaya and NW china need more investigation.

Prepared pollen reference slides from fresh and Herbarium polliniferous materials and studied pollen morphology of 80 tropical plant taxa for identification of fossil palynomorphs in sediment. Pollen analysed various palynogical substrates like surface sediments, moss cushion, humus, tree barks and air catches to assess pollen pollen/vegetation relationship. Soil profiles from swamp/river section of Dibrugarh and Jokai reserve forests were pollen analysed. Construction of pollen deposition model, maps, tables & pollen spectra is in progress. A three meter exposed river section from Saraighat, Dibrugarh District has been procured. Chemical processing and pollen analysis of sediments are in progress. Besides, two research papers entitled 'Pollen morphological and phenological variations in some economically important plant taxa from reserve forests of Dibrugarh, Assam' and 'Interpretation of flood plain pollen in lacustrine sediment from reserve forests, Dibrugarh, Assam' have been finalized.

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)

Visited various fossiliferous localities including some new ones in Mizoram and collected a large number of fossil woods (about 250) from there. They belong to the Tipam Group and are Upper Miocene in age. Presented a paper in the Seminar on the Indo-Myanmar ranges in the tectonic framework of the Himalaya and Southeast Asia held at Imphal during Nov. 27-29, 2008.

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)

Organized Indo-China International Conference on the Biotic and Climatic Changes in the Indo-China Region during Nov. 14-17, 2008 at the Birbal Sahni Institute of Palaeobotany (BSIP), Lucknow. This Conference was first of its kind in India. The present conference was focussed on the biotic and climatic changes in the Indo-China region so that we could protect our rich biodiversity. The experts were invited to deliver talks on various themes such as, taxonomy, dendrochronology, archaeobotany, biodiversity, palaeoclimate and radiometric dating etc. in three technical sessions. The pre-conference field trip in and around Nainital provided an opportunity to the delegates to make detailed discussion on the future expedition in the area.

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)

A field trip was undertaken around Zemu village close to Zemu glacier, Sikkim Himalaya and collected samples for both pollen and tree ring analysis. Twenty one surface samples (moss cushion) from diversified forest of this region were collected to understand modern pollen vegetation relationship of this region. Besides, tree ring samples were collected from 10 Birch and 39 Fir trees for analysis of climatic changes vis-à-vis glacial fluctuations during recent past. Cross dating of these samples is in progress

A. Bhattacharyya, S.K. Shah & 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)

Literature pertaining to distribution of modern plant taxa in ecological perspective and palynology from the Western Ghat region has been consulted and data base was prepared.

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

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Bera SK, Dixit S, Basumatary SK & Sarma GC – Pollen analysis of honey from Kamrup reserve forests, Assam. *J. Palynol.*

Bhattacharyya A & Shah SK – Tree-ring study in India: Past appraisal, present status and future prospects. *IAWA.*

Chauhan MS, Pokharia A K & Singh IB – Pollen record of Holocene vegetation, climate change and human habitation from Lahuradewa Lake, Sant Kabir Nagar District, Uttar Pradesh, India. *Man and Environment*.

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Gupta A – Study of Holocene floral and faunal remains revealed concealed neotectonic disturbance (Saria Tal, Kumaun Himalaya, India). *Acta Geologica Sinica*.

Kalkar SA, Bhute SM & Sarate OS – Palynoflora recorded from Makardhokada area, Nagpur district, Maharashtra. *Palaeobotanist*.

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District, Gujarat, India and its implications on palaeoenvironment and age. *J. Geol. Soc. India*.

Saxena RK & Trivedi GK – Palynological investigation of the Kopili Formation (Late Eocene) in North Cachar Hills, Assam, India. *Acta Palaeobotanica*.

Shah SK & Bhattacharyya A – Tree-ring analysis of sub-fossil woods of *Pinus wallichiana* from Ziro valley, Arunachal Pradesh, North-East Himalaya. *J. Geol. Soc. India*.

Sharma M, Mishra S, Dutta S, Banerjee S & Shukla Y – On the affinity of *Chuaria–Tawuia* complex: A multidisciplinary study. *Precambrian Res.*

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Singh SK & Prasad M – Occurrence of some new fossil leaves in the Late Tertiary sediments of Mahuadanr Valley, Latehar District, Jharkhand, India. *J. Appl. Biosci.*

Singh SK & Prasad M – Fossil leaf-impressions from the Late Tertiary sediments of Mahuadanr Valley, Latehar District, Jharkhand, India. *Nat. Sci. Acad.*, Allahabad.

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Srivastava R, Kapgate DK & Chaterjee S – Perminaralized fungal remains in the fossil wood of *Barringtonia* from the Deccan Intertrappean sediments of Yavatmal District, Maharashtra, India. *Palaeobotanist*.

Tewari R, Kumar M & Prakash N – Early Cretaceous megaspores from the Sher River section (Sehora) of Satpura Basin, Madhya Pradesh. *Phytomorphology*.

Tewari R, Mehrotra NC, Meena KL & Pillai SSK – Permian megaspores from Kuraloi area, IB-River Coalfield, Mahanadi Basin, Orissa. *J. Geol. Soc. India*.

Tripathi A – Mesozoic age relationship of Talchir sediment in Brahmani River Section, Talcher Coalfield, Orissa, India. *J. Palaeontol. Soc. India.*

Trivedi A & Chauhan MS – Holocene vegetation and climate fluctuations in northwest Himalaya, based on pollen evidence from Surinsar Lake, Jammu region, India. *J. Geol. Soc. India*.

Trivedi GK – Palynofloral diversity in the Kopili Formation (Late Eocene) from north-east India. *Acta Musei Nationalis Pragae, Natural History Series*.

Young research scholars rendering National Anthem on Independence Day

Consultancy / Technical Assistance Rendered

The **Radiocarbon laboratory** also served as a national facility for various organizations across the country for dating materials like sediments, charcoal, shells and other carbonates etc. under consultancy. Scientists from the following organizations availed of the consultancy:

Agharkar Research Institute, Pune (Maharashtra)

ASI, Agra Circle (UP)

Archaeological survey of India, New Delhi

Benaras Hindu University, Varanasi (UP)

Karnataka Bio- diversity Project, Bangalore (Karnataka)

Centre for Earth Science Studies, Trivandrum (Kerala)

Cochin University of Science and Technology, Cochin (Kerala)

Dibrugarh University, Assam

Deccan College, Pune (Maharashtra)

Geological Survey of India, Kolkata (WB)

Indian Institute of Science, Bangalore (Karnataka)

IIT, Kanpur (UP)

KP Jaiswal Research Institute, Patna (Bihar)

Nagaland University, Kohima (Nagaland)

PG Institute of Archaeology, Columbo, Srilanka

University of Pune, Pune (Maharashtra)

UP State Archaeology Dept., Lucknow (UP)

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

Department of Botany, Lucknow University, Lucknow (Botanical samples- 14)

Department of Physics, Lucknow University, Lucknow (Nanofilm/powder- 62)

Department of Geology, Lucknow University, Lucknow (Zoological sample- 4)

Department of Botany, University of Allahabad, Allahabad (Botanical samples- 5)

National Botanical Research Institute, Lucknow (Botanical, Microbiological samples- 55)

Department of Civil Engineering, BHU, Varanasi (Cement /building material samples- 52)

G.B. Pant University of Agricultural & Technology, Garampani, Nainital (Zoological samples-3)

Sardar Patel PG Institute of Dental Sciences, Lucknow (Dental material- 33)

CSM Dental University, Lucknow (Dental material- 12)

Babu Banarsi Das National Institute of Technology and Management, Lucknow (Pharmaceutical- 29)

Institute of Pharmacy, Bundelkhand University, Jhansi (Pharmasceutical- 30)

Central Institute for Plastic Engineering and Technology, Lucknow (Polymer samples-4)

Rajkumar Goel Institute of Technology, Ghaziabad (pharm. Samples-12)

Saroj Institute of Technology (pharm. sample- 1)

Sobhit University, Meerut (pharm. samples- 23)

Punjab University, Chandigarh (mineral samples- 7)

Smriti College of Pharmaceutical Sciences, Indore (pharm. Samples- 2)

The **Library** staff provided one year technical training to two Library Science trainees– Rashmi Bala Dixit and Anita Kushwah send by the Board of Apprenticeship Training (Northern Region), Kanpur.

Computer Section provided the training to students from Rajkiya Mahila Polytechnic, Lucknow for a period of one month (July 15-Augugust 14, 2008)

J.S. Guleria rendered consultancy and technical assistance to GEER Foundation (Gujarat Ecological Education and Research Foundation) at Gandhinagar in developing and improving their Fossil Park (Indrodra Nature Park) and provided them relevant literature on Mesozoic and Tertiary plant fossils of Gujarat (in March 2009).

B.D. Singh and **Alpana Singh** provided consultancy services to Essar Oil Limited (Durgapur) and BRGM

(France)/ MECL (Nagpur) for the coal petrographic and micro-cleat patterns study on bore-core coal and block samples. Also provided scientific assistance in observation of coal and *jhama* samples under SEM to Dr. A.K. Singh, Scientist of Central Institute of Mining and Fuel Research, Dhanbad.

Madhav Kumar provided consultancy services to BRGM (France)/ MECL (Nagpur) for the palynological study on coal/ shale samples.

Samir Sarkar provided scientific assistance for identification of palynofossils to Ms. Bhagyapati, Research Scholar of Geology Department, Delhi University, Delhi.

Rakesh Saxena provided the guidance to Mr. Runcie Paul Mathew of IIT, Mumbai for his research work in studies of Indian Tertiary lignite petrology for two weeks (in November, 2008). It incorporates the recent trends in developments of lignite petrology as per the new ICCP recommendation, methodology in the preparation of samples, important precautions to be taken during polishing the pellets, observations of varied maceral under normal light. Quantitative maceral characterization in samples and its impact in the seam genesis, Fluorescence microscopic characteristics and its role in better elucidations of maceral, viz. suberinite, resinite, alginite, etc. were the part of the training. Besides, the studies of rank, i.e. reflectance measurements; the only tool to quick measurement of maturity level of the organic sediments.

Students visiting BSIP Herbarium

Papers presented at Conferences/Symposia/Meetings

Agarwal A & Ambwani A – Petiolar anatomy of *Elaeis guineensis* Linn: An attempt to resolve fossil palms. Conf. *Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Babu R – Microbiotic fossil assemblage from the Chhuipali Formation of Singhora Group, Chhattisgarh Supergroup. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November, 2008.

Bajpai SC – Using plants as fuel: An environmental impact analysis. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November, 2008.

Bajpai SC – Environmental architecture for combating global warming. *Int. Conf. Climate Change: Impacts & Responses*, Pune, January 2009 (Virtual Presentation).

Basumatary SK – Development of vegetation and climate change in West Garo Hills since late Holocene: pollen sequence and anthropogenic impact. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Bera SK & Basumatary SK – Late Holocene pollen record in lacustrine deposits from tropical deciduous forest of Tinsukia District, Assam, North East India. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Bera SK, Basumatary SK, Nautiyal CM, Dixit S, Mao AA & Gogoi R – A pollen sequence from the vegetation and climatic changes in and around Dzuko Valley, Nagaland since last 1100 yrs BP. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Bera SK & Dixit S – Pollen analysis of late Holocene lacustrine sediment from Jeypore Reserve Forest, Dibrugarh, Assam. *Nat. Conf. Quaternary Geological Processes: Natural Hazards & Climate Change*, Lucknow, February 2009.

Bhattacharyya A, Ranhotra PS, Sharma J & Shah SK 2009 – Late Quaternary climate changes around upper Baspa valley, Kinnaur, Western Himalaya. *3rd LIMPACS Conference*, Chandigarh, March 2009.

Bhattacharyya A & Shah SK – Spatio-Temporal variation of vegetation during Holocene in the Himalayan region. *23rd Himalayan-Karakoram-Tibet Workshop*, Leh (Ladakh), August 2008.

Bhattacharyya A & Shah SK – Role of tree-ring proxy data in analyzing fluctuation of Gangotri glacier. *Nat. Conf. Quaternary Geological Processes: Natural Hazards & Climate Change,* Lucknow, February 2009.

Bhattacharyya A Shah SK & Ranhotra PS – Analysis of climatic changes vis-à-vis glacial fluctuation of Gangotri Glacier. *Int. Symp. Mountain Building & Climate-tectonic Interaction*, Dehradun, October 2008.

Bhattacharyya A, Shah SK & Shekhar M – Tree-ring analysis along an altitudinal gradient from Uttarkashi to Gangotri, Uttarakhand Himalaya. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Chauhan MS & Quamar MF – Vegetation and climate change in southeastern Madhya Pradesh during late Holocene, based on pollen evidence. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Chauhan MS & Singh SK – Melittopalynological investigation of honey from Unnao District, Uttar Pradesh. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Dixit S & Bera SK – Use of varied substrates in interpreting modern pollen rain in and around Jeypore reserve forest, Assam, Northeastern India. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Dixit S & Bera SK – Diatom assemblage as indicator of environmental conditions: A preliminary interpretation from surface sediment of Lower Assam flood plain. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Farooqui A & Naidu TY – Pleistocene palynological record showing dominance of *Botryococcus* from Godavari delta: Its implication in climate and sea level fluctuations. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Farooqui A & Sekar B – Holocene climate and vegetation: Lalitpur, Uttar Pradesh (India), *3rd LIMPACS Conference*, Chandigarh, March 2009.

Ghosh AK – Palaeoecological aspects of the Palaeocene Karasur Formation (Pondicherry area, Cauvery Basin) based on coralline red algae and other Biogenic components. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Ghosh AK – Eocene coralline red algal associations of South Shillong Plateau (Meghalaya, NE India): Diversity, Growth forms, Taphonomy and Palaeoenvironmental implications. *31st All India Bot. Conf. & Int. Symp. on Plant Biol. & Envir.: Changing Scenario*, Allahabad, December 2008.

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Gupta A – Organic matter and climate since Early Holocene, from Kumaun Himalaya: Geochemical analysis. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

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Gupta A – Liverworts: Frontier to assess modern pollen deposition. *XXXI All India Bot. Conf.*, Allahabad, December 2008.

Jha N, Md. Saleem & Goel N – Palynological dating of Lower Gondwana sediments in Gundala area, Godavari Graben, Andhra Pradesh. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Kapoor S, Bhattacharyya A & Ahmed MS – Reconstruction of climate during late Quaternary based on Pollen and Diatom from sediments cores (SK 157/14 and SK 157/27) of Bay of Bengal. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Khandelwal A & Kohli D – Holocene evolution of mangrove vegetation at Chandrapur, Chilka Lake, Orissa, India in relation to pollution and anthropogenic impact. *EMECS-8 Int. Conf.*, Shanghai, China, October 2008.

Kumar K, Prasad V, Sharma A & Phartiyal B – Distribution of modern fresh water diatoms in Mahi river basin, mainland Gujarat. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Kumar M & Gogoi B – Palynofacies analysis and depositional environment of coal and associated strata of the Anaki coalfields, Mokokchung District, Nagaland, Northeast India. *Conf. Plant Life through the Age*s, BSIP, Lucknow, November 2008.

Mandaokar BD – Stratigraphic and palaeoenvironmental significance of Miocene palynomorphs from Unakoti, Tripura. *Conf. Plant Life through the Age*s, BSIP, Lucknow, November 2008.

Mehrotra NC, Jha N & Tewari R – Multidisciplinary Antarctic studies at BSIP. *Open Sci. Conf. Polar Research– Arctic & Antarctic Perspectives*, St. Petersburg, Russia, July 2008.

Mehrotra NC & Tewari R – Indian Gondwana Megaspores -Distribution, Radiation and Structural Diversity. *Indo-China Int. Conf. Biotic & Climatic Changes in the Indo-China Region*, BSIP, Lucknow, November 2008.

Misra KG – Tree ring based Satluj river flow reconstruction in western Himalaya: implications for climate change. *Conf. Plant Life through the Age*s, BSIP, Lucknow, November 2008.

Nautiyal CM – Dividing lines between Science Fiction, Science Fantasty and Fiction: Are they there? *Nat. Discussion Science Fiction: Past, Present & Future*, Varanasi, November 2008.

Nautiyal CM – Radiocarbon Dating of sediments in Himalayan regions for palaeoclimate Studies. *Indo-China Int. Conf. Biotic & Climatic Changes in the Indo-China Region*, BSIP, Lucknow, November 2008.

Nautiyal CM – Scientists as science- communicators: A survey-based report. *2nd African Sci. Commun. Conf.*, Midrand, February 2009.

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Pauline Sabina K, Bilwa M & Mahesh S – Evaluation of morphographic characters of palynomorphs for the interpretation of palaeoenvironment of the Umrer Coalfield, Wardha Basin. *Conf. Plant Life through the Age*s, BSIP, Lucknow, November 2008.

Phartiyal B – Tectono-climatic importance of Quaternary deposits of Ladakh region, NW Himalayas, *Indo-China Int. Conf. Biotic and Climate change in Indo-China Region,* BSIP, Lucknow, November 2008.

Phartiyal B & Sharma A – Soft sediment deformation structures in the Late Quaternary sediments of Ladakh: evidence of multiple phase of palaeo-earthquakes on the northwestern Himalayan region. *23rd Himalayan-Karakoram-Tibet Workshop,* Leh (Ladakh), August 2008.

Phartiyal B & Sharma A – Geochemistry of the late Quaternary Spituk palaeolake deposit of Ladakh, NW Himalaya. 23rd *Himalayan-Karakoram-Tibet Workshop,* Leh (Ladakh), August 2008.

Phartiyal B, Sharma A & Srivastava P – Tectono-climatic signatures in the NW Himalayas during late Quaternary period in Spiti valley. *Int. Symp. Mountain Building & Climate-Tectonic Interaction,* Dehradun, October 2008.

Pokharia AK & Sekar B – Pre-Columbian American Custard-apple in Indian subcontinent: evidence of trans-oceanic voyages between India and America. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November, 2008.

Prakash N – Mesozoic seed ferns of Indian Gondwana: Its present status. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Prasad M – Flora of Churia Formation in Koilabas area, Nepal and its palaeoclimatic significance. *Int. Symp. Plant Biol. & Environ.: Changing Scenario,* Allahabad, December 2008.

Prasad M – Carbonised fossil woods from the Middle Siwalik of Himachal Pradesh and their significance. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November, 2008.

Prasad M, Khare EG, Ambwani K & Singh SK – Palynological study of the lower Siwalik sediments of Nahan, Himachal Pradesh. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November, 2008.

Rai J & Singh A – Albian age calcareous nannofossils from Tanot Bore- well, Jaisalmer Basin in Rajasthan area, Western India. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November, 2008.

Rajanikanth A, Agarwal A & Stephen A – Early Cretaceous floristics of Palar Basin- An integrated inquiry. Conf. *Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Ram-Awatar – Occurrence of Permian palynofossils from the Saltoro Formation, Shyok-Suture-Zone, Ladakh Himalaya, India. 23nd *Himalaya-Karakoram-Tibet Workshop*, Leh (Ladakh), August 2008.

Ram-Awatar – Dominance of spore tetrads in the Triassic sediments of India and their climatic inferences. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Ram-Awatar, Tripathi A & Chakraborti B – Palynological correlation of subsurface samples from Mand Coalfield, Son-Mahanadi graben, Chhattisgarh. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Ranhotra PS & Bhattacharyya A – Holocene palaeoclimate around Baspa Valley, Kinnaur, North-West Himalaya. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Ranhotra PS, Kar R & Bhattacharyya A – Palynological studies and chronological dating of glacial geomorphic features with reference to palaeoclimate and glacial fluctuations. *Nat. Conf. Quaternary Geological Processes: Natural Hazards & Climate Change,* Lucknow, February 2009.

Rao MR – Palynological constraints on palaeoecology and palaeoenvironment of Periakurichchi Limestone (Early Palaeocene), Cauvery Basin, Tamil Nadu. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Rao MR, Verma P & Patnaik P – Vegetation and climate change in hominin bearing Quaternary Succession of Narmada Valley, central India. *Plio-Pleistocene Environments & Human Adaptations in India,* Bhopal, December 2008.

Sarate OS – Petrographic characterization of the coals from Queen Seam, Yellendu Area, Godavari Valley Coalfield, Andhra Pradesh. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Sarkar S – Palynological investigation of the Baratang Formation in Baratang Island, Andaman Sea. *Conf.*

Plant Life through the Ages, BSIP, Lucknow, November 2008.

Saxena A & Singh IB - Holocene palaeoclimate Reconstruction deduced from the phytoliths record of lacustrine sediments, Ganga Plain. *Nat. Conf. Quaternary Geological Processes: Natural Hazards & Climate Change,* Lucknow, February 2009.

Saxena A & Singh IB - Spatial and temporal variations in the Lakes and Ponds of the interfluve areas of Ganga Plain in the ~past hundred years. *Nat. Conf. Quaternary Geological Processes: Natural Hazards & Climate Change,* Lucknow, February 2009.

Saxena R & Verma K – Neyveli Lignites- A biopetrographic assessment. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Saxena RK & Ranhotra PS – Palynofloral study of the Naredi Formation (Early Eocene), Kutch District, Gujarat and its implications on the palaeoenvironment. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Saxena RK, Srivastava AK & Ranhotra PS – Microscopic wingless insects of the order Phthiraptera, discovered from early Palaeogene sediments of Kutch district, Gujarat. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Shah SK & Bhattacharyya A – Analysis of climate change during recent past in the North-East Himalaya based on tree-ring data. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Sharma A, Bartarya S. K. & Phartiyal B – Rock weathering, sediment characteristics and hydrochemistry in trans-Himalayan Ladakh region of NW Himalaya: Implications to tectonics and climate. *Int. Symp. Mountain Building & Climate-Tectonic Interaction,* Dehradun, October 2008.

Sharma A, Prasad V, Phartiyal B & Kumar K – Multi-proxi study of late-Holocene estuarine sedimentary sequence: A case study from Mahi Basin, mainland Gujarat. *Indo-China Int. Conf. Biotic and Climate change in Indo-China Region,* BSIP, Lucknow, November 2008.

Sharma M – Neoproterozoic biogeography and organismal constraints: position and connection between South China Block *vis a vis* Australia and India in SWEAT hypothesis. *Indo-China Int. Conf.: Biotic & Climatic Changes in the Indo-China Region,* BSIP, Lucknow, November 2008.

Sharma M, Mishra S, Dutta S, Banerjee S & Shukla Y – On the affinity of *Chuaria – Tawuia* complex: A multidisciplinary study. *World Summit on Ancient Microscopic Fossils,* Los Angeles, USA, July-August 2008.

Sharma M & Sergeev VN – Biostratigraphic scheme for Mesoproterozoic sedimentary successions. *33rd Int. Geol. Cong.,* Oslo, Norway, August 2008.

Sharma M & Shukla Y – *Chuaria*- the megascopic carbonaceous fossil and its relevance in Precambrian Palaeobiology. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Singh A & Singh BD – Genesis of Indian Cenozoic lignites— petrological and palaeobotanical evidences. *Int. Conf. Coal & Organic Petrology (joint 60th ICCP-25th TSOP Meeting),* Oviedo, Spain, September 2008.

Singh H, Divya Srivastava & Tripathi SKM 2008 - Palynological studies from Early Eocene sequence exposed near Matasukh, Nagaur District, western Rajasthan, India. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Singh KJ, Singh R & Cleal CJ – Carboniferous floras in siliciclastic rocks of Kashmir Himalaya, India and the evolutionary history of the Tethyan Basin. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Singh RS & Kar R – Floral response to the Deccan volcanic episode at the K-T transition as recorded from the Intertrappeans of Anjar, Gujarat. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Singh S & Khandelwal A – Pollen analysis of mangrove honeys from Little Andaman (India) and Sunderbans (Bangladesh). *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Singh S, Khandelwal A, Scharf WB & Mohanti M – Comparative analysis of palynoassemblages of sediment profiles (CH-I & CH-51) from two different regimes of Chilika Lake, Orissa, India. *EMECS-8 Int. Conf.,* Shanghai, China, October 2008.

Singh SK & Prasad M – Fossil flora of Mahuadanr valley, Jharkhand during late Tertiary period. *Int. Symp.*

Plant Biol. & Environ.: Changing Scenario, Allahabad, December 2008.

Singh SK & Prasad M – Further contribution to the late Tertiary flora of Mahuadanr Valley, Latehar District, Jharkhand. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Singh V, Mehrotra NC, Singh DS, Jha N, Tewari R & Farooqui A – Arctic Studies: A reconnaissance for organic matter and phytoplankton dynamics. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Singh VK – Meso-Neoproterozoic microbiotic fossil assemblage from the Chitrakut Formation, Semri Group, Vindhyan Supergroup. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Srivastava AK – Insect-Plant alliance in fossil flora of India. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Srivastava AK – Plant fossils and coal seam correlation *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Srivastava AK – Lower Gondwana Pteridophytes. *Int. Symp. Perspectives in Pteridophytes,* NBRI, Lucknow, November 2008.

Srivastava AK & Agnihotri D – Plant fossils from the Bijori Formation of Satpura Gondwana Basin, Madhya Pradesh. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Srivastava AK & Agnihotri D – Two new species of *Gangamopteris* McCoy from New Sethia Colliery of Satpura Gondwana Basin, Madhya Pradesh. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Srivastava AK & Agnihotri D – Sterile and fertile lycopsid remains from Satpura Gondwana Basin, Madhya Pradesh. *Int. Symp. Perspectives in Pteridophytes,* NBRI, Lucknow, November 2008.

Srivastava AK & Pillai SSK – Plant fossils from the Rawanwara area of Pench valley coalfield, Satpura Gondwana Basin, M.P. *XXV Annual Conv. Indian Assoc. Sedimentol. & Nat. Sem. Sedimentary Basins of India,* Baroda, November 2008.

Srivastava AK & Srivastava R – Palaeobotany, biodiversity and conservation. *Indo-China Int. Conf. Biotic & climatic changes in the Indo-China Region*, BSIP, Lucknow, November 2008.

Srivastava, C – Recent trends of palaeo-ethnobotanical investigations at Iron Age sites in Upper and Middle Ganga Plain. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Srivastava G & Mehrotra RC - Legume fruits from the Oligocene sediments of Assam. *Indo-China Int. Conf. Biotic & Climatic changes in the Indo-China Region*, BSIP, Lucknow, November 2008.

Srivastava G & Mehrotra RC Tertiary flora of northeast India vis-à-vis movement of the Indian plate. *Sem. Indo-Myanmar Ranges in the Tectonic Framework of the Himalaya and Southeast Asia*, Imphal, November 2008.

Srivastava R – Fossil dicotyledonous woods from Deccan Intertrappean beds of Seoni District, Madhya Pradesh and their palaeoenvironmental significance. *Conf. Plant Life through the Ages,* BSIP, Lucknow, November 2008.

Srivastava R. & Mehrotra RC - Plant fossils from the Dafla Formation, West Kameng District, Arunachal Pradesh. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Tewari R, Chatterji S & Mehrotra NC – Correlation of Permo-Triassic floras of Antarctica and India-An integrative approach for palaeoclimatic reconstruction. *Open Science Conf. Polar Research- Arctic and Antarctic Perspective in the Int. Polar Year,* St. Petersburg, Russia, July 2008.

Tewari R, Mehrotra NC, Meena KL & Pillai, SSK – Permian Megaspores from Kuraloi Area, Ib.-River Coalfield, Mahanadi basin, Orissa. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Thakur B, Prasad V & Garg R 2008. Diatoms from surface sediments off Bhatkal region, eastern Arabian Sea: a potential proxy for palaeoenvironmental interpretations. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Thakur OP, Sarkar S & Dgra NN – Discovery of Late cretaceous palynofossils from the Nahan area of Himachal Pradesh: Palaeogeographic implications. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Thakur OP, Singh A & Singh BD – Petrographic characterization of Khadsaliya Lignites, Bhavnagar District, Gujarat. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Tewari R, Chatterji S & Mehrotra NC – Correlation of Permo-Triassic floras of Antarctica and India: An integrative approach for palaeoclimatic reconstruction. *Open Sci. Conf. Polar Research–Arctic & Antarctic Perspectives*, St. Petersburg, Russia, July 2008.

Tripathi SKM & Divya Srivastava – Palynological studies and palaeoenvironmental interpretations from Thanetian-Ypresian sequence of Vastan, Gujarat, Western India. *12th Int. Palynol. Congr. & 8th Int. Organis. Palaeobot. Conf.*, Bonn, Germany, August-September 2008.

Verma P & Rao MR – Vegetation and climate change since Late Pleistocene through Holocene in central Narmada Valley, Madhya Pradesh. *Conf. Plant Life through the Ages*, BSIP, Lucknow, November 2008.

Verma P & Rao MR – Quaternary vegetation and climate change in central Narmada Valley: Proxy records from hominin bearing sedimentary successions. *Quaternary Geological Processes: Natural Hazards & Climate Change*, Lucknow, February 2009.

Verma P & Rao MR – Holocene climatic history of Kusumelli Swamp, central Narmada Valley, India. *3rd LIMPACS Conference*, Chandigarh, March 2009.

Yadav RR – Tree rings in understanding long-term climate change in cold desert region of Lahaul and Spiti, Himachal Pradesh, India. *Int. Workshop Environmental Conservation for Sustainable Livelihoods in the cold desert region in Asia*, Solan, October 2008.

Enthusiastic Students showing keen interest in Scanning Electron Microscopy & Radio Carbon Dating Facilities

Deputation/Training/Study/Visit in India/Abroad

B.D. Singh & A.K. Ghosh

Attended Workshop on 'Intellectual Property and Opportunities in Biotechnology' held at Biotech Park, Lucknow on May 04, 2008.

Asha Khandelwal

Attended Brain-Storming Session on 'Cultural Property- Theft and Authentication' held at National Research Laboratory for Conservation of Cultural Property, Lucknow on May 13, 2008.

B.D. Singh

Attended National Residential Convention on 'The Right to Information Act-2005' held at Varca Le Palms Beach Resort, Goa from May 19-20, 2008.

D.C. Saini & M.S. Chauhan

Attended the 'Conference Biodiversity and Agriculture' on the occasion of International Biodiversity Day-2008 held at Hotel Piccadilly, Lucknow on May 22, 2008.

S.K. Shah

Attended '7th Framework Programme for Research and Technological Developments (FP7)' held at India Habitat Centre, New Delhi on July 07, 2008.

Amalava Bhattacharyya

Participated in the 'Interaction Meet with the Glaciologists' meeting held at DST, New Delhi on August 05, 2008.

Attended PMAC meeting and presented progress report of glacier project sponsored by DST entitled 'Glacier Morphology and Quaternary Glacial History of Durung Drung Glacier, Zanskar Ladakh (Jammu and Kashmir State)' held at Chandigarh from November 11-12, 2008.

Rahul Garg

Attended the Annual Meeting of the Vigilance Officer held at JNCASR, Bangalore from August 06-07, 2008.

A. Rajanikanth

Attended the 'Alarms of Global warming- Reduce or Perish- S.N. Tripathi Memorial Lecture Series' organized by Lucknow Management Association and Swayam Siddha, Lucknow on August 23, 2008.

Attended National Seminar on 'Mahamana's Vision for Self Reliant India: Current issues and Future prospects' held at Banaras Hindu University, Varanasi from January 29-30, 2009.

Vartika Singh

Attended Pre-Antarctic Acclimatization Training camp at Auli, Uttarakhand from August 31 to September 12, 2008. Later participated in Expedition to Antarctica from December 27, 2008 to April 02, 2009.

S.K.M. Tripathi

Visited the Institute of Geological Sciences, Masaryk University, Brno, Czech Republic during September 06 to October 15, 2008 under the INSA Exchange of Scientists Programme to work with well known palynologist, Dr. Nela Dolacova.

Rupendra Babu

Attended National Residential Convention on Reservation Policy of Government of India Meeting for Liaison Officers for SCs/STs/OBCs held at Chandigarh from September 08-10, 2008.

N.C. Mehrotra, Biswajeet Thakur, Vartika Singh, K.G. Mishra, Shilpa Singh, Deepti Singh, G.K. Singh, Divya Srivastava, Poonam Verma & Kamlesh Kumar

Participated in the South Asia's Premier Geosciences Event 'GEO India 2008 Expo & XXI International Conference: Investing in Geoscience to Secure the Future' sponsored by ONGC and held at Greater Noida, New Delhi from September 16-19, 2008.

Alpana Singh

After attending the International Conference, visited Asturian Jurassic Coast at Oviedo, Spain on September 27, 2008 and observed black shales and Jurassic cliffs with the foot prints of Dinosaurs, the largest in the world. Also visited Jurassic Museum which has excellent collection of Dinosaurs fossils.

Anupam Sharma

Attended 3rd PMAC-SSS meeting and presented progress report of project sponsored by DST and held at Trichurapalli from October 16-17, 2008.

R.R. Yadav

Visited Germany from November 01, 2008 to January 29, 2009 under INSA-DFG Scientists Exchange Programme.

Jyotsana Rai & Abha Singh

Participated in a 'Field Workshop under IGCP-506' in Jaisalmer Basin during November 10-11, 2008. Took part in the spot group discussions of specialists of various disciplines (ammonites, brachiopod, calcareous nannofossils, field geologists) and in joint collection of samples from various members of Lathi, Jaisalmer, Baisakhi and Bhadesar formations.

Ratan Kar

Attended the 'DST Meeting of the Expert Committee on Glaciology' held at Punjab Engineering College, Chandigarh from November 10-11, 2008 and presented the project proposal entitled "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".

Visited NCAOR, Goa on March 13, 2009 for presentation of the project entitled "Multi proxy geological studies in Svalbard area and surrounding Ocean: Implications to Quaternary palaeoclimate, Permo-Carboniferous and Mesozoic-Tertiary biostratigraphy, biogeography, ecology, tectonics and hydrocarbon potential" related to the 3rd Arctic Expedition.

C.M. Nautiyal

Participated in the National Discussion on 'Science Fiction: Past Present and Future', catalysed and supported by RVPSP (DST) at Sanjay Motel, Varanasi on November 11, 2008.

Attended 'Study Material Development for young Writers (Training Workshop)' as a resource person held at Vigyan Parishad and organised by Vigyan Prasar and Vigyan Parishad from March 8-9, 2009.

C.M. Nautiyal, Ratan Kar, P.S. Ranhotra & S.S.K. Pillai

Participated in the Science Expo at the *96th Indian Science Congress Association* held at NEHU, Shillong from January 03-07, 2009 and put up stall of fossil exhibits and literature pertaining to the work being done at the Institute.

Neerja Jha & Rajni Tewari

Attended Programme on Ethical, Legal and Gender Issues in Science organized for women scientists" at Administrative Staff College of India, Hyderabad during January 12-16, 2009.

B.D. Singh & O.P. Thakur

Attended the 'Academia-Industry Interface Meet' organized by Petrotech Society and held at India Habitat Center, New Delhi from January 13-14, 2009.

N.C. Mehrotra, Neerja Jha, Rajni Tewari, Ratan Kar & S.K. Shah

Attended Annual Meeting of Directors and Scientists of Autonomous Scientific Institutions of DST held at ARCI, Hyderabad from January 17-18, 2009.

Mukund Sharma

Visited Geological Institute of Russian Academy of Sciences, Moscow under a running ILTP Project for 25 days (March 24-April 18, 2009) for finalization of Treatise of Microfossils from Precambrian sequences within the framework of the Project with Prof. V. N. Sergeev.

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S.C. Bajpai

Attended 'Building Energy Simulation Capacity Development Workshop' of the Faculty of Architecture held at UP Technical University, Lucknow on October 05, 2008.

Attended National Conference on 'Energy Security for Rural Development' held at Rural Energy Centre, Gandhigram Rural University, Gandhigram, Dindigul, TN on March 26, 2009.

P.S. Katiyar

Attended the First Advanced Training Programme on 'Cyber Laws, Information Security and Computers for Scientists and Technologists of S&T Department of Govt. of India' held at Indian Institute of Public Administration, New Delhi from June 09-15, 2008

Dhirendra Sharma, Sumit Bisht & Avanish Kumar

Attended IIM-Libsys Workshop on 'RFID Application in Libraries' held at Indian Institute of Management, Lucknow on July 18, 2008.

Dhirendra Sharma & Sumit Bisht

Attended Workshop on 'Digitization of Resources using Open Source Software: Greenstone Digital Library

(GSDL)' held at Indian Institute of Management, Lucknow from September 23-26, 2008.

Kavita Kumar

Attended DST Librarian Meeting CSIR-DST, E-Journal Consortium held at ARCI, Hyderabad on September 27, 2008.

Nilay Govind

Attended National Conference on 'Advance Computing and Communication Technology' organized by Dept. of Computer Science and Engineering Information Technology Computer application, Academy of Business and Engineering Science, Ghaziabad from February 6-7, 2009.

D.K. Dutta

Attended workshop on Pay Fixation held at ISTM, New Delhi from October 13-15, 2008.

V. Nirmala

Attended Training Workshop on 'Implementation of Right to Information Act-2005' conducted by Lucknow Management Association and held at Hotel Taj Residency, Lucknow on May 15, 2008.

Pradeep Mohan

Attended '24th FIP All India Convention of Photography' organized by Lucknow Camera Club, Lucknow from December 05-08, 2008.

Dr. D.S.N. Raju (Retd Scientist, ONGC) presenting research data during the National Conference on Plant Life through Ages

Deputation to Science Meets

Neerja Jha & B.D. Singh

- *Workshop on Research Projects Review and Planning of Indian Scientific Expeditions to Arctic & Antarctic* held at NCAOR, Goa during May 21-22, 2008.

N.C. Mehrotra & Rajni Tewari

- *SCAR/IASC IPY Open Science Conference on Polar Research– Arctic and Antarctic Perspectives* held at St. Petersburg, Russia during July 08-11, 2008.

Mukund Sharma

- *World Summit on Ancient Microscopic Fossils,* IGPP Centre for the study of Evolution and the Origin of Life (CSEOL), held at University of California, Los Angeles, USA during July 27-August 02, 2008.
- *33rd International Geological Congress* held at Oslo, Norway during August 06-14, 2008.
- *IGCP-509 Field Meeting* held at Zawar, Udaipur during November 28-December 02, 2008.

Ram Awatar, A. Bhattacharyya, Anupam Sharma & Binita Phartiyal

- *23rd Himalayan-Karakoram-Tibet Workshop* held at Leh (Ladakh) during August 08-11, 2008.

S.K.M. Tripathi

- *12th International Palynological Congress* and *8th International Organisation of Palaeobotany Conference* held at Bonn, Germany during August 30-September 05, 2008.

Alpana Singh

- *International Conference on Coal and Organic Petrology— Joint Meeting ICCP-TSOP (60th International Committee for Coal and Organic Petrology – 25th The Society for Organic Petrology)* held at Oviedo, Spain during September 21-27, 2008.

Neerja Jha & Rajni Tewari

- *4th Seminar on Modern Practices in Petroleum Exploration* held at KDMIPE, Dehradun during September 22-27, 2008.

N.C. Mehrotra, M.R. Rao, A. Rajanikanth, Mukund Sharma, B.D. Singh & Vandana Prasad

- *Golden Jubilee Celebrations of the Geological Society of India Meet– Recent Trends in Earth Sciences* held at IIS Campus, Bangalore during October 12-13, 2008.

R.R. Yadav

- *International Workshop on Environmental Conservation for Sustainable Livelihoods in the cold desert region in Asia* held at Solan during October 15-17, 2008.

A. Bhattacharyya, Anupam Sharma & Binita Phartiyal

- *International Symposium on Mountain Building and Climate-Tectonic Interaction MBCT-2008* held at WIHG, Dehradun during October 23-25, 2008.

Asha Khandelwal & Shilpa Singh

- *EMECS-8 International Conference on Harmonizing River Catchment and Estuary* held at Shanghai, China during October 27-30, 2008.

16 Scientists

- *Indo-China International Conference: Biotic and Climatic Changes in the Indo-China Region* held at BSIP, Lucknow during November 14-15, 2008.

All the Scientific staff

- *Conference on Plant Life through the Ages* held at BSIP, Lucknow during November 16-17, 2008.

Vandana Prasad

- *Brainstorming Session on Out of India Hypothesis* (DST sponsored) held at New Delhi during November 22-23, 2008.

S.S.K. Pillai

- *XXV Annual Convention of Indian Association of Sedimentologists and National Seminar on Sedimentary Basins of India- their Geological significance and Economic prospects* held at Sayajirao University, Baroda during November 26-28, 2008.

A.K. Srivastava, Archana Tripathi, Vijaya & Deepa Agnihotri

- *International Symposium on Perspectives in Pteridophytes* held at NBRI, Lucknow during November 27-29, 2008.

R.C. Mehrotra & Gaurav Srivastava

- *Seminar on Indo-Myanmar Ranges in the Tectonic Framework of the Himalaya and Southeast Asia* held at Manipur University, Imphal during November 27-29, 2008.

M.R. Rao & Poonam Verma

- *International Workshop on Plio-Pleistocene Environments and Hominin Adaptations in India* held at Hotel Lake View Ashoka, Bhopal during December 01-05, 2008.

Mahesh Prasad, Asha Gupta, A.K. Ghosh & S.K. Singh

- *31st All India Botanical Conference & International Symposium on Plant Biology and Environment: Changing Scenario* held at Allahabad University, Allahabad during December 17-19, 2008.

Amalava Bhattacharyya

- *Maintaining Sustainable Flows in River Ganga: Methodology Workshop* held at IIT, Kanpur during February 16-17, 2009.

C.M. Nautiyal

- *2nd African Science Communication Conference* held at Gauteng, South Africa during February 18-21, 2009.

M.R. Rao, A. Bhattacharyya, Anupam Sharma, Binita Phartiyal, Ratan Kar, S.K. Shah, P.S. Ranhotra, Anju Saxena, Nivedita Mehrotra, Mayank Shekhar & Jyoti Verma

- *National Conference on Quaternary Geological Processes: Natural Hazards and Climate Change* held at University of Lucknow, Lucknow during February 25-26, 2009,

M.R. Rao, A. Bhattacharyya, Anjum Farooqui, S.K. Shah, Poonam Verma & Harinam Joshi

- *3rd LIMPACS Conference (IGBP, PAGES)– Holocene Lake Records: Patterns, Impacts, Causes and Societal Importance of abrupt Hydroclimatic changes* held at Panjab University, Chandigarh during March 05-08, 2009.

Group photograph of participants of Hindi Science Writing Workshop co-organized with District Science Club

Lectures Delivered

N.C. Mehrotra

- *Multidisciplinary Antarctic studies at BSIP* at Open Science Conference on Polar Research– Arctic and Antarctic Perspectives, St. Petersburg, Russia (July 2008).
- *Commercialization of R&D Issues and Challenges— Role of BSIP in Present Scenario* at Petrotech Society Meeting, Goa (August 2008).
- *High Impact Palynology in Hydrocarbon Exploration in Indian Petroliferous Basins* at GEO India-2008 Expo & XXI International Conference, New Delhi (September 2008).
- *Activities of Birbal Sahni Institute of Palaeobotany* during Golden Jubilee Celebrations of the Geological Society of India Meet– Recent Trends in Earth Sciences held at IIS Campus, Bangalore October 12, 2008.
- *BSIP Perspectives: Today and Tomorrow* at Annual Meeting of Directors and Scientists of DST Institutions, ARCI, Hyderabad (January 17-18, 2009).

A.K. Srivastava

- *Latest trend in Plant Science Research and Relevance of Palaeobotany in modern context* (Focal theme) at Inaugural function of the Conference on Plant Life through the Ages, BSIP, Lucknow (November 16, 2008).

A. Rajanikanth

- *Global Warming Share, Care or Bear* at The Alarms of Global warming- Reduce or Perish- S.N. Tripathi Memorial Lecture series, Lucknow Management Association & Swayam Siddha, Lucknow (August 23, 2008).
- *Reinventing Scientific Temper* at National BHU Alumni Meet, Varanasi (January 29-30, 2009).

Mukund Sharma

- *Palaeo-Meso-Proterozoic Carbonaceous Remains from India-Recent Developments* at IGCP-509 Field Meeting, Zawar, Udaipur (November 28, 2008).

Amalava Bhattacharyya

- *Research related to Himalayan glaciers carried out at BSIP* at the 4th Meeting of Study Group of Himalayan Glaciers, TIFAC, DST, New Delhi (July 28, 2008).
- *Tree Ring Analysis of the Himalayan Region* at the National Seminar on Remote Sensing and GIS Application, HNB Garhwal University, Srinagar (September 11, 2008; as Resource Person).

C.M. Nautiyal

- *Sooraj Hamara Padosi Tara* at Prasar Bharati, Lucknow (April 2008).
- *Radiocarbon and Isotopic Methods and Cultural Heritage* at Brain Storming Session on Cultural Property Theft and Authentication, NRLC, Lucknow (May 13, 2008).
- *Global Warming* (Hindi) at Prasar Bharati, Lucknow (June 21, 2008).
- Three lectures *Science Popularisation Scenario in India*, *Writing Science for Radio Writing* and *Science for TV* in Distt. Science Club- BSIP Workshop on Science Journalism at BSIP (June 26-30, 2008).
- Two Lectures at MB College, Barabanki during Regional Workshop on NCSC, Energy and Noosphere (August 30-31, 2008).
- *CNG Kya Hai*? (Hindi) at Prasar Bharati, Lucknow (October 10, 2008).
- *Dividing Lines between Science Fiction, Science Fantast and Fiction: Are They There*? at Varanasi (November 10, 2008).
- *How Old is Old*? at Science Expo-2009, Regional Science City, Lucknow (February 01, 2009).

Vandana Prasad

- *Holocene studies: Climatic Variability of Recent Past* (young scientist presentation) at Golden Jubilee Celebrations Function of Geological Society of India, Bangalore (October 13, 2008).
- *Late Cretaceous-Early Paleogene: Cradle for Tropical Palaeobiodiversity* at DST sponsored Symposium on Out of India Hypothesis, New Delhi (November 22-23, 2008).

A.K. Ghosh

- *Problems of Water Logging and Remedies: Alternative Practices in Duck Rearing and Aqua-*

Crop Cultivation for Water Logged Areas at Kisan Sewa Sansthan (Mother NGO, GoI, R.C.H. Programme), Santkabir Nagar, Basti, UP (December 11, 2008).

S.K. Shah

- *Application of tree-ring data in analyzing Himalayan climate* at Annual Meeting of Directors and Scientists of DST Institutions, ARCI, Hyderabad (January 18, 2009).

S.C. Bajpai

- *Solar Radiation* and *Photovoltaic Systems* at the Training Programme on Non-Conventional Sources of Energy, NEDA Alternative Energy Research Development and Training Centre, Chinhat, Lucknow (December 16 & 17, 2008).
- *Role of Renewable Energy for Habitat Development* (Guest Lecture) at National Conference on Energy Security for Rural Development, Gandhigram Rural University, Gandhigram, Dindigul, Tamil Nadu (March 26, 2009).

Dr. N.C. Mehrotra apprising about BSIP Activities to eminent Earth Scientists during the Golden Jubilee Celebrations of the Geological Society of India Meet– Recent Trends in Earth Sciences held at IIS Campus, Bangalore, October 12, 2008.

Lectures by outside scientists

Prof. Sir Peter Crane, University of Chicago, Chicago, USA

- *New information on Bennettitales, Erdmanithecales and Gnetales* (September 12, 2008)

Dr. Steven R. Manchester, Florida Museum of Natural History, Gainesville, Florida, USA

- *Systematics and fossil history of Vitaceae (Grapes)* (September 15, 2008)

Dr. Christopher Liu, Dept. of Biological Sciences, Johnson City, Tennessee, USA

- *A newly found Late Neogene flora in NE Tennessee USA* (November 24, 2008)

Prof. Z.K. Zhou, Dept. of Biogeography & Ecology, Kunming, Yunnan, China

- *Quercus sect. Heterobalanus response to uplift of Himalayas* (November 24, 2008)

Dr. M Shanmukhappa. ONGC, Dehradun

- *Use of Palynology in Oil Exploration-Second B.S. Venkatachala Memorial Lecture* (January 02, 2009).

Dr. Sreepat Jain, Smithsonian Institute, National Museum of Natural History, Washington, USA

- *Changes in Caribbean Palaeoproductivity, Diversity and Benthic Foraminiferal Test Size caused by the Neogene closing of the Tropical Atlantic-Pacific Ocean Gateway* (December 15, 2008)

Dr. K.B. Jain, DST, New Delhi

- *International Science and Technology Collaborations: Need, Relevance and some Approaches* (February 13, 2009)

Dr. P.N. Kapoor, KDMIPE, ONGC Ltd., Dehradun

- *Organic Matter Maturation studies in Hydrocarbon Exploration* (February 19, 2009)
- *Fluorescence Microscopy in Palynology* (February 20, 2009)

In House Lectures Series

As a spirited effort to stimulate scientific temper and science skills, a series of lectures were organized, participated by young researchers. Vibrant youth made their presentation in an interactive ambiance and actively took part in lively discussions. The following lectures were delivered :

1. Sequence Stratigraphy and Sedimentology–Prof.Robert Spicer (2nd May 2008).
2. Gondwana Palynology–Ms.Neha Goel, J.R.F. (02 May 2008).
3. Preliminary Quaternary palynological investigations from Central India–Mr. Md. Firoze Quamar, J.R.F. (02 May 2008).
4. Palynology & Palaeobotany–Research Work 2006-2008 – An Overview –Dr. Hukam Singh (30 May, 2008).
5. Late Quaternary evolution of Mangrove vegetation in relation to palaeoclimate and sea level changes at Chilka lake, Orissa, India–Ms. Shilpa Singh (06 June 2008).
6. Pollen/Vegetation relationship in and around some important wetlands of Assam Valley, North-East India: Evidences of anthropogenic influence and pollen degradation–Ms. Swati Dixit (06 June 2008).
7. Vegetational and climatic changes in the Himalayan and Trans-Himalayan regions since late Pleistocene–Dr. P.S. Ranhotra (13 June 2008).
8. Modern pollen rain and late Holocene pollen records from reserve forests of Tinsukia district, Upper Assam–Mr. Sadhan Kumar Basumatary (20 June 2008).
9. Evidence of Pre-Columbian trans-oceanic voyages based on conventional LSC and AMS ^{14}C dating of associated charcoal and a carbonized seed of custard apple (*Annona sqamosa* L –Dr. Anil Pokharia (03 July 2008).
10. Groping Gondwana–Dr.A. Rajanikanth (11 July 2008).
11. Stepping in to the Gondwana Palynological Research–Some reflections–Dr.Srikanta Murthy (18 July 2008).
12. Calcareous Nannofossl Biostratigraphy – A Preliminary Study from Western Indian Cretaceous Succession–Mrs. Abha Singh (25 July 2008).
13. The so called Jurassic equable climate and Nanno-fossils-A story teller–Dr. Jyosna Rai (22 August 2008).
14. Multiproxy database study of Quaternary deposits in Mainland Gujarat : Implications to Palaeoclimate–Mr. Kamlesh Kumar (29 August 2008).
15. Tracing palaeoclimate and palaeoceanographic signals through marine biotic proxies: Case study from Kerala – Konkan Coast, Arabian Sea–Mr.Biswajeet Thakur (05 September 2008).
16. New information on Bennettitales, Erdmanithecales and Gnetales–Prof.Sir Peter Crane University of Chicago, Chicago U.S.A. (12 September 2008).
17. Systematics and Fossil History of Vitaceae (Grapes)–Dr. Steven R. Manchester Florida Museum of Natural History, University of Florida, Gainesville, Florida, USA. (15 September 2008).
18. Evolutionary explosion in deep time: A peep in to the Proterozoic basins of Indian sub-continent–Mr. Veerukant Singh (19 September 2008).
19. Elemental and isotopic measurements for radio carbon dating–Dr. C.M. Nautiyal (19 September 2008).
20. IBC Vienna /Tertiary Palaeobotany–Dr. R.C.Mehrotra (26 Septempber 2008).
21. Conventional and AMS C^{14} dating techniques and their recent applications–Dr. B. Sekhar (03 October 2008).

Dr. Prabhas Pande, Director, Geological Survey of India, Lucknow delivering a talk on *Earthquake Disaster Management,* (August 01, 2008) (Under the auspices of the Geological Society of India, Northern Chapter)

Facets of Palaeobotany

BSIP organised an interactive lecture series for newly appointed research scholars and scientific staff of the institute during November 25th, 2008 to January 23rd, 2009. In this lectures series following experts delivered lectures and demonstrated various aspects of research activities in the labs providing an opportunities of hands on training to fresh students and scientific staff. The concluding session of the lecture series was organised on 12th February 2009 marking the Bicentennial Birth Anniversary of famous Charles Darwin. Following 35 lectures were delivered by eminent scientists of the institute.

Title	Speaker	Date
Birbal Sahni Institute of Palaeobotany: the Founder and the Vision	*H.P. Singh*	25-Nov-2008
Palynology in Biostratigraphy and Fossil Fuel Exploration	*N.C. Mehrotra*	28-Nov-2008
Stratigraphic Principles and Geologic Time Scale	*R. K. Saxena*	1-Dec-2008
Fossil Calcareous Algae and their palaeoenvironmental studies	*Amit K. Ghosh*	5-Dec-2008
Terminology for fossil Microbialites	*Mukund Sharma*	8-Dec-2008
Early land plant developments: Global progress and Indian priorities	*K.J. Singh*	10-Dec-2008
Gondwana Biodiversity: Lower Gondwana	*A.K. Srivastava*	11-Dec-2008
Gondwana Megaspores-Morphology, Evolutionary Trend and Study Techniques	*Rajni Tewari*	12-Dec-2008
Permian Palynostratigraphy, Dating and correlation of coal bearing horizons	*Neerja Jha*	15-Dec-2008
Lower Gondwana – Palynology, Palaeozoic Spores	*Ram-Awatar*	16-Dec-2008
Permian-Triassic (P/Tr) Mass Extinction: Palynological perspective	*Vijaya*	17-Dec-2008
Indian Coals and their relevance to Coal Bed Methane	*Omprakash S. Sarate*	18-Dec-2008
Futeristic trends in Coal Petrological Investigations	*Rakesh Saxena*	19-Dec-2008
Deccan Intertrappean Flora of India	*Rashmi Srivastava*	22-Dec-2008
Early Angiosperm through Palynological Window	*Archana Tripathi*	23-Dec-2008
Evolutionary innovations in Mesozoic Flora	*A. Rajanikanth*	24-Dec-2008
Palaeogene Megaflora	*R. C. Mehrotra*	30-Dec-2008
Neogene Megaflora	*J.S. Guleria*	31-Dec-2008
Mass Extinction & Climatic Extremes during Cretaceous - Palaeogene: Examples from the Marine Realm	*Rahul Garg*	2-Jan-2009
Palynological preparation techniques	*S.K.M. Tripathi*	5-Jan-2009
Nannofossils – Morphotaxonomy and Biostratigraphy	*Jyotsana Rai*	6-Jan-2009
Fossil Dinoflagellates: Morphology and stratigraphic significance	*Khowaja-Ateequzzaman*	9-Jan-2009
Sedimentary Organic Matter: Proxy for Depositional Environments	*Madhav Kumar*	9-Jan-2009
Evolutionary trends in Precambrian microfossils and acritarchs	*Rupendra Babu*	12-Jan-2009
Pollen and Quaternary Palaeoclimate	*M.S. Chauhan*	13-Jan-2009
Mangrove Palynology	*Asha Khandelwal*	14-Jan-2009
Differential Pollen production, Dispersal & accumulation in the light of exotic pollen	*S. K. Bera*	15-Jan-2009
Dendrochronology – Proxy in Palaeoclimatology	*Amalava Bhattacharyya*	16-Jan-2009
Pollen: taxonomy and morphological attributes	*R.S. Singh*	19-Jan-2009
Farming and Domestication	*Chanchala Srivastava*	19-Jan-2009
Environmental Magnetism and Palaeoclimatology	*Binita Phartiyal*	20-Jan-2009
Geochemistry and its application	*Anupam Sharma*	21-Jan-2009
Mesozoic Mega Flora: Morphology and evolutionary aspect	*Neeru Prakash*	22-Jan-2009
Isotopes in Stratigraphy and Palaeoclimatology	*CM Nautiyal*	22-Jan-2009
Rules of Botanical Nomenclature (as pertinent to Palaeobotany)	*R. K. Saxena*	23-Jan-2009

Recognition

N.C. Mehrotra

Invited by Geological Society of India to Felicitate and Address the Geoscientific community on the occasion of Golden Jubilee Celebrations at Bangalore (in October 2008).

Elected Member of the Council of the Geological Society of India, Bangalore.

Archana Tripathi, Ram Awatar, R.C. Mehrotra, Anupam Sharma & Binita Phartiyal

Awarded "Team Medal–2008" from BSIP, amongst scientists who have excelled to inculcate team sprit and collaborative integrated work within the Institute.

Samir Sarkar, M.R. Rao, R.S. Singh, S.K.M. Tripathi, Anil Agarwal, B.N. Jana, Chanchala Srivastava, A. Rajanikanth, Ram Awatar, D.C. Saini, Mukund Sharma, Mahesh Prasad, Rashmi Srivastava & Asha Gupta

Elected Fellows of the Palaeobotanical Society of India, Lucknow.

Neerja Jha

Awarded "Scientific Output Medal–2008" of BSIP.

A. Rajanikanth

Chaired, Session 1- Global Warming: Fallacies and Facts— The Alarms of Global Warming- Reduce or Perish, S.N. Tripathi Memorial Lecture Series, Lucknow Management Association & Swayam Siddha, Lucknow on August 23, 2008.

Amalava Bhattacharyya

Chaired a Technical Session of the National Seminar on "Remote Sensing and GIS Application in Natural Resources Management, Sustainability and uses" held at HNB Garhwal University, Srinagar in September, 2008.

Co-chaired a Session at the "3rd LIMPACS Conference- Holocene lake records: Patters, impacts, causes and societal importance of abrupt hydroclimatic changes" held at Chandigarh in March, 2009.

K.J. Singh & Rajni Tewari

Awarded "Diamond Jubilee Medal–2008" of BSIP for publishing research papers of high quality in refereed journals.

C.M. Nautiyal

Coordinator (Academic), Workshop on Science Journalism, organized under the joint auspices of District Science Club and BSIP during June 26-30, 2008.

Coordinator, Regional Workshop for RTI (AIR), Lucknow during February 4-8, 2008 on Popularising Science at Lucknow.

Asha Gupta

Conferred Fellow of the Society of Earth Scientists.

Anupam Sharma

Awarded "Shri Chandra Dutt Pant Medal–2008" for the best piece of research work amongst the Scientist-'C' category of the BSIP, Lucknow.

Anupam Sharma, Vandana Prasad, Binita Phartiyal & Kamlesh Kumar

Won "2nd Prize" in the Best Poster for paper *Late Holocene estuarine sedimentary sequences of Mahi River Basin, Mainland Gujarat: their significance in palaeoclimatic and depositional regime studies* presented at the 'National Conference on Quaternary Geological Processes' held at Lucknow in February 2009.

Vandana Prasad

Received a "Memento" for valuable contribution in the field of Geology on the occasion of 50th Anniversary of Geological Society of India Celebrations (in October 2008) at Bangalore and invited for Young Scientists presentation on the same.

Poonam Verma & M.R. Rao

Awarded "Second Best Poster" for poster *Quaternary vegetation and climate change in central Narmada Valley: Proxy records from hominin bearing sedimentary successions* presented at the 'National Conference on Quaternary Geological Processes: Natural Hazards & Climate change' held at Lucknow in February 2009.

Representation in Committees/Boards

N.C. Mehrotra

- President, The Palaeobotanical Society of India, Lucknow.
- Chief Editor, *The Palaeobotanist.*
- 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, Organizing Committees, *Conference on Plant Life through the Ages*, BSIP, Lucknow (November 2008).
- Member, Local Advisory Council, Regional Science Centre, Lucknow (Ministry of Culture).

Rahul Garg

- Vice President, The Palaeobotanical Society, Lucknow.
- Joint Secretary, The Palaeontological Society of India.
- Co-ordinator, Joint Research Committee (BSIP-NIO).

J.S. Guleria

- Chief Editor, The Palaeobotanical Society & *Geophytology.*
- Vice President, Organizing Committee, *Indo-China International Conference: Biotic & Climatic Changes in the Indo-China Region*, BSIP, Lucknow (November 2008)
- Member, Organizing Committees, *Conference on Plant Life through the Ages*, BSIP, Lucknow (November 2008).
- Member, Executive Committee, Lucknow University's Botany Department Alumni Association.

R.K. Saxena

- Treasurer, The Palaeobotanical Society, Lucknow.
- Member, Editorial Board, *Geophytology*.
- Convener, Abstract Publication Committee, *Conference Plant Life through the Ages*, BSIP, Lucknow (November 2008).

A.K. Srivastava

- Editor, *The Palaeobotanist*.
- Secretary, The Palaeobotanical Society of India, Lucknow.
- Member, Editorial Board and Treasurer, Indian Society of Geoscientists.
- Organising Secretary, Conference on *Plant Life through the Ages*, BSIP, Lucknow (November 2008).
- 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.

Archana Tripathi

- Member, Acritarch Subcommission, Commission Internationale de Microflora du Palaeozoique.
- Member, Spore-pollen Working Group, CIMP.
- Joint Secretary, Lucknow University's Botany Department Alumni Association.

S.K. Bera

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

Usha Bajpai

- Member, Executive Committee, Electron Microscope Society of India.
- Member, Executive Committee, Baba Bhim Rao Ambedkar University.
- Member, Technical Advisory Committee of U.P. Environmental Concern.

Neerja Jha

- Vice President, The Society of Earth Scientists, Lucknow.

Asha Khandelwal

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

Madhav Kumar

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

R.C. Mehrotra

- Convener, *Indo-China International Conference: Biotic & Climatic Changes in the Indo-China Region*, BSIP, Lucknow (November 2008).
- Councilor, Executive Council, The Palaeobotanical Society, Lucknow.
- Convener, Smart Administration Cell, BSIP.

Mahesh Prasad

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

A. Rajanikanth

- Joint Editor, BSIP Annual Report.
- Member, International Working Group IGCP Project- 506.

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

- Judge, National Children's Science Congress-2008.
- External Paper Setter, on Coal Bed Methane and Gas Hydrate Exploration for the session 2008-09, Indian School of Mines, Dhanbad.

Mukund Sharma

- Member, National Working Group- IGCP Project-493, Kolkata.
- Member, National Working Group IGCP-509, Kolkata.
- Joint Editor, Miscellaneous Publications, BSIP.
- Member, Institutional Animal Ethics Committee of ITRC, Lucknow.
- Judge, National Children's Science Congress, Barabanki.

S.K.M. Tripathi

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

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

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

C.M. Nautiyal

- Member (Outstation) Executive, Vigyan Parishad, Prayag.
- Member, Evaluation Pannel, JLN KVS National Science Exhibition (September 22, 2008).
- Member, Jury (Elocution) 17th Anniversary of Regional Science City, Lucknow (September 7, 2008).
- Member, Project Selection and Project Monitoring Committees, Uttarakhand Council of Science and Technology, Dehradun. (December, 2008).
- Advisor, Coordination Committee, National Children's Science Congress, UP.
- Member, Organising Committee for Science Expo-2009, Regional Science City, Lucknow.

Alpana Singh

- Member, Bureau of Indian Standards, Solid Mineral Fuel Sectional Committee– PCD-7.4: Methods of Analysis Subcommittee.

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, Programming Committee, *Conference on Plant Life through the Ages*, BSIP, Lucknow (November 2008).
- 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.

Rashmi Srivastava

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

Rajni Tewari

- Editor, *Geophytology.*
- Member, Smart Administration Cell, BSIP.

Anjum Farooqui

- Executive Member, International Society of Plant and Environment, NBRI, Lucknow.

A.K. Ghosh

- Judge, National RANK (Race for Awareness & Knowledge- for students) and BOLT (Broad Outlook Learner Teacher- for teachers) Award for the state of UP at Krishi Bhavan Auditorium, Lucknow (sponsored by Air India and Dainik Jagran on September 6-7, 2008).
- Judge, National Children's Science Congress (District level) at Lucknow (November 2, 2008).

S.C. Bajpai

- Guest Faculty, M.Sc. Programme on Renewable Energy, Dept. of Physics, Univ. of Lucknow.

Doctoral Degree Awarded

Name	Subject	Date	University	Supervisor	Title of Ph.D. Thesis
Anju Saxena	Geology	09 March, 2009	Lucknow University	Prof. I.B. Singh	Vegetational and climatic changes in the Himalayan and Trans-Himalayan regions since Late Pleistocene

Units

Publication

Journal *The Palaeobotanist* — The journal Volume 57 comprising of two numbers was published with state of the art printing technology. Both were proceeding volumes for the Diamond Jubilee National Conference on *Challenges in Indian Palaeobiology: Current status, Recent developments and Future directions* organized during November 15-17, 2005, and Diamond Jubilee International Conference on *Changing Scenario in Palaeobotany and Allied Subjects* from November 15-17, 2006. Papers for the Volume 58 are under process.

BSIP Newsletter — Annual BSIP Newsletter 2008 (No. 11) was published with information on important activities of the Institute during the period July 2007 to June 2008.

Annual Report — English and Hindi versions of Annual Report were published incorporating the research work carried out in different research projects during the period 2007-2008. 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 also published.

Hindi Book — A Hindi book entitled *Padpashm- Ateet ki ek Kari* translated by Mukund Sharma was published. This book is the Hindi translation of popular book *Plant Fossils- A link with the Past* earlier published by BSIP in English.

Booklet on Lectures — A booklet entitled *Facets of Palaeobotany* incorporating 34 in-house lectures given by Institute's scientists during November 25, 2008 to January 23, 2009 was compiled.

Abstract Volume— An Abstract volume for Conference on *Plant Life through the Ages* which was organized during November 2008 was published with information on Abstract content, various committees and author index.

Souvenir — A Souvenir for Conference on *Plant Life through the Ages* was published containing Institute history, guide, messages received from VIPs and information about different scientific institutes of Lucknow.

Handouts— Following biographical profiles and themes of lecture of eminent speakers delivered on the occasion of Foundation Day, Founders' Day and other special events were published:

Sir Peter R. Crane — Fossils and Angiosperm Evolution: Lessons from Fagales and Prospects for the Future (12th Jubilee Lecture, September 2008)

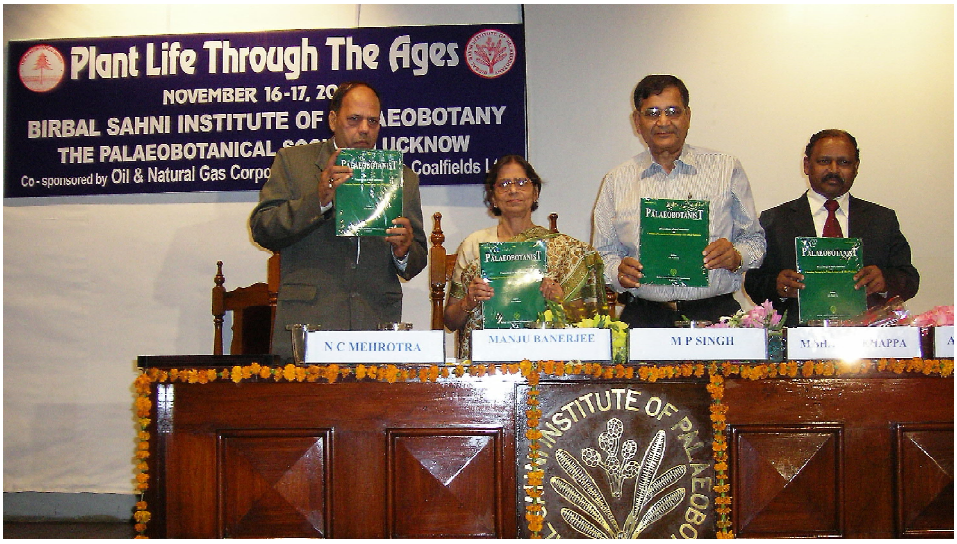
Dr. B.R. Arora — Geodynamic Evolution of Himalaya (54th Sir AC Seward Memorial Lecture, November 2008)

Prof. Song Ge — Plant Diversity in China and current researches at Institute of Botany (38th Birbal Sahni Memorial Lecture, November 2008)

Sri D.K. Pande — R&D in High Impact Palynological Research as applied in Hydrocarbon Exploration (3rd Diamond Jubilee Lecture, November 2008)

Sri D.C. Garg — Initiatives to add Sustainability in CO_2 Cycle: Coal Bed Methane, Carbon Capture and Sequestration (Key-note Address: Special Session on Fossil Fuel, Conference Plant Life through the Ages, November 2008)

Invitation Cards— Invitation cards for Foundation Day, Founders' Day, and Conference were printed.



Library

Library and Information services at BSIP play an important role in facilitating the creation of new knowledge through the acquisition, organization and dissemination of library materials.

The current holdings of library are as under:

Particulars	Additions during 2008-09	Total
Books	50	5,822
Journals (bound volumes)	532	15,610
Reprints	228	40,030
Reference Books	02	339
Hindi Books	12	367
Ph.D. Thesis	-	91
Reports	-	46
Maps & Atlases	-	61
Microfilm/ Fisches	-	294
CD	2	74

Currently the library is receiving 172 journals (98 through subscription and 74 through exchange). There are 151 registered card holders using the library facilities.

Exchange Facility

Institutions on exchange list	59
Individuals on exchange list	144
Journals received on exchange basis	72
Reprints sent out in exchange	844
Reprints of research papers purchased for exchange	29

Institute's Annual Report and Newsletter have been distributed to various organizations/ Institutions.

Automation

The Library uses Libsys software package which is an integrated multi-user library management system that support all in-house operations of the Library. The collection is accessible via OPAC (Online Public Access Catalogue). OPAC is searchable by author, title, subject, call number and keyword. The collection of newly acquired literature is regularly updated.

e-Resources

The Library provides web-based access of the journals from the following publishers on Institute LAN: i) Science Direct, ii) Micropress, iii) Cambridge*, and iv) Oxford*. In addition trial access of journals* from publishers like CSIRO Publishing, NRC Press Journals, M/S Maney Publishers, Pro-Quest Metadex and Royal Society was provided. (*available through CSIR-DST Consortium).

Other Facilities

Current Awareness Service— To keep readers in touch with the latest arrivals in the library, contents of the journals displayed every month are collated and presented in the form of a volume "Current Awareness Service".

Lamination— To preserve the old and rare literatures, lamination and xeroxing of such publications is done.

Xeroxing— Xeroxing facility is provided to institute scientists as well as to out side scientists.

Inter-Library Loan Service is provided to users on request.

The following Institutions/Organizations availed the library facilities:

Centre for Earth Science Studies, Akkulam, Thiruvananthapuram.

Department of Botany, University of Lucknow, Lucknow.

Gujarat Ecological Education & Research Foundation, Gandhinagar, Gujarat.

Department of Botany, Serampore College, Serampore, Hoogly (W.B.).

Department of Botany, D.A.V. College, Kanpur.

Department of Geology, Bangalore University, Bangalore.

Isabella Thoburn College, Lucknow.

Department of Botany, Annamalai University, Tamil Nadu.

Museum

The Museum is a nodal center for popularizing and dissemination of palaeobotanical knowledge. The Institute displayed its exhibition in Science Congress held at Shillong from January 3-7, 2009 and also participated in Science XPO from January 28 to February 1, 2009 at Regional Science Centre, Lucknow.

Research materials collected by the scientists of the Institute from 248 localities of the country under different projects, as well as the DST sponsored projects were submitted. Type and figured material of 32 research papers were deposited in the repository. Details of additions are as follows:

Holdings

Type	Addition during 2008-2009	Total
Type and figured specimens	170	7,226
Type and figured slides	334	13,156
Negatives of above	57	17,611

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

Project	Specimens	Samples
Project– 1	-	34
Project– 2	655	26
Project– 3	10	466
Project– 4	533	500
Project– 5	87	458
Project– 6	-	304
Project– 7	-	158
Project– 9	-	369
Project– 11	-	152
Project– 13	14	303
Project– 14	87	449

Samples deposited under Sponsored/ Collaborative Projects:

DST Sponsored (ESS/16/254(4)/2005) samples - 100 specimens 246

DST Sponsored (SR/S4/ES-138/2005) - 69 samples

DST (SR/S4/ES-21/Baroda window/PI) - 397 samples

149 Samples received from Prof. Prabha Kalia, Delhi University, New Delhi.

Fossil specimens gifted within the country to the following centers:

Govt. College Rajahmundry, Andhra Pradesh.

Department of Museology, Aligarh Muslim University, Aligharh-202 002.

S.B.P.G. College, Baragaon, Varanasi-221204.

Dept. of Botany, Goswami Ganesh Dutta Sanatan Dharma College, Sector-2-C, Chandigarh.

J.M. Patel College of Arts, Commerce & Science, Bhandara-441904 (MS).

Department of Botany, B.N.D. College, Kanpur.

Science City Kolkata, West Bengal.

Institutional Visitors

Forest Training Institute, Kanpur

I.T. College, Lucknow

Christ Church College, Lucknow

Asutosh College, Kolkata

Serampore Collage, West Bengal

Dept. of Botany, Brahmanand College, Kanpur.

Dept. of Botany, I.B.P.G. College, Varanasi

Dept. of Botany, Nagaland University, Lumani

Lucknow University, Lucknow

M&N Virani Science College, Yogidham Gurukul Rajkot, Gujarat

Dept. of Botany, Burdwan University, Burdwan.

Herbarium

About 167 identified plant specimens were mounted on herbarium sheets, data slip were filled and registered. All herbarium sheets were placed in the pigeon-hole almirrah in their respective families. About 89 samples of leaves, 110 wood cores, 98 wood slides, 27 pollen slide, and 34 fruits and seeds were added to the repository Herbarium. Collections of Prof, Birbal Sahni and other renound scientists were displayed.

Holdings

Particulars	Addition during 2008-2009	Total
Herbarium		
Plant specimens	187	23,187
Leaf specimens	98	1,062
Laminated mounts of venation pattern	-	66
Xylarium		
Wood blocks	-	4,158
Wood discs	-	68
Wood cores	118	7,380
Wood slides	98	4,278
Palm slides (stem, leaf, petiole, root)	-	3,195
Sporothek		
Polleniferous materials	-	3,016
Pollen slides	27	12,264
Carpothek		
Fruits & seeds	48	4,254
Museum Samples		
Medicinal & food plant	-	91

Students visiting BSIP Herbarium

Visitors

Dr. R.C. Srivastava, Botanical Survey of India, Itanagar

Prof. Manish Mohanti, Rohilkhand University, Jhansi

Prof. N.D. Parik, University of Calcutta, Kolkata

Prof. Li Liang Qian, Prof. Zhang Zhiyun, Prof. Jia Yu, Prof. Jian Yang, Prof. Yu-Fei Wang, Prof. Cheng-Sen Li, Prof. Shi-Liang Zhou and Prof. Tsun-shen Ying, Institute of Botany, CAS, Xiangshan, Beijing, China

Prof. Xiaodong Liu, Prof. Ran Zhang, Prof. Wijian Zhou, Prof. Xuefeng Lu, Prof. Peng Cheng, Prof. Wang Hao, Prof. Qingmin Chen, Zhao, Prof. Liu, Zhihi Kang, Prof. Xiaok Qiang, Prof. Xinwen Xu Wang, and Prof. Zishen, An State Key Laboratory of Loess and Quaterary Geology, Institute of Botany, CAS, Xi'an, China

Mr. Manish Kumar Singh, NISCAIR, Pusa Campus, New Delhi

Mr. Aman Kumar, Delhi Institute of Heritage Research and Management, New Delhi

Prof. R.A. Spicer, The Open University, Milton Keynes, UK

Forest Guards (Trainees) of Forest Training Institute Kanpur (UP)

D.C Saini collected 250 plant specimens, 34 samples of fruits and seeds from Naini Tal and adjoining areas with Chinese delegates, and 148 plant specimens from Dudhwa National Park with Prof. R.A. Spicer during preconference field work. Identified 2 plant species from Nani Tal, as new record for flora of Upper Gangetic Plain.

Electronic Data Processing

Internet connection with Radio link facility from Software Technology Park of India, Lucknow with 3 MBPS (1:1) is running in the Institute. Proxy, Mail and DNS Servers are successfully running on Sun V440, Sun V240 having Solaries Operating System. This provides 24 hours Internet facility to the Institute Staff. At present 130 Computers are connected with the LAN.

An Anti Virus Program "Symantec EndPoint Protection 11.0" has been procured with 150 user license to protect the systems from viruses and worms. This year Institute has procured 13 Compaq P-IV system with UPS and laser printers, three scanner 'HP 3570', two colour laser HP-3505 and one A3 scanner Epson make. 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. Section is providing help to the scientists in preparing the multimedia presentations, charts, graphs, lithologs and diagrams for their scientific publications and documentation.

Section Cutting Unit

The unit is one of the important units of the institute where fossil and rock samples are cut and their thin sections are prepared. During the year over 400 samples were cut and about 1350 slides were prepared. In addition, 130 slices were made and polished for detailed examination by scientists.

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

Reservations and Concessions

The Institute is following General Reservation Orders of the Government of India as applicable to Autonomous Bodies and amended from time to time for the reservations and concessions of Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Classes (OBC) and Physically Handicapped Persons for the posts meant for direct recruitment in Group 'A', 'B', 'C' and 'D' as per Govt. of India Orders.

Status of Official Language

BSIP is ever striving towards achieving the target set for official language. Activities like Rajabhasha Workshop and competitions, as part of Hindi fortnight, were organized during the year. Director addressed the staff and visiting students in Hindi in all the functions. He also delivered a lecture at Regional Science City to a group of students in Hindi. The main speaker on the Science Day Dr. KK Dwivedi of International Division, DST spoke in Hindi. The Institute was represented in meetings of Official Language Implementation Committee of Lucknow (NARAKAS) and staff members were deputed in the training workshops. In several exhibitions put up by the Institute at Lucknow and Shillong, science was communicated primarily in Hindi to the common people. Dr. CM Nautiyal delivered a lecture on *Brahmand mein Jeevan* (Life in the Universe) in Hindi at CDRI during the All India Official Language Symposium, 4 lectures in Hindi on science and science writing at Allahabad, Barabanki, Lucknow and Noida, and also 3 radio talks. Mr. Ashok Kumar attended the Symposium on deputation. Dr. Jyotsana Rai recited an original Hindi poem at All India Radio, Lucknow. District Science Club, Lucknow organized five-day Workshop on 'Hindi Mein Vijnan Lekhan' with the institute at BSIP campus, in which Dr. Nautiyal delivered three lectures in Hindi on various aspects of communicating science. Mr. Ashok Kumar attended the 5 day Refresher Course on Translation at Central Translation Bureau, New Delhi during August 4-8, 2008. The Institute participated in the meetings of NARAKAS in August and February respectively. Thus staff of the institute took active part in Science Communication in Hindi through various media.

Majority of the computers of the Institute have been facilitated with bilingual software and others are advised to make use of the now available free software for the purpose. Annual Report of the Institute was published in Hindi. Hindi abstracts of the research papers were also published in the international journal of the Institute *The Palaeobotanist*. The Newsletter contains material in Hindi. In adherence to the official language Act-1963 implementation section 3(3), use of Hindi has improved and efforts are continuing to promote the correspondence in Hindi.

Hindi Fortnight

Hindi Pakhwara was inaugurated on 10th September with a Workshop addressed by Dr. (Mrs.) Suman Keshari Agrawal, Dy Secretary, DST. She spoke on *Kaaryakshetra mein Abhiprerana: Kuchh Vichaar* (Motivation at the work Place). She said that while the subordinate staff is supposed to follow the seniors, the seniors must also take care of the subordinate staff. This will keep the staff motivated. On the occasion, a *Kavi Sammelan* was also organized in which three staff members of the Institute also participated. The Director cheered up the participants during the 6 competitions organised. Sixty-four staff members participated in a series of competitions. There were 5 guest poets. Prize distribution was held on 25th September by the Director and Mr. Avadh Kisore Pathak 'Vairagi', who also spoke on the occasion. Hindi books of reputed authors were given away to the winners as under:

Spot the Error: I- Sri Tapan Kumar Mandal, II- Sri Syed Rashid Ali, III- Km. Deepa Agnihotri, Encouragement - Sri Avinash Srivastava and Sri Avinesh Kumar Srivastava.

Typing (computer): I- Km. Manisha Tharu, II- Sri Ajay Kumar Srivastava, III- Sri Rajesh Kumar, Encouragement- Sri Ashok Kumar.

Essay: I- Sri Tapan Kumar Mandal, II- Km. Richa Tiwari, III- Sri Dheerendra Kumar Pal, Encouragement- Dr.(Smt.) Chanchala Srivastava.

Noting: I- Smt. Kavita Kumar, II- Sri Ajay Kumar Srivastava, III- Sri Avinesh Kumar Srivastava, Encouragement- Sri Tapan Kumar Mandal and Sri Dheerendra Kumar Pal

Antaakshari: I- Dr. (Smt.) Rashmi Srivastava & Km. Deepa Agnihotri, II- Km. Kirti Singh & Sri Rajesh Kumar Awasthi, III- Smt. Shail Singh Rathore & Smt. Anumeha Shukla

Encouragement- Dr..Parminder Singh Ranhotra & Sri Nilay Govind.

Quiz: I- Dr. Ratan Kar, Dr. EG Khare & Sri Gaurav Srivastava, II- Dr. (Smt.) Chanchala Srivastava, Sri Tapan Kumar Mandal & Sri Dheerendra Kumar Pal, III- Dr. Mukund Sharma, Sri Syed Rashid Ali & Km. Shiwani Kapoor

Encouragement- Dr. A Rajanikanth, Sri Sumit Kumar Bisht & Sri Sunil Kumar Bisht.

Prizes for Promoting Use of Official language

To promote the use of official language in the Institute, cash prizes were awarded to the followings:-

I - Dr. (Smt) Archana Tripati & Dr. (Smt.) Asha Khandelwal

II - Dr. (Smt.) Rajni Tiwari, Dr. (Ms.) Asha Gupta & Sri Dhoom Singh

III- Smt. Sunita Khanna, Smt. Reeta Banarjee, Smt. P. Thomas, Ms. Chitra Chatterji, Sri Avinash Srivastava & Ms. Manisha Tharu

Hindi Workshop

Three Rajabhasha Workshops were organized:

i) *Hindi mein Vijnan Sampreshan and Dakshini Dhruv ki Yatra* (by Dr. Dhruv Sen Singh, LucknowUniversity)

ii) Kaaryakshetra mein Abhiprerana:Kuchh Vichaar [by Dr. (Smt) Suman Keshari Agrawal, Dy Secretary, DST]

iii) *Kaaryalayeen Hindi* [by Sri.Ashok Kumar, BSIP]

Deputation in Workshops

C.M. Nautiyal

Attended *All India Seminar on Official Language* held at Central Drug Research Institute, Lucknow on May 30, 2008 and delivered talk on 'Brahmand mein Jeevan'.

Attended a Seminar on *Hindi mein Vigyan lekhan: Vyaktigat evam Sansthagat Prayas* held at Indian Institute of Management, Noida Campus (organised by Vigyan Prasar) on September 29, 2008 and delivered talk on 'Hindi mein Vigyan Lekhan ki Chunautiyan: Kyon se Kyon nahin tak'.

Chanchala Srivastava, V. Nirmala, Ashok Kumar, Dheerendra Kumar Pal & Ms. Manisha Tharu

Attended two-day *Hindi Workshop* conducted by Central Drug Research Institute, Lucknow from November 25-26, 2008.

Ashok Kumar

Attended *All India Official Language Symposium* held at Central Drug Research Institute, Lucknow from May 29-30, 2008.

A view of Hindi Pakhwara celebrations 10-24 September, 2008

Staff

Director

Dr. Naresh C. Mehrotra

Scientists

Scientist 'F'

Dr Rahul Garg
Dr Jaswant S. Guleria
Dr Jagannath P. Mandal (retired w.e.f. 30.06.2008)
Dr Ramesh K. Saxena
Dr Ashwini K. Srivastava
Dr (Mrs) Archana Tripathi
Dr (Ms) Vijaya

Scientist 'E'

Dr Anil Agarwal
Dr (Mrs) Usha Bajpai
Dr Samir K. Bera
Dr Amalava Bhattacharyya
Dr Brajendra N. Jana
Dr (Mrs) Neerja Jha
Dr (Mrs) Asha Khandelwal
Dr Madhav Kumar
Dr Rakesh C. Mehrotra
Dr Mahesh Prasad
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 Kamal J. Singh
Dr Rama S. Singh
Dr (Mrs) Chanchala Srivastava
Dr Surya K.M. Tripathi
Dr Ram R. Yadav

Scientist 'D'

Dr Rupendra Babu
Dr Mohan S. Chauhan
Dr (Ms) Asha Gupta
Dr Khowaja Ateequzzaman
Dr Bhagwan D. Mandaokar
Dr Kindu L. Meena
Dr Chandra M. Nautiyal
Dr (Mrs) Neeru Prakash
Dr (Mrs) Vandana Prasad
Dr (Mrs) Jyotsana Rai
Dr (Mrs) Alpana Singh
Dr Bhagwan D. Singh
Dr (Mrs) Rashmi Srivastava
Dr (Mrs) Rajni Tewari
Dr Gyanendra K. Trivedi

Scientist 'C'

Dr Supriya Chakraborty (on lien w.e.f. 01.09.2007)
Dr (Mrs) Anjum Farooqui
Dr Amit K. Ghosh
Dr Anupam Sharma

Scientist 'B'

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

Scientist 'A'

Dr (Mrs) Binita Phartiyal (till 14.09.2008)
Dr Anil K. Pokharia

Birbal Sahni Research Associate

Mr. Om Prakash
Dr Parminder S. Ranhotra (till 14.09.2008)
Dr Santosh K. Shah (till 14.09.2008)

Birbal Sahni Research Scholar

Ms Deepa Agnihotri
Ms Neha Goel
Mr Mohamad Firoze Quamar
Mrs Anumeha Shukla
Mrs Abha Singh
Ms Shilpa Singh

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

Technical Personnel

Technical Officer 'D'
Dr B. Sekar

Technical Officer 'C'
Mr P.K. Bajpai
Dr (Mrs) Madhabi Chakraborty
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 Avinesh K. Srivastava

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

Technical Assistant 'E'
Mr Chandra Bali

Technical Assistant 'D'
Mr S.R. Ali
Mr D.S. Bisht
Mr Sumit Bisht
Mr D.K. Pal
Mr S.S.K. Pillai (till 14.09.2008)
Mr Dhirendra Sharma
Dr. S.K. Singh
Mr R.K. Tantua (resigned w.e.f. 04.03.2005)
Mr C.L. Verma
Mr S.M. Vethanayagam

Technical Assistant 'B'
Mr Avanish Kumar
Mr M.S. Rana
Mr S.C. Singh
Mr Ajay K. Srivastava

Technical Assistant 'A'
Mr. J. Baskaran
Mr Pawan Kumar
Mr Om Prakash
Mr. A.K. Sharma

Administrative Personnel

Registrar: Dr Suresh C. Bajpai

Accounts Officer: Mr Dipak K. Dutta

Private Secretary: Mrs M. Jagath Janani

Section Officer
Mr R.K. Kapoor
Mrs V. Nirmala

Accountant: Sri Dhoom Singh (retired w.e.f. 31.03.2009)

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

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

Lower Division Clerk
Ms Sudha Kureel
Ms Manisha Tharu

Driver
Mr Nafis Ahmed ('IV')
Mr D.K. Mishra ('III')
Mr M.M. Mishra ('III' w.e.f. 02.02.2009)
Mr V.P. Singh ('III' w.e.f. 29.01.2009)
Mr P.K. Mishra ('II' w.e.f. 02.02.2009)

Class 'D' Personnel

Attendant 'IV' (Technical)
Sri K.C. Chandola

Attendant 'III'
Sri Kesho Ram
Sri Haradhan Mahanti
Smt. Munni
Sri Prem Chandra
Sri Ram Deen
Sri Ram Kishan (retired w.e.f. 31.08.2008)
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 Ram Ujagar (till 27.07.2008)
Sri Mohammad Shakil
Sri Bam Singh
Sri Kedar N.Yadav

Attendant 'I'
Sri R.K. Awasthi
Smt. Beena
Sri Deepak Kumar
Sri Vishwanath S. Gaikwad
Sri Inder Kumar
Sri Subhash C. Mishra (expired on 23.01.2009)
Km. Nandani
Smt. Ram Kali
Sri Ramesh Kumar
Sri Ravi Shankar

Mali
Sri Rameshwar Prasad Pal ('III')
Sri Ram Chander ('I')
Sri Ram Kewal ('I')
Sri Mathura Prasad ('I')

Sponsored Project Personnel

Dr Ratan Kar, CSIR SRA (tenure expired w.e.f. 26.05.2008)
Dr Shantanu Chatterjee, CSIR SRA (tenure expired w.e.f. 13.09.2008)
Mr K.G. Mishra, SRF (resigned w.e.f. 28.07.2008)
Ms Divya Srivastava, SRF (tenure expired w.e.f. 27.06.2008)
Mrs Yogmaya Shukla, SRF (tenure expired w.e.f. 31.03.2009)
Mrs Poonam Verma, SRF
Mr Kamlesh Kumar, SRF
Mr. Harinam Joshi, JRF
Ms Swati Dixit, Project Assistant
Mr Gaurav Srivastava, Project Assistant
Mr Jagdish Prasad, Field/Lab Assistant (tenure expired w.e.f. 08.04.2008)
Mr Saheb Lal Yadav, Lab Assistant

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

Appointments

Dr. (Mrs) Binita Phartiyal, Scientist 'C' w.e.f. 15.09.2008 (FN)
Dr. Ratan Kar, Scientist 'C' w.e.f. 15.09.2008 (FN)
Dr. Santosh Kumar Shah, Scientist 'B' w.e.f. 15.09.2008 (FN)
Dr. Parminder Singh Ranhotra, Scientist 'B' w.e.f. 15.09.2008 (FN)
Mr. Krishna Gopal Misra, Scientist 'B' w.e.f. 15.09.2008 (FN)
Ms. Vartika Singh, Scientist 'B' w.e.f. 15.09.2008 (FN)
Mr. S. Suresh K. Pillai, Scientist 'B' w.e.f. 15.09.2008 (FN)
Dr. K. Pauline Sabina, Scientist 'B' w.e.f. 24.09.2008 (FN)
Mrs. Anju Saxena, Scientist 'B' w.e.f. 06.11.2008 (FN)

Ms Vartika Singh, Birbal Sahni Research Associate w.e.f. 30.04.2008 (AN)
Mr. Krishna Gopal Misra, Birbal Sahni Research Associate w.e.f. 29.07.2008 (FN)

Ms Shivani Kapoor, Birbal Sahni Research Scholar w.e.f. 01.05.2008 (FN); resigned w.e.f. 25.11.2008
Mr. Gaurav Kumar Singh, Birbal Sahni Research Scholar w.e.f. 01.08.2008 (FN)
Ms Deepti Singh, Birbal Sahni Research Scholar w.e.f. 04.08.2008 (FN)
Ms Nivedita Mehrotra, Birbal Sahni Research Scholar w.e.f. 02.02.2009 (FN)

Mr. Nilay Govind, Technical Assistant 'D' w.e.f. 29.07.2008 (FN)
Ms Kirti Singh, Technical Assistant 'D' w.e.f. 29.07.2008 (FN)
Mr. Sunil Kumar Bisht, Technical Assistant 'D' w.e.f. 19.08.2008 (FN)
Mr. Ram Ujagar, Technical Assistant 'A' w.e.f. 28.07.2008 (FN)
Ms Richa Tiwari, Technical Assistant 'A' w.e.f. 31.07.2008 (FN)

Dr. Shantanu Chatterjee, Research Associate w.e.f. 16.02.2009 (FN)
Ms Jyoti Verma, Senior Research Fellow w.e.f. 16.01.2009 (FN) to 15.03.2009
Mr. Mayank Shekhar, Junior Research Fellow w.e.f. 14.07.2008 (FN)
Mr. Vinayak Srivastava, Junior Research Fellow w.e.f. 31.07.2008 (FN)
Mrs. Kalpana Devi, Junior Research Fellow w.e.f. 20.02.2009 (FN); resigned w.e.f. 20.03.2009
Mr. Ram Ketar, Field Assistant w.e.f. 16.02.2009 (FN)

AUDIT REPORT

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

1. We have audited the attached Balance Sheet of Birbal Sahni Institute of Palaeobotany, Lucknow, as at 31st March 2009 and attached Income and Expenditure account and Receipt and Payment account for the year ended on that date. These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these statements based on our audit.

2. We conducted our audit in accordance with the 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, evidences supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

3. Further to note on account and our comments in the Annexure "A" attached, we report that:

(a) We have obtained all the information and explanation, which to the best of our knowledge and belief were necessary for the purpose of our audit;
(b) In our opinion, proper books of account as required by law have been kept by the Institute so far as it appears from examination of books;
(c) The said Balance Sheet and Income & Expenditure account and Receipt & Payment account dealt with by the report are in agreement with the books of account;
(d) In our opinion and according to our information and explanations given to us, the said accounts give a true and fair view in conformity with the accounting principles generally accepted in India;

i) In case of Balance Sheet, of the state of affairs of the Institute as at 31st March, 2009;
ii) In the case of the Income & Expenditure Account, excess of Income over expenditure for the year ended on that date, and
ii) In the case of Receipt & Payment account, of the receipts & payments of the Institute for the year ended on that date.

Date : September 2, 2009
Place : Lucknow

For **R.N. Khanna & Company**
Chartered Accountants

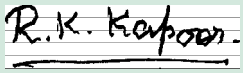
R.N. Khanna
(Partner)

ANNEXURE - 'A'

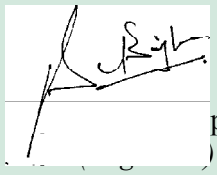
(Annexed to and forming part of the Audit Report for the year ended 31st March, 2009)
Comments/Audit observations on accounts of Birbal Sahni Institute of Palaeobotany- Lucknow for the year ended 31st March, 2009

Comments/Observations by the Chartered Accountants	Actions taken by the Institute
1. The Institute gets separate grant from the Department of Science and Technology for Plan and Non Plan expenditure based on budgeted approval. During the year, total grant of Rs.10,26,00,000/- received during the year which includes Rs.9,24,00,000/ for Plan expenditure, Rs.99,00,000/- for Non-Plan expenditure and Rs.3,00,000/- for the conference.	
During the year, the Institute has transferred Rs.74,00,000/- to Pension Fund.	The transfer to Pension Fund is as per the recommendation of the F&B Committee and approval of the GB.
2. During the year, the Institute has enforced the salary fixed by 6th Pay Commission and paid Rs.2,42,04,464.00 as 40% arrears, resulting the establishment cost of the Institute has shooted.	The payment of 40% arrears has been made as per the recommendation of the F&B Committee and approval of the GB.
3. The Institute has from current year introduced medical benefits to the Pensioners.	The medical benefits to the Pensioners have been as per the Scheme approved by the GB and the DST, New Delhi.
4. The Institute has charged depreciation on fixed assets w.e.f. 01.04.2005 at the rates prescribed under the Income Tax Act, 1961. During the year full depreciation is charged on Written Down Value of fixed assets as on 01.04.2008 and 50% depreciation on additions during the year.	---
5. The Institute have furnished stocks positions of priced publication valuing Rs.66.78 Lacs which includes Reserved Stocks. The Institute should take due measures to liquidate its inventory.	The stock of priced publications of the Institute is gradually being reduced.
6. We observed that in few cases assets do not bear the identification mark and year of purchase and the discrepancies reported on physical verification for shortage, damaged and unserviceable including the vehicles identified have not been disposed off and	The identification marks on Fixed assets is under process and nearing completion. Physical verification reports are being received and further action as per rules will be taken. The process for auction of unserviceable vehicle is also under way.

Comments/Observations by the Chartered Accountants	Action taken by the Institute
accounted. The Office Memorandum for physical verification of stocks of assets as on 31.03.2009 have been issued on May 20, 2009, the reports are yet to be received and examined, to be looked for appropriate action be taken for write-off, disposal and recovery of discrepancies reported.	
7. The old unsettled advances needs attention of the Institute for recovery and adjustment, further observed that official advances are not timely settled, to be adhered strictly. The balances outstanding from staff Rs.1,35,56,463.00 and on parties on capital account Rs.1,45,26,464.00 as on 31.03.2009.	The advances against staff are House Building Advances, Conveyance Advances, Computer Advances and a few cases of TA advances for field trips. Recoveries against advances are being made as per schedule. Most of the advances on parties on capital account are against LCs/Government Agencies and are being settled.
8. During the year Rs.2,42,00,155.00 are settled LC and credit of one lost bank demand draft lost in transit are accounted as refund from parties which were standing as advance.	Apart from cancellation of one LC (Rs.25.74 Lacs) and refund of one foreign draft (Rs.1.55 Lacs), remaining amount is due to settlements of LCs during the financial year as indicated in Receipt and Payment account in balance-sheet.
9. The investment of GPF includes Rs.124800.00 unadjusted amount of premium paid on RBI Bonds, which were redeemed in the year 2006-07.	The matter has been discussed in the F&B Committee and Governing Body meetings. The Investment Committee of the Institute has recommended for booking Rs.124800/- as an expenditure on revenue in the balance-sheet instead of the investment.



R K Kapoor
(Section Officer (F&A))



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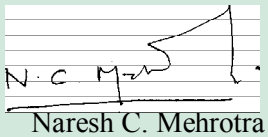


Naresh C. Mehrotra
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow

Balance Sheet as at March 31, 2009

Fig. in Rupees

CORPUS/CAPITAL FUND AND LIABILITIES	Schedule	Current Year	Previous Year
CORPUS/CAPITAL FUND	1	152007756	195407118
RESERVES ANS SURPLUS	2	20960903	20960903
EARMARKED/ENDOWMENT FUNDS	3	101053748	85707875
SECURED LOANS AND BORROWINGS	4	1000	1000
UNSECURED LOANS AND BORROWINGS	5	0	0
DEFERRED CREDIT LIABILITIES	6	0	0
CURRENT LIABILITIES AND PROVISIONS	7	135449	126066
TOTAL		**274158856**	**302202962**
ASSETS			
FIXED ASSETS	8	121173181	110362075
INVESTMENTS-FROM EARMARKED/ENDOWMENT FUNDS	9	100437008	85062653
INVESTMENTS-OTHERS	10	24402400	22891245
CURRENT ASSETS,LOANS,ADVANCES ETC.	11	28146267	83886989
(to the extent not written off or adjusted)			
TOTAL		**274158856**	**302202962**
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

CERTIFICATE

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

For **R.N. Khanna & Company**
Chartered Accountants

R.N. Khanna
(Partner)

R K Kapoor
(Section Officer (F&A))

...bai
(Registrar)

Naresh C. Mehrotra
(Director)

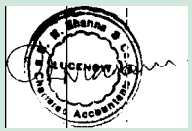
Birbal Sahni Institute of Palaeobotany, Lucknow

Income and Expenditure Account for the year ending March 31, 2009

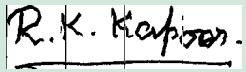
Fig. in Rupees

INCOME	Schedule	Current Year	Previous Year
Income from Sales/Services	12	1054793	963324
Grants/subsidies (OB, Deposit A/C and Transfer from Cap. Fund)	13	102600000	63000000
fees/Subscriptions	14	0	0
Income from Investments (Income on Invest. From earmarked/endow.Funds transferred to Funds)	15	1511155	946842
Income from Royalty, Publication etc.	16	169114	114903
Interest Earned	17	1092743	2963513
Other Income	18	501498	670211
Increase/(decrease)in stock of Finished goods and works-in-progress	19	0	0
TOTAL (A)		**106929303**	**68658793**
EXPENDITURE			
Establishment Expenses	20	100100504	56336259
Other Administrative Expenses etc.	21	24188008	20350875
Expenditure on Grants, Subsidies etc.	22	0	0
Interest	23	0	0
Depreciation (Net Total at the year-end-corresponding to Schedule 8)		18640153	16322011
TOTAL (B)		**142928666**	**93009145**
Balance being excess of Income over Expenditure A-B		(35999362)	(24350352)
Transfer to Special Reserve (Specify each)		0	6000000
Transfer to/from General Reserve to Pension Fund		7400000	9400000
BALANCE BEING SURPLUS/DEFICIT CARRIED TO CORPUS/CAPITAL FUND		**(43399362)**	**(39750352)**
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

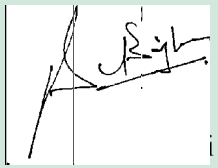
For **R.N. Khanna & Company**
Chartered Accountants



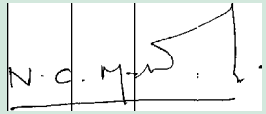
R.N. Khanna, *(Partner)*



R K Kapoor
(Section Officer (F&A))



(Registrar)



Naresh C. Mehrotra
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow

Receipts and Payments Account for the year ended March 31, 2009

Fig. in Rupees

RECEIPT	Current Year	Previous Year	PAYMENTS	Current Year	Previous Year
I. Opening Balances			1) Expenses		
a) Cash in hand	68	30	a) Establishment Expenses(Corresponding to Schedule 20)	100100504	56336259
b) Bank Balances			b) Administrative Expenses(Corresponding to Schedule 21)	24188008	20350875
i) In current accounts	35737202	104127845	II) Payments made against funds for various projects		
ii) In deposit accounts			(Name of the fund or project should be shown along with		
iii) Endowment deposits			the particulars of payments made for each project)		
iv) Salary Account	59368	1000			
II. Grants Received					
a) From Government of India	102600000	63000000	III. Investments and deposits made		
b) From State Government			a) Out of Earmarked/Endowment funds		
c) From other sources(details) (Grant for capital & revenue exp. To be shown separately)			b) Out of Own Funds (Investments-Others)	7400000	15400000
d) Deposit Account			IV. Expenditure on Fixed Assets & Capital Work-in-Progress		
			a) Purchase of Fixed Assets	23633301	10582028
III. Income on Investment from			b) Expenditure on Capital Work-in-Progress		
a) Earmarked/Endow. Funds		0			
b) Own Funds (Utilized)			V. Refund of surplus money/ Loans		
IV. Interest Received			a) To the Government of India		
a) On Bank deposits	562123	2440287	b) To the State Government		
b) Loans, Advances etc.	530620	523226	c) To other providers of funds		
V. Other Income (specify)			VI. Finance Charges (Interest)		
i) Sale proceeds of Publications	169114	114903			
ii) Miscellaneous Income	427096	657275	VII. Other Payments (Specify)		
iii) Sale of Services (Consultancy)	1054793	963324	i) Advances to Staff	1711275	4194010
iv) Group Insurance	49776	298744	ii) Earnest Money Refunded	10000	20000
			iii) Advances to Parties	10949728	31750342
VI. Amount Borrowed			iv) Group Insurance	77258	271262
VII. Any other receipts (give details)			VIII. Closing Balances		
(Pension Contribution)	46920	12936	a) Cash in hand	102	68
			b) Bank Balances		
			i) In current accounts	-73993	35737202
i) Recovery of Advances	2650214	2551844	ii) In deposit accounts		
ii) Earnest Money Deposit	46865	10000	iii) Saving account	138131	59368
iii) FDR Matured	0	0	iv) Endowment deposit account		
iv) Recovery from parties	24200155		v) Excess Expenditure		
TOTAL	168134314	174701414		168134314	174701414

Chartered Accountants

R.N. Khanna, *(Partner)*

R K Kapoor
(Section Officer (F&A))

(Registrar)

Naresh C. Mehrotra
(Director)

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