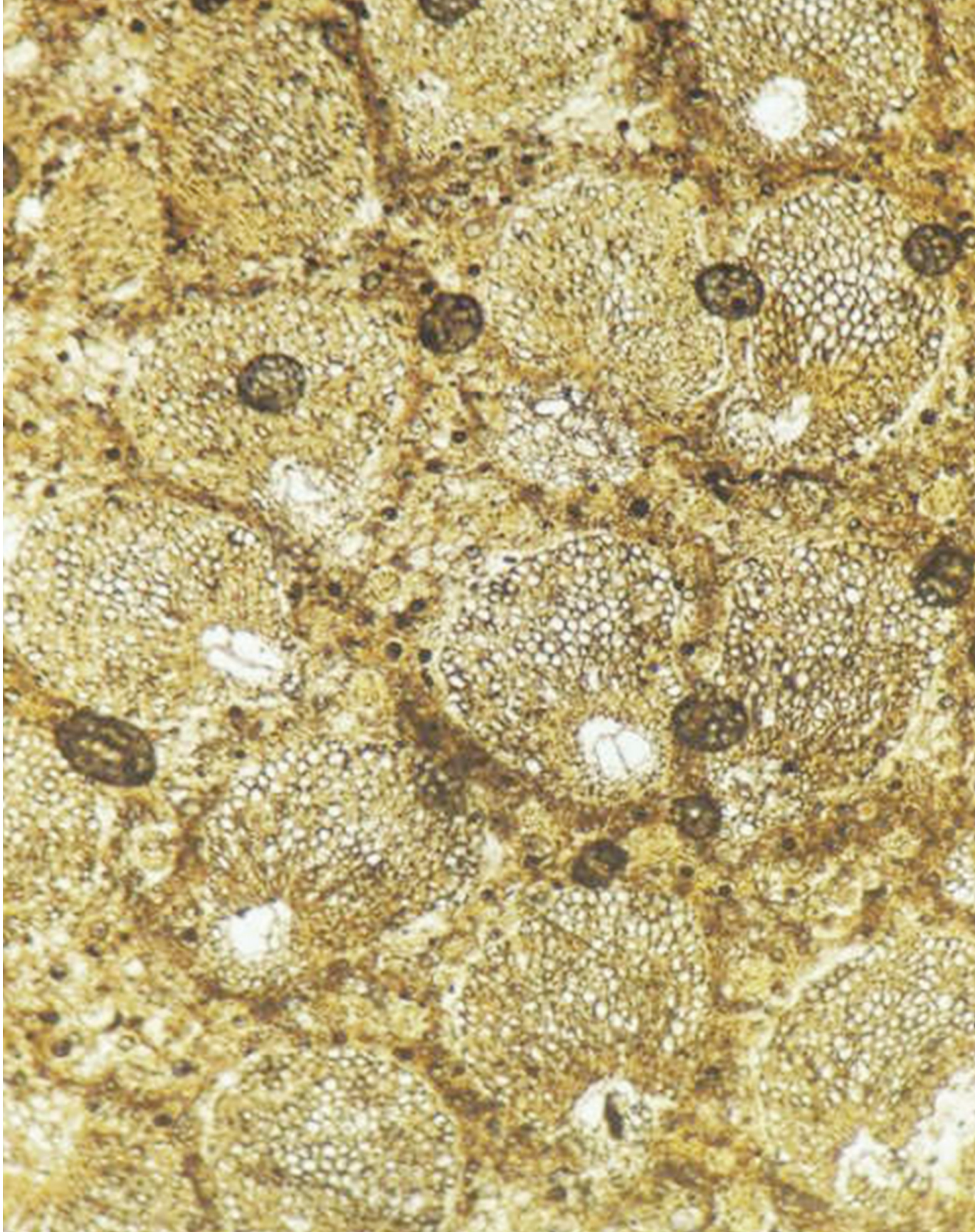


ANNUAL REPORT



2007 - 2008



*Birbal Sahni Institute of Palaeobotany
Lucknow*

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

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

With Best Compliments



Naresh C. Mehrotra
Director





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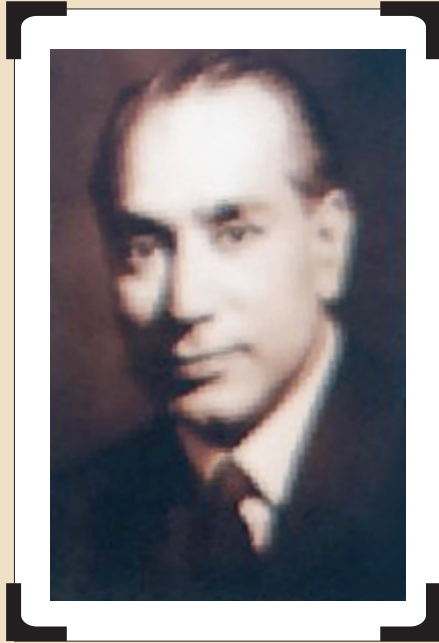
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Front Cover: A palm wood *Palmoxydon assamica* sp.nov. from the Tertiary of North-east India (refer page no. 18)

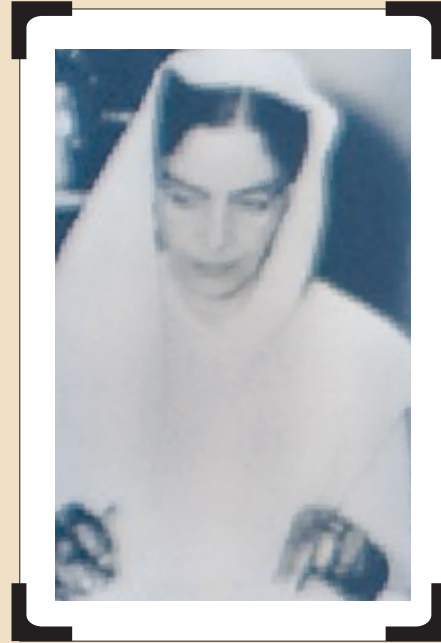
Back Cover: A view of Vastan Lignite Mine Section, Gujarat showing resin bands (refer page no. 27)

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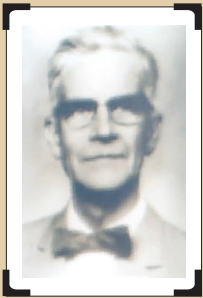


Prof. Birbal Sahni



Smt. Savitri Sahni

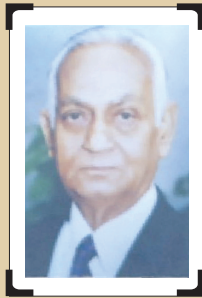
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Dr. K.R. Surange



Dr. M.N. Bose



Dr. B.S. Venkatachala



Dr. R.S. Tiwari



Prof. A.K. Sinha

Current Institutional Executive Head



Dr. N.C. Mehrotra

Organization Structure

Department of Science & Technology Autonomous Institute





Participants of XXI ICMS held at BSIP

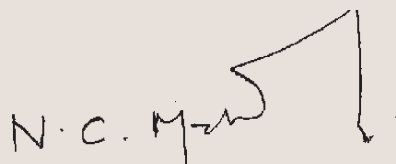
Foreword

The Birbal Sahni Institute of Palaeobotany, Lucknow, is a premier Research Organization dedicated to both basic and applied aspects of Palaeobotany. The Eleventh Plan Research Activities during the year 2007-2008 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.

Year long research activities have culminated in significant research data helpful to users. 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 the distinction of organising a National Symposium on *Palynology in Fossil Fuel Exploration* during November 14-15, 2007 and *XXI Indian Colloquium on Micropalaeontology and Stratigraphy* during November 16-17, 2007.

I am extremely pleased to forward this Annual Document of the Institute comprising Scientific, Technical and Administrative collective inputs. Necessary advice was sought from the peers of Governing Body and Research Advisory Council.

Members of Publication, RPCC, Museum, Administrative and Technical units are collectively responsible to bring out this document.



(Naresh C. Mehrotra)
Director



Executive Summary

The Birbal Sahni Institute of Palaeobotany (BSIP), Lucknow, an autonomous institution under the Department of Science and Technology, Govt. India is dedicated to promote research on basic as well as applied aspects of Palaeobotany and allied Earth System sciences. The institute has a commitment to ensure growth in basic and applied aspects of paleophyto-resource studies and their bearing on climate change. Research activities during 2007-2008 were focused under six Thrust Area Programmes:

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

Various research groups are motivated to contribute data on identified mandates in the frontier research themes.

During the year 2007-2008 efforts of various Working Groups resulted in 71 published papers, 118 conference/symposia abstracts, 23 articles / reports, besides 35 research papers accepted for publication. Two scientists were deputed abroad under inter-academy exchange programme of INSA. One scientist participated in the 27th Indian Scientific Expedition to Antarctica. Twenty-six scientists, one Administrative Officer and One Technical staff were deputed for attending various training programmes and study/ consultancy visits. Forty-two scientists and one Technical Officer were deputed to attend various national and international conferences/ seminars/ workshops. Ninety-five research papers were presented in these meetings at different centers of India. All the scientists were also deputed to attend *XXI Indian Colloquium on Micropalaeontology and Stratigraphy* (21st ICMS), which was organized by BSIP during November 2007. Research highlights of the various working Groups are as follows:

Precambrian Palaeobiology Group

Recovery of primitive animal casts akin to Ediacaran animal fossils on the silt stone, Sonia Sandstone Formation (Jodhpur Group) in the Artiyan Kalan area, Jodhpur district, Rajasthan is significant as it may help to trace evolution of ediacaran fauna.

Low amount of the OWM including fragmentary trichomes in the microbiotic assemblage from Bhalucona Formation of the Singhora Group, indicates tentatively Mesoproterozoic age (~1,400 Ma) and probably warm environmental conditions.

Gondwana - Mesozoic Palaeofloristics Group

New pteridospermous leaf discovered from Pench Valley area with well-preserved cuticular features indicate the firm example of pteridospermic leaves in Gondwana flora. Occurrence of such leaves, stalked seeds and calamitalean-axes shows presence of mixed flora in Satpura Basin.

The cuticles recorded from carbonaceous shales (Gondwana), exposed along the bank of Gopad River, near Nidhpuri show unusual development of massive trichomes having strong rounded (disc-like) foot cells giving rise to short glandular trichomes, so far not reported in the leaf cuticle of any of the extinct seed plants.

Occurrence of *Ginkgo* leaves in the entire basin is important because of its long survival history during the geological past and its resemblance with extant *Ginkgo* leaves. 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.

Autecology of *Elatocladus* showing long, narrow, smooth margined leaves reflects favourable environment of growth during the Early Cretaceous times in the Krishna-Godavari (K-G) Basin. Synecology of floral assemblage from the K-G Early Cretaceous sequence suggests that individual floral components were derived from small community consisting of individual species.

Gondwana Palynology Group

Early Cretaceous Palynoassemblage within the Intertrappean sediments (181.40-215.00 m) in bore-hole. RRK-1, Damodar Basin is recognized for the first time in this part of Raniganj Coalfield.

Cenozoic Palaeofloristics Group

Rare occurrence of dinoflagellate and filamentous algae in a palm peduncle recovered from the offshore sediments of Gogha, near Bhavnagar (Gujarat) was reported.

Two new fossil woods from the Surma Group of Lumding (Assam) - *Palmoxylon assamicum* sp. nov., a first record of a palm wood from the Neogene of northeast India; *Daniellia miocenica* sp. nov. is phytogeographically important as it is presently found in Africa.

A carbonised fossil fruit comparable to extant species *Terminalia foetidissima* Griff. of the family Combretaceae has been described from the lignite bed overlying China clay at Payangadi Clay Mines, Cannanore (Kerala). This forms first report of the genus *Terminalia* from this area, indicating presence of littoral swamp forests with warm humid climate.

Late Mesozoic and Cenozoic Palynology Group

Palyno-assemblage of Deccan Intertrappean deposits, near Anjar town, Gujarat exhibits Maastrichtian age. Fungal remains (spores and fruiting bodies) are also abundantly represented in the assemblages indicating a warm and humid climate. The associated remains of aquatic freshwater ferns (*Ariadnaesporites*, *Azolla* and *Minerisporites*) belonging to Salviniaceae indicate that the sedimentation took place in small freshwater bodies.

Palynofacies and palynostratigraphic analyses of a 4.00 m thick sedimentary section exposed along eastern bank of Saraijan River in Upper Assam Basin indicate that coal and carbonaceous shale were deposited under lacustrine to deltaic conditions, while clayey unit deposited under transgressive phase of shallow marine condition.

Marine Micropalaeontology Group

Dinocysts/ palynofacies analyses of the coal bearing clastic sandstone (Lakadong Sandstone Formation) provided biotic evidence to characterize PETM interval and to enhance understanding of paleoecological and relative sea level changes associated with this event. The study reveals considerably low diversity of terrestrial palynoflora prior to PETM event and enhanced diversity pattern subsequent to the event.

Rich and well-diversified nannofossil assemblages from the Langpar Formation revealed a succession of nannofossil events (FADs & LADs) closely comparable with globally well established low-latitude nannofossil zonations. Danian zonal markers of NTP1, NTP2, NTP3, NTP5 and NTP7 zones (corresponding to NP1-NP4 and CP1-CP3 zones) of Tethyan Intermediate Province, Europe and Tunisia have been recorded.

Kaladongar Formation exposed in Kuar Bet Islet which is the last outcrop within Indian Territory, yielded reworked Pleinsbachian to Torcian age nannofossils having wide ranging palaeogeographical implication related to breakup of Gondwanaland.

Organic Petrology Group

Petrological and palaeobotanical evidences from Indian Tertiary (Eocene-Miocene) lignites show that dominant huminite group is mainly represented by attrinite and densinite (humodetrinite) macerals. The deposits seem to originate primarily from deciduous/ evergreen angiospermous forest vegetation growing under humid tropical climate. The lignite-forming flora consisted of inland, coastal, beach, back mangrove, mangrove-associates and mangrove plant communities, in addition to moisture- and shade-loving angiosperms herbs and shrubs as well as those of pteridophytes, which grew profusely as under growths.

Fossil Fuel Exploration Research Group

Organic-walled microfossils comprising algae and acritarchs are recorded from the Gotan Limestone Formation (Bilara Group), Marwar Supergroup (Rajasthan). The thermal alteration index (TAI) of recovered Type I liptinites indicates matured organic matter facies significant for hydrocarbon exploration.

Quaternary Palaeoclimate Group

Geochronological and palynological data from Chilka Lake indicate records one of the earliest ($12,960 \pm 130$ yrs BP) mangrove environments in south east Asia.

Broadly 3 phases of environmental change have been identified from four shallow cores and surface samples in Nilarevu river of Godavari Delta. Arcellaceans combined with palynological proxy variables in the river-sea transitional ecosystem is reported for the first time from such sub-optimal ecosystems in India.

Pollen analysis of a 1.30 m deep sediment core from Dabi Swamp, Shahdol district Based on the representation of major arboreals and non-arboreals, the pollen sequence is divisible in three phases This apparent alteration in the vegetation mosaic is attributable to the prevalence of warm and relatively less humid climate in the region.

Pollen analytical investigation of 18 surface samples from Umaria and Hoshangabad show erratic representation of most of the tree taxa, despite their good presence in the forest floristics that could be attributed to their low pollen productivity since they exhibit a strong tendency of entomophily.

The lacustrine lake sediments of Upper Assam Basin and adjoining foot-hill forests of Arunachal Pradesh (Subansiri District) revealed *Areca catechu* pollen from 1,000 yrs BP sediment of Lekhapani Reserve forest, Tinsukia (Assam) for the first time where no such trees are found at present.

Dendrochronology Group

The chronology of Himalayan cedar extends back to the early part of the 16th century and Himalayan pencil cedar to the early part of the 13th century.

Tree-growth climate relationship of teak growing at Perambikulam, Kerala indicates that precipitation during May is the limiting factor for the growth of this tree at the region.

Palaeoethnobotany Group

The ancient site at Sanchankot/Ramkot, District Unnao (UP) from cultural horizon of P.G.W., N.B.P.W., Sunga and Kushana Periods (approx. 1000 BC-300 AD) site exhibits ancient plant economy comprising of the field-crop finds belonging to cereals; pulses along with seeds of oil yielding plants.

The remains of custard apple (*Annona squamosa*) from Kushana levels (100-300 AD) reveal the new evidence from this region in Ganga plain. Analysed archaeobotanical samples from a Harappan settlement at Kanmer datable to 2800-1500 BC.

Isotope and Geochemistry Group

Multiple levels of soft-sediment deformation structures (seismites) of Late Quaternary times are recorded from the Spituk palaeolake near Leh town, along Indus Suture Zone (ISZ) and the Khalsar palaeolakes, along Shyok Suture Zone (SSZ) and Karakoram Fault (KF). The release of stresses along ISZ, SSZ and KF in the form of earthquakes is concentrated between ~35,000 yr BP to approximately the Last Glacial Maxima (LGM).

Arctic -Antarctic Research Cell

The palynological study of 3 dry lake bed soil sections (clay lenses trapped between the sandy/silty layers) from Schirmacher Oasis depicts the occurrence of palynodebris including diatom (30%), desmids (15%) and exotic angiosperm (4%) only in clayey silt column dated back to 3.3 yrs BP indicating warm and humid climate.

Palynological investigations in sub-surface sediments of bore-holes GSP-1 and 9 from Satrajpalli area, Mulug coal belt, Godavari sub-basin have revealed the presence of two palynoassemblages, one belonging to Early Permian (Barakar) palynoflora and other belonging to Late Permian (Raniganj) palynoflora.

Sagar Kanya Cruise

Under the ongoing collaboration with National Institute of Oceanography (NIO), one scientist of the Quaternary Palaeoclimate Group participated in the ORV **Sagar Kanya cruise SK-237** organised in the region off Kerala-Konkan coast during July-August 2007 to collect sediment samples from the Arabian Sea.

XXVII Antarctic Expedition

One of our scientists had participated in the XXVII Indian Expedition to the Antarctica (during December 6, 2007-April 11, 2008) and collected samples (subsurface sediments, moss layer, algae and water from different lakes) for palaeoclimatic analyses from two major sites— Schimacher Oasis and Larseman Hills.

Commemoration & Memorial Lectures

The Institute celebrated its 61st Foundation Day on September 10, 2007. On this occasion Prof. S.K. Brahmachari, Director, Institute of Genomics and Integrative Biology, Delhi delivered '11th Jubilee Commemoration Lecture' on the topic *Human Genome Research: The Road Ahead*. On the same evening, Dr. P.K. Seth, Ex-Director, ITRC and presently Chief Executive Officer, Biotech Park, Lucknow delivered a popular lecture in Hindi on *Biotechnology in India and Opportunities in Bio-business* to mark the beginning of Hindi Pakhwara.

On November 14, 2007—the Founders' Day, two memorial lectures were organized. Professor Harsh K. Gupta, Former Secretary, DOD, Govt. of India and presently Raja Ramanna Fellow at National Geophysical Research Institute, Hyderabad delivered the '53rd Sir Albert Charles Seward Memorial Lecture' on the theme of National interest *Earthquake Precursors: Indian Scenario*. Sri Rasik Ravindra, Director, National Centre for Antarctic and Ocean Research, Goa delivered the '37th Birbal Sahni Memorial Lecture' on the fascinating topic— *Polar Research: Indian Contributions*.

National Events

Institute celebrated Independence Day and Republic Day (2007) with great enthusiasm. This year also, the Institute celebrated Science Day by organizing science film show as well as, collage, poster and essay competitions for the city students, and two lectures for BSIP staff. The programme was spread over several days during February 21 and 28, 2008. Institute also observed an Open House on the Science Day (28th February). Besides outreach activities were organized throughout the year which included three workshops related to science communication/journalism in cooperating each with Doordarshan, Regional Training Institute (All India Radio) and the District Science Club and participated in exhibitions in Delhi, Kozikode and Lucknow.

Symposium on Palynology in Fossil Fuel Exploration

Keeping in view the significance and role of palynological research in the field of fossil fuel exploration including oil, gas, and coalbed methane, a National Symposium on *Palynology in Fossil Fuel Exploration* was hosted by BSIP during November 14-15, 2007, coinciding with its Founders' Day Function. The event was a part of Golden Jubilee celebration activities of Geological Society of India (Bangalore). The symposium aimed to provide a platform for in depth dialogue and discussion on the innovative approaches and breakthroughs in the fields of palynological, palynofacies and organic petrological researches and their applications to address the basic and industrial problems related to hydrocarbon exploration.

The two-day symposium was inaugurated by Prof. Harsh K. Gupta, Raja Ramanna Fellow at NGRI (Hyderabad) and Vice-President, Geological Society of India, in the forenoon of 14th November. Over 50 delegates, representing scientists, planners and academicians from ONGC (Dehradun & Vadodara), Directorate General of Hydrocarbons (New Delhi), Reliance Industries Ltd. (Navi Mumbai), Central Mining and Fuel Research Institute (Dhanbad), National Geophysical Research Institute (Hyderabad), BSIP (Lucknow), etc. attended the symposium. Guest of Honour Shri Jokhan Ram, Executive Director-Chief KDMIPE (Dehradun) in the Theme Lecture *Multiple Applications of Palynology in Hydrocarbon Exploration* illustrated that the subject of Palynology has developed into a multifaceted discipline in recent years.

A Round Table discussion was held (in the afternoon of November 15th) under the Chairmanship of Prof. Ashok Sahni (Chandigarh) for sharing of the perception of the experts from academia and industry who are involved in studies related to hydrocarbon research and exploration. The purpose of these discussions was to project future directions/approaches in R&D in High Impact Palynological research, so as to find avenues to develop *outsourcing hubs* in institutions/research labs in the academia sector to take up exploration related palynological work from the industry. The general consensus that emerged out of these discussions favoured greater involvement of academia in taking up research projects in consultation with industry in areas of focus with reference to fossil fuels exploration activities.

XXI Indian Colloquium

The *XXI Indian Colloquium on Micropalaeontology and Stratigraphy* (21st ICMS) was organized by BSIP during November 16-17, 2007. The Colloquium was mainly focused on various aspects of Micropalaeontology and Stratigraphy on selected focal themes. The inaugural function was presided over by Dr. N.C. Mehrotra, Director (BSIP). The Welcome Address and an overview of ICMS: *A trek through the past and voyage in to the future* was presented by Dr. Rahul Garg (BSIP), Convener 21st ICMS. Dr. B.R. Arora, Director, Wadia Institute of Himalayan Geology (Dehradun) was the Chief Guest and Dr. Arabinda Mitra, Executive Director, INDO-US Science & Technology Forum (New Delhi) was the Guest of Honour in the Inaugural Function. Prof. Ashok Sahni FNA, General President of 21st ICMS delivered the Presidential Address entitled *Biomaterials to Nannomaterials: A new dimension for Micropalaeontology*.

The 21st ICMS was attended by over 200 delegates from different States of the country, representing scientists and research students from 12 Institutions, besides BSIP; research students and faculty members of 28 Universities and Colleges; besides researchers from GSI, ONGC, DGH, and Reliance Industries Limited. An abstract volume containing 173 abstracts was released. Sixty two research papers were presented orally on various aspects of Micropalaeontology dealing with the biotic assemblages from Precambrian to Recent. In addition, five Key Note lectures were also delivered. Eighty posters were presented by the delegates and amongst these special awards were given to young researchers specifically for the poster session. ICMS provides a common platform for meeting of scientists from both Academia and Industries of India and through scientific deliberations and interactions obviously some significant goal is achieved. Some fruitful discussions and interactions between the scientists from the academia and industries regarding the applied aspects of micropalaeontology were one of the major achievements of this colloquium. Dominance of young researchers revealed the earnestness of younger generation in the field of Micropalaeontology.



The Chairman Governing Body, Dr. T. Ramasami and the Director, Dr. N.C. Mehrotra discussing Institute activities during the Chairman's visit to BSIP during September 2007



A view of Foundation Day celebrations on 10 September 2007

Governing Body

Chairman

(w.e.f. 20.12.2006 to 19.12.2009)

Dr. T. Ramasami

Secretary

Department of Science and Technology
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Member-Secretary (Ex-officio)

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Director

Birbal Sahni Institute of Palaeobotany, Lucknow

Non-Member Assistant Secretary (Ex-officio)

Dr. S.C. Bajpai

Registrar

Birbal Sahni Institute of Palaeobotany, Lucknow



Research Advisory Council

(w.e.f. 30.05.2007 to 29.05.2010)

Chairman

Professor Ashok Sahni
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Member-Convener (Ex-officio)

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Non-Member Secretary (Ex-officio)

Dr. Rahul Garg

Convener, Research Planning and Coordination Cell, BSIP

Finance and Building Committee

(w.e.f. 20.12.2006 to 19.12.2009)

Chairman (Ex-officio)

Dr. T. Ramasami
Secretary, DST &
Chairman, Governing Body
Birbal Sahni Institute of Palaeobotany

Members

Shri K.P. Pandiyan
Joint Secretary & Financial Adviser
or his Nominee, DST, New Delhi

Dr. B.R. Arora
Director, WIHG &
Member, Governing Body
Birbal Sahni Institute of Palaeobotany

Shri Ajai K. Srivastava
Chief Engineer, Museum Project
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Director
Birbal Sahni Institute of Palaeobotany

Non-Member Secretary (Ex-officio)

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

Foundation Day

The Institute celebrated its 61st Foundation Day on September 10, 2007. On this occasion Professor Samir K. Brahmachari, Director, Institute of Genomics and Integrative Biology, Delhi delivered ‘11th Jubilee Commemoration Lecture’ on the topic *Human Genome Research: The Road Ahead*.

On the same evening, Dr. P.K. Seth, Ex-Director, ITRC and presently Chief Executive

Officer, Biotech Park, Lucknow delivered a popular lecture in Hindi on *Biotechnology in India and Opportunities in Bio-business* to mark the beginning of Hindi Pakhwara.

Professor Ashok Sahni, Chairman, Research Advisory Council of our Institute presided over the function. Many guests and scientists from outside the Institute attended the function.



Founders' Day

On November 14, 2007—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.

Professor Harsh K. Gupta, Former Secretary, DOD, Govt. of India and presently Raja Ramanna Fellow at National Geophysical Research Institute, Hyderabad delivered the '53rd Sir Albert Charles Seward Memorial Lecture' on the theme of National interest *Earthquake*

Precursors: Indian Scenario.

Sri Rasik Ravindra, Director, National Centre for Antarctic and Ocean Research, Goa delivered the '37th Birbal Sahni Memorial Lecture' on the fascinating topic—*Polar Research: Indian Contributions.*

Prof. Ashok Sahni, Professor Emeritus, Center of Advanced Studies in Geology, Chandigarh and presently Chairman of our Research Advisory Council presided over the function. Many guests and scientists from outside the Institute and several symposium delegates attended the occasion.



National Science Day

This year also, the Institute celebrated National Science Day by organizing science film show as well as collage, poster and essay competitions for the city students, and two lectures for BSIP staff. The programme was spread over a week during February 21 and 28, 2008.

One hundred and nine students of class VI to XII from 14 schools submitted essays on *Our Planet Earth*. On 21st February, there were 47 entrants for collage (class VI- IX) and 86 for the poster competition (up to class V) held on the day on *Our Planet Earth* and *Our Dear Earth* respectively. The topic for the essay was *Science and Technology: Root as well as Remedy of the Environmental Problem*.



The Institute also observed Open House on the Science Day (28th February). A large number of students, some with parents and teachers, visited the museum and laboratories of the Institute. On this auspicious day, Dr. N.C. Mehrotra, Director BSIP welcomed Dr. S.K. Grover, Dy. DG, Doordarshan and Prof. Robert A Spicer, Open University, UK. Dr. Mehrotra said that the competitions organized for the students serve the great purpose of

sensitizing them to conservation of our resources. Speaking on the occasion, Dr. Grover said that the term scientific temper was made popular in Indian context by the late Prime Minister Pt. Nehru. Elaborating on the philosophy of broadcast, he said that media's job is to appraise the society of the quality of life and also to motivate all to attain it.

Prof. Spicer made an illustrated presentation on Planet Earth and its problems. He elaborated on the challenge before the society in attaining economic and industrial growth without damaging the environment. He said that understanding the past changes is the best way to be able to predict future changes which demands characterizing the past changes. It is imperative that we develop appropriate precise and accurate proxies for the parameters such as surface temperature of Earth. The two guests gave away prizes to 32 winner students out of a total of about 250 competitors. Dr A.K. Srivastava proposed the Vote of Thanks.

Other Outreach Activities

Various activities carried out/ supported throughout the year under outreach programme were reported by the coordinator of the Science Day programme, Dr. C.M. Nautiyal. These included three Workshops related to science communication/ journalism in cooperating each with Doordarshan, Regional Training Institute (All India Radio) and the District Science Club and participated in exhibitions in Delhi, Kozikode and Lucknow. In the science journalism Workshop coordinated with District Science Club-Lucknow during June 27- July 01, 2007, about 40 persons were trained in the skill of science writing/ communication/ journalism. The Workshop was inaugurated by Dr. PK Seth, CEO of the Biotechnology Park, Lucknow who spoke on Biotechnology. The resource persons included Prof. Ashok Sahni from Panjab University, some other scientists from BSIP and other institutions, and renowned journalists of Lucknow.

Symposium on Palynology

Keeping in view the significance and role of palynological research in the field of fossil fuel exploration including oil, gas, and coalbed methane, a National Symposium on *Palynology in Fossil Fuel Exploration* was hosted by BSIP during November 14-15, 2007, coinciding with its Founders' Day Function. The event was a part of Golden Jubilee celebration activities of Geological Society of India (Bangalore). The symposium was sponsored by Department of Science and Technology (New Delhi) and Oil and Natural Gas Corporation Limited (Dehradun).

Palynology has proven its application in all the commercially producing sedimentary basins of India and has strong potential in the Frontier basin also. The symposium aimed to provide a platform for in depth dialogue and discussion on the innovative approaches and breakthroughs in the fields of palynological, palynofacies, and organic petrological researches and their applications to address the basic and industrial problems related to

hydrocarbon exploration. The symposium was arranged to address the following focal themes:

- High-resolution biostratigraphy: regional case studies,
- Sequence biostratigraphy and palaeoenvironmental modeling,
- Palynofacies, organic petrology and source rock evaluation, and
- Modern techniques, tools and computer applications in organic matter characterization.

The two-day symposium was inaugurated by Prof. Harsh K. Gupta, Raja Ramanna Fellow at NGRI (Hyderabad) and Vice-President, Geological Society of India, in the forenoon of Wednesday, 14th November. He exhorted the geoscientists and palynologists to contribute their might in evaluating the fossil fuel resources for fulfilling the energy demands of the country. Concerted multi-disciplinary and multi-institutional R&D programmes have to be urgently taken up and developed in the true



'team India' spirit. He stressed the need for closer interaction between academia and industry. Over 50 delegates, representing scientists, planners and academicians from ONGC (Dehradun & Vadodara), Directorate General of Hydrocarbons (New Delhi), Reliance Industries Ltd. (Navi Mumbai), Central Mining and Fuel Research Institute (Dhanbad), National Geophysical Research Institute (Hyderabad), BSIP (Lucknow), etc. attended the symposium.

The Director, BSIP in his Welcome Address stated that with the accelerated exploration activities, demand for concerted geo-scientific researches is bound to increase substantially in near future. A better fine-tuning of academic research in line with industrial demands and professional attitude are required to channelize the immense academic expertise available, which should highlight potential of palynological research in the benefit of fossil fuel industry (Hydrocarbon, Coal and CBM) in the coming decades.

Guest of Honour Shri Jokhan Ram, Executive Director-Chief KDMIPE (Dehradun) in the Theme Lecture *Multiple Applications of Palynology in Hydrocarbon Exploration* illustrated that the subject of Palynology has developed into a multifaceted discipline in recent years. Various parameters of palynology are being presently applied by different oil companies for precise dating of sediments, high resolution sequence biostratigraphy, palaeoenvironmental modelling, and evaluation of hydrocarbon source rock potential.

Multiple specific applications were demonstrated in the following various Key-note lectures by:

- R.R. Singh (ONGC) on *Development in modern Geochemical Techniques in Organic Matter characterization.*
- N.C. Mehrotra (BSIP) on *Palynofossils and High-resolution Biostratigraphy: Examples from Petroliferous basins of India.*
- Manoj Asthana (ONGC) on *Role of Source Rock Palynology in Basin analysis.*

- S. Nanjundaswamy & P.N. Kapoor (ONGC) on *Palynofacies and Organic Maturity as indicators for delineating Source Potential Facies in Space and Time- A case study.*
- A.K. Singh and others (CMFRI & BSIP) on *Coal Bed Methane Genesis and its Status in Indian Context.*
- B. Kumar & Devleena Mani (NGRI) on *Modern Geochemical Techniques, Tools and Computer Applications in Hydrocarbon Research and Exploration.*
- Ravi Mishra (ONGC) reviewed the *Global vis-à-vis Indian Energy Scenario.*

A Round Table discussion was held (in the afternoon of November 15th) under the Chairmanship of Prof. Ashok Sahni (Chandigarh) for sharing of the perception of the experts of from academia and industry who are involved in studies related to hydrocarbon research and exploration. Besides the delegates, Shri Ravi Shanker, Ex-DG, GSI and Vice-President, Geological Society of India, and Shri Jokhan Ram, ED & Head, KDMIPE (ONGC) also participated and shared their views. The purpose of these discussions was to project future directions/approaches in R&D in High Impact Palynological research, so as to find avenues to develop *outsourcing hubs* in institutions/research labs in the academia sector to take up exploration related palynological work from the industry. The general consensus that emerged out of these discussions favoured greater involvement of academia in taking up research projects in consultation with industry in areas of focus with reference to fossil fuels exploration activities. It was also informed that ONGC has already taken concrete steps in this direction. Director (BSIP) while presenting a vote of thanks emphasized that the Institute is ready and capable of undertaking industry related palynological work and expressed the hope for greater and long-term association with industry. The symposium was a good platform for sharing knowledge, information and experiences of the country's experts engaged in hydrocarbon exploration.

XXI Indian Colloquium

Following the Symposium on Palynology in Fossil Fuel Exploration, the *XXI Indian Colloquium on Micropalaeontology and Stratigraphy* (21st ICMS) was also organized by BSIP during November 16-17, 2007. The Colloquium was mainly focused on various aspects of Micropalaeontology and Stratigraphy from different geological ages and different geographical locations of the country. Considering the recent trends of research on varied groups of microfossils (with diverse approaches) the colloquium was confined to the following focal themes:

- Precambrian Palaeobiology and search for Early Life
- Phanerozoic biostratigraphy and palaeoenvironmental analysis
- Past global climate changes and Extreme Climates in Earth History
- Global bioevents, time boundaries and mass extinction
- Microfossil proxies and Quaternary Palaeoclimate
- Microfossils and Sequence Biostratigraphy
- Microvertebrates: Evolutionary and stratigraphic significance
- Role of microfossils in Palaeo-oceanography and integration with isotopic and trace elemental studies
- Applied Micropalaeontology and Fossil Fuel Exploration
- Palynology and Palynofacies: Application in biostratigraphy and Source Rock Evaluation
- Recent foraminifera: Culture studies and their application
- Recent and Ancient benthic communities – their ecological significance
- Evolutionary trends in microfossils
- Molecular Micropalaeontology
- Modern techniques, tools and computer applications in Micropalaeontological research

The inaugural function was presided over by Dr. N.C. Mehrotra, Director (BSIP). The Welcome Address and an overview of ICMS: *A trek through the past and voyage into future* was presented by Dr. Rahul Garg (BSIP), Convener 21st ICMS. Dr. B.R. Arora, Director, Wadia Institute of Himalayan Geology (Dehradun) was the Chief Guest and Dr. Arabinda Mitra, Executive Director, INDO-US Science & Technology Forum (New Delhi) was the Guest of Honour in the Inaugural Function. Prof. Ashok Sahni FNA, General President of 21st ICMS

delivered the Presidential Address entitled *Biomaterials to Nanomaterials: A new dimension for Micropalaeontology*.

The 21st ICMS was attended by over 200 delegates from different States of the country, representing scientists and research students from 12 Institutions, viz. Agharkar Research Institute (Pune), French Institute (Pondicherry), Indian Institute of Tropical Meteorology (Pune), Institute of Petroleum Technology (Gandhinagar & Dehradun), National Centre for Antarctic & Ocean Research (Goa), National Institute of Oceanography (Goa), Physical Research Laboratory (Ahmedabad), SD Marine Biological Institute (West Bengal), Wadia Institute of Himalayan Geology (Dehradun), Asian Biostratigraphic Services (Korattur, Chennai), besides BSIP (Lucknow); research students and faculty members of 28 Universities and Colleges (Aligarh, Allahabad, Bangalore, Baroda, Chandigarh, Cochin, Chennai, Dehradun, Delhi, Garhwal Srinagar, Jammu, Kharagpur, Kolkata, Lucknow, Mumbai, Nagpur, Nainital, Roorkee, Salem, Sibsagar, Silchar, Tanjavur, Tiruchirapalli, Tirunelveli, Udaipur, Varanasi, Visakhapatnam); besides researchers from GSI (Nagpur), ONGC (Dehradun, Vadodara, Chennai), DGH (New Delhi) and Reliance Industries Limited (Navi Mumbai).

An abstract volume containing 173 abstracts was released. Sixty two research papers were presented orally on various aspects of micropalaeontology dealing with the biotic assemblages from Precambrian to Recent. In addition, five Key Note lectures were also delivered. The Oral presentation was classified into six technical sessions. The overwhelming response of the poster session was the main attraction of the 21st ICMS. Eighty posters were presented by the delegates and amongst these special awards were given to young researchers specifically for the poster session. Three best posters were selected by a member of jury and the awards were announced and presented in the valedictory session.

ICMS provides a common platform for meeting of scientists from both Academia and Industries of India and through scientific deliberations and interactions obviously some significant goal is achieved. Some fruitful discussions and interactions between the scientists from the academia and industries regarding the applied aspects of Micropalaeontology were one of the major achievements of this colloquium. Dominance of young researchers revealed the earnestness of younger generation in the field

of Micropalaeontology. Amongst the oral presentations all the papers presented were qualitatively very good. However, some outstanding Key Note lectures and some exceptionally significant papers presented in different technical sessions were highly appreciated by all the delegates. These are entitled as follows:

- Foraminifera and otholiths: tools for assessing effect of natural and anthropogenic changes of climate on marine fisheries,
- Evolution of the Indian monsoon system during Neogene: present status and unresolved issues,
- Reconstructing quantitative changes in seawater physico-chemical properties during geologic past by coupled isotopic and elemental analysis of calcareous foraminifera,
- Deep water changes in the equatorial Indian Ocean during the last 350 KYR BP: the North Atlantic Connection,

- Use of benthic foraminifera as proxy for gas hydrate accumulation and its destabilization: observations from Blake Ridge,
- Glacial-Interglacial variability of the Indian Monsoon during the past 440 KYR,
- Benthonic foraminiferal proxies to interpret dysoxic deep water palaeoenvironment: example from Miocene sediments of offshore K.G. Basin and its significance in deepwater exploratory targets,
- Well-site biostratigraphy: a pilot study from the Cauvery Basin, India, and
- Deccan volcanism responsible for termination of Indian dinosaurs before Cretaceous-Tertiary boundary and triggering of associated floral change.

In all 62 posters (out of 85) were presented by the BSIP scientists.



A view of scientific deliberations - XXI Indian Colloquium

Distinguished Visitors

- Dr. T. Ramasami, Secretary, Department of Science and Technology, New Delhi
- Prof. Ashok Sahni, CAS in Geology, Panjab University, Chandigarh
- Prof. Harsh K. Gupta, Raja Ramanna Fellow, NGRI, Hyderabad
- Prof. S.K. Brahmachari, Director, Institute of Genomics and Integrative Biology, Delhi
- Shri D.K. Pande, Director (Exploration), Oil & Natural Gas Corporation, New Delhi
- Shri Rasik Ravindra, Director, National Centre for Antarctic and Ocean Research, Goa
- Prof. S.N. Bhalla, Ex-Chairman, Geology Dept., AMU (Savita Vihar, New Delhi)
- Dr. B.R. Arora, Director, Wadia Institute of Himalayan Geology, Dehradun
- Shri Jokhan Ram, Executive Director-Chief KDMIPE, ONGC, Dehradun
- Dr. Arabinda Mitra, Executive Director, INDO-US Science & Technology Forum, New Delhi
- Dr. Sankar Chatterjee, Curator of Palaeontology, Museum of Texas Tech University, Texas, USA
- Dr. S.K. Srivastava, Scientist, Central Institute of Mining and Fuel Research, Dhanbad
- Dr. P.K. Seth, Chief Executive Officer, Biotechnology Park, Lucknow
- Dr. James Peters, Basin Manager (Geology & CBM) KDMIPE, ONGC, Dehradun
- Dr. Baleshwar Kumar, National Geophysical Research Institute, Hyderabad
- Dr. Rajiv Nigam, Scientist, National Institute of Oceanography, Goa
- Sri S.K. Srivastava, Dy. Director General, Directorate General of Hydrocarbons, Noida
- Dr. Andrew C. Rozefelds, Dy. Director, Tasmanian Museum & Art Gallery, Hobart, Tasmania
- Prof. Robert A. Spicer, CEPSAR, The Open University, Walton Hall, Milton Keynes, UK
- Dr. M. Shanmukhappa, Dy. General Manager (Palynology), Western Onshore Basin, ONGC, Vadodra
- Shri K.P. Pandiyan, Jt. Secretary and FA, Department of Science and Technology, New Delhi
- Shri V.P. Rawat, Ministry of Science and Technology, New Delhi
- Dr. Fransisco Cabral, Ruarodrigues Cabrilho, Lisbon, Portugal
- Mr. Reichi Miura, Kyoto University, Japan
- Dr. S.K. Grover, Dy. Director General, Doordarshan, Lucknow



A view of visit of ONGC Delegation on 20 October 2007

Research

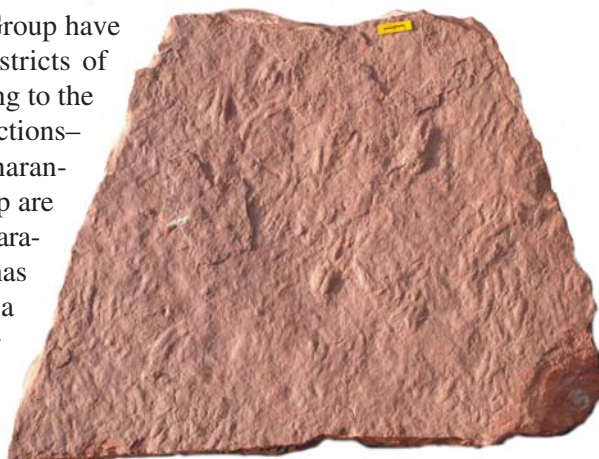
Thrust Area : EARLY LIFE, ATMOSPHERE AND OCEANS: EVIDENCES FROM INDIAN CRATON (Bio-Geosphere interactions in the Precambrian)

Precambrian Palaeobiology Group

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

Work on previously collected material is finalized. Study on the Katni fossil assemblage demonstrates that helically coiled specimens are constituted of two morpho-taxa, i.e. *Grypania spiralis* and *Katnia singhii*. Another spirally coiled circular fossil with epi-relief represents *Spiroichnus beerii*. The other morpho-taxa of the assemblage include *Proterotainia montana* and *Proterotainia katniensis*. The large size in the fossil assemblage rather indicates gigantism in megascopic fossils. In other work, specimens of *Chuarina circularis* were subjected to SEM, TEM and LM studies. Observations on Suket specimens suggest presence of distinct radial canals and single walled cell structure. It is suggested that presence of radial canals and trabecular structure should be considered as an additional taxonomical attributes for *C. circularis*.

Representative units of Marwar Supergroup and Bhandar Group have been sampled from Jodhpur, Nagaur, Bikaner and Barmer districts of Rajasthan and Satna district of M.P respectively. Rocks belonging to the Jodhpur Group of Marwar Supergroup are collected from 5 sections—Artiyan Kalan-Bhopalgarh, Bhopalgarh-Nagaur-Ustaran, Pokharan-Osian, Randha section and Khatu section. Rocks of Bilara Group are collected from Jodhpur-Bilara section, Gotan-Nagaur section, Atabara-Pali section, and Dhanapa-Nagaur section. Pundlo Formation has been sampled from Tunklian area and time equivalent Birmania Formation has been collected from Birmania area of Barmer district. Samples of Nagaur Group have been collected from Dulmera area in Bikaner district. On the silt stone, occurring within the Sonia Sandstone Formation (Jodhpur Group) in the Artiyan Kalan area, Jodhpur district shows the presence of



Trace fossils on the surface of Nagaur Sandstone

primitive animal casts of animal remains akin to Ediacaran animal fossils. Nagaur Sandstone exposed in Dulmera area of Bikaner shows the presence of varied trace fossils on the surface that can at present be assigned to movement traces and burrow structures. Possible *Trepticnus* (burrow system with sickle shaped probes), *Monomorphicnus* (unpaired Scratch-marks) and bilobed structures possibly *Rusophyscus* other bilobed structures similar to *Cruziana* with transverse or oblique ridges.

Mukund Sharma

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

Studies on microbiotic assemblage have been carried out from the macerated residues of the samples (?porcellanites/hard dark grey shales intercalated in sandy facies) belonging to Bhalucona Formation of the Singhora Group exposed 100 m away east of the Bhalucona village, Mahasamund district. The recovered assemblage comprises mostly cyanobacterial algal remains both coccoides and filaments with single taxa of acritarchs. The recorded taxa are *Eosynechococcus*, *Tetraphycus*, *Myxococcoides*, *Siphonophycus* and *Leiosphaeridia*. Low amount of the OWM including fragmentary trichomes in the assemblage indicates tentatively Mesoproterozoic age (~1,400 Ma) and extreme condition probably hot environment during these deposits. The final conclusion requires detailed studies (under progress)

including more data on the microbiota from this formation. In addition, visited 24 different localities of Mahasamund (Chhattisgarh) and Bargarh (Orissa) districts and collected palynological samples (shales, siltstones and cherts), and carbonaceous mega-remains preserved on the bedding plane of the shales and limestones and stromatolites. Also prepared litho-sections of the studied areas.

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.

Systematic morphotaxonomical analysis, description, identification, photo- documentation and comparison of plant fossils of different areas of Satpura Gondwana Basin, e.g. Pench Valley, Kanhan Valley and Pathakhera coalfields are under progress. The assemblages are known by the species of *Buriadia*, *Euryphyllum*, *Gangamopteris*, *Glossopteris*, *Noeggerathiopsis*, *Botrychiopsis*, *Phyllothea*, variety of seeds, *Samaropsis*, *Cornucarpus* and new cordaitalean-type stalked seed. Number of scale leaves in isolation and in groups has been collected. The isolated scales are comparable with the scale leaves of *Ottokaria*-type fructification, whereas scale leaves found in isolation having thick ribbed surface probably represent the covering of seed. New Pteridospermous leaf discovered from Pench Valley area with well-preserved cuticular features indicate the firm example of pteridospermic leaves in Gondwana flora. Occurrence of such leaves, stalked seeds and calamitalean-axes shows presence of mixed flora in Satpura Basin.

Chemical processing of samples has yielded a variety of megaspores and microspores. Observation, description and identification of spore-pollen and megaspores are under progress. In addition, undertook field work to different areas of the Satpura Basin, viz. Pench, Kanhan, Pathakhera Valley coalfields, localities of Bijori Formation and Mohpani Coalfield. Plant fossils have been collected from the Rawanwara Khas pit No. 3, Pench East incline, Pench river section, abandoned OCP of Rawanwara area, New Sethia OCP, Shivpuri OCP, and Vishnupuri, Thisgora, Mathani and Naheria underground mines of Pench Valley Coalfield; Ghorawari OCP (5 & 6), Ghorawari incline, Borkuhi OCP, Ambara OCP, and Mohan and Tandsi (1–4) underground mines of Kanhan Valley Coalfield and Shobhapur mine, Satpura mine-2, Pathakhera mine-1 and 2 of Pathakhera Coalfield. Good collections of fossils have also been made from the type locality of Bijori Formation exposed in the road section near Bijori and Tamia villages. Plant fossils and samples for bulk maceration have also been collected from Sitarewa river section of Mohpani Coalfield.

A.K. Srivastava & Deepa Agnihotri

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

Undertook field work in Hasdo area and in the Chirimiri coalfield falling in Korea district and collected around 350 megafossil specimens belonging to *Glossopteris* flora from Rajnagar sectors E & F and Kurasia collieries. Only a few specimens (7) are found to be preserved in Rajnagar E colliery, while a good number (220 specimens) are collected from carbonaceous and grey shale of Barakar Formation in Rajnagar F colliery; represented by fine meshed specimens of *Glossopteris*, seeds and equisetalean stems. Lower Barakar flora is found preserved in the Kurasia colliery (125 specimens) with several *Glossopteris* species having fine venation, *Gangamopteris* species and abundance of *Noeggerathiopsis*. The taxa *Chirimiria*, fan shaped bilobed specimens and many specimens of seeds are also collected from Kurasia. Fifty megafossil specimens from Kurasia colliery have been processed and 25 are photographed. In addition, finalized/ documented three papers– Occurrence of *Dicroidium* in Tatapani-Ramkola Coalfield,

Palaeobiodiversity of the Lower Gondwana rocks in Korba Coalfield, and on Early Land Plant remains from the Late Silurian of Ludford Corner, Ludlow, Shropshire (England).

K.J. Singh

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

Morphotaxonomic study of plant fossil assemblage, collected from one meter thick carbonaceous shale (of 5.50 m thick section), of Tekan area of South Rewa Basin has been carried out. The assemblage comprises of number of species of conifers, e.g. *Elatocladus*, *Brachyphyllum*, *Pagiophyllum*, *Araucarites*, *Allocladus* and pteridophytes *Todites*, *Gleichenites* and *Onychiopsis*, that dominate the plant fossil assemblage. Cycad is represented by single genus *Taeniopteris* (*T. spatulata*). Occurrence of *Ginkgo* leaves in the entire basin is important because of its long survival history during geological past and its resemblance with extant *Ginkgo* leaves. The flora is compared and correlated with various Early Cretaceous palaeofloral assemblages of India and found that it is coeval with the flora of Dhrangadra and Himmatnagar formations where too flora is dominated by conifers and pteridophytes and lack of cycadophytes. The flora also resembles to some extent with Gangapur Formation (Andhra Pradesh) as both are rich in conifers and pteridophytes. Recorded palaeofloral assemblage shows close affinity with floristic assemblage zone-10 of 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

A paper on 'Revision of the Cretaceous fossil plant assemblage from Gardeshwar (Gujarat): A conifer dominated floral association from an Upper Gondwana Sequence in the West Coast of India' has been prepared. A small but diverse fossil plant assemblage from Gardeshwar has been dealt in it, noticed by the dominance of conifer genera like *Brachyphyllum*, *Elatocladus* and *Pagiophyllum*. Other plant groups are rare but include notable occurrences of *Lycopodites* and *Gleichenia*, and the seed fern *Sphenopteris*. The assemblage is important as it represents the only datable fossils available from Gardeshwar Formation. It is concluded that this formation belongs to Lower Cretaceous *Allocladus-Brachyphyllum-Pagiophyllum* floral biozone. This floral association is unusual as it lacks *Allocladus* includes other taxa more typical of Lower Cretaceous fern dominated *Weichselia-Onychiopsis-Gleichenia* floral biozone, and may represent a transitional assemblage with characters of both biozones. In addition, fresh collection of megafossils and palynological samples has been made from 12 fossil localities in Rajasthan and Gujarat. Very good amount of megafossils have been collected from Sarnu (Rajasthan) and Gardeshwar (Gujarat). Recent flood of 2007 in Jaisalmer district has virtually damaged the plant megafossil (impression) bearing bed of Pariwar Formation exposed around Habur village. Whatever fossils are left in the bed can not be identified properly at present.

B.N. Jana

Project 2.6 : Integrated Palaeobiology of East Coast Cretaceous

Autecology of *Elatocladus* leaf genera has been studied. Long, narrow, smooth margined leaves reflect favourable environment of growth during the Early Cretaceous times in the Krishna-Godavari (K-G) Basin. Synecology of floral assemblage from the K-G Early Cretaceous sequence suggests that individual floral components were derived from small community consisting of individual species. The sediments of plant fossil preservation were essentially composed of disarticulated plant parts dominated by leaves and the sediments were laid down in same conditions. In addition, undertook field work in Cauvery Basin to explore phytorelics in the Cretaceous Sequences of Sivaganga, Uttatur, Karai, Garudamangalam and Kulakkalnattam, Tamil Nadu. New additions to wood flora of east coast are made, besides sediment sample collection 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

Ten samples of carbonaceous shales (Gondwana), exposed along the bank of Gopad River, near the village Nidhpuri (Shahdol district, Madhya Pradesh) have been bulk-macerated in nitric acid. Large amount of organic debris is recovered, which primarily contained pieces of phytolemma, cuticles, and a few seeds. Phytolemma and pieces of cuticle are sorted under a low power binocular microscope. Phytolemma are cleaned of adhering silica by treatment with hydrofluoric acid. Selected pieces are macerated in nitric acid and cleared with dilute potassium hydroxide for examination under the SEM. The cuticles show lot of variation in the type of stomatal complex, arrangement of subsidiary cells and the nature of epidermal cell walls. In most cases the anticlinal and periclinal walls of the epidermal cells are sinuous, and papillate. A few pieces do show cells with straight cell walls. It has been often observed that the stomatal slit, and in some cases even the guard cells are blocked or covered with a waxy-looking substance, the exact nature of which is yet to be decided by elemental analysis. One of the cuticles shows unusual development of massive trichomes. The trichomes have strong rounded (disc-like) foot cells from which arise short glandular trichomes. The trichomes are stout and topped by bulbous glands, which often get truncated. This feature has so far not been reported in the leaf cuticle of any of the extinct seed plants. Another feature observed is the presence of certain cells that may have had a secretory function. However, more cuticles with similar feature need to be observed to be sure that these cells indeed did have a secretory function.

Usha Bajpai

Gondwana Palynology Group

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

In bore-hole BRS-7 from south of Brahmini Coalfield an Early Cretaceous palynoflora is recorded from 87.40 to 104.20 m depth. It includes dominance of *Araucariacites* in association with *Murospora florida*, *Klukisporites* spp, *Foraminisporis* spp, *Januasporites*, *Coptospora* and *Triporoletes*, etc. Reworking of Permian palynomorphs is noted within 101.20 and 104.20 m depth. Typical Late Permian palynoassemblage having dominance of *Striatopodocarpites*, *Crescentipollenites*, *Faunipollenites* in association with *Microbaculispora*, *Microfoveolatispora*, *Indospora* is observed from 110.20 to 122.20 m depth. Visited different areas in Rajmahal Basin and Bokaro Coalfield (Damodar Basin) for collection of samples. Also visited GSI, Kolkata for discussion on palynodating of borecore material.

Archana Tripathi

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

Two bore-holes SMJS-2 (319.10 m deep) and SMJS-3 (631.50 m deep) from Singrauli Coalfield have been analysed to understand the palynoflora. In SMJS-2, the palynoassemblage indicates Early Permian age from 353.85 to 831.50 m depth and Late Permian palynoassemblage is recorded at 187.20 to 256.80 m depth. The yield of palynofossils in most of the samples of bore-hole SMJS-3 is poor. The bore-hole TROD-1 (645.15 m deep) from Tatapani Coalfield shows presence of Late Permian palynoflora up to 285.50 m depth and Early Permian palynoassemblage from 554.55 to 636.20 m depth.

Archana Tripathi & Vijaya

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

Palynological analysis of 40 productive samples of bore-hole MBKW-3 from Mand-Raigarh Coalfield shows Late Early Permian (Upper Barakar palynoassemblage) at 36.35 to 41.95 m depth and Early Permian (Lower Barakar palynoassemblage) at 45.90 to 289.15 m depth. Palynological analysis of 44 samples from bore-hole MSK-1 has been finalized. Late Permian (Raniganj) palynofloras have been identified (27.65-90.90 m depth), showing the dominance of striate bisaccate pollen- *Faunipollenites*, *Striatopodocarpites* and *Crescentipollenites* in association with *Densipollenites*. In the core samples (of borehole MSK-1), Barren Measures (92.50-135.40 m), Upper Barakar (139.40-303.40 m) and Lower Barakar (309.90-463.60 m) palynofloras have also been recorded. Also undertook field work and collected outcrop samples from Sohagpur and Mand-Raigarh coalfields.

RamAwatar

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

Recorded upper Barakar-Raniganj flora from the bore-hole IBSK-1 and IBK-A2. The dominance of *Faunipollenites* and subdominance of *Scheuringipollenites* with the presence of *Striapollenites*, *Verticypollenites*, *Rhizomaspora*, *Ibisporites*, *Cyclogranisporites*, *Cyclobaculilspora*, *Ephedripites*, etc. shows the affinities with upper Barakar age in the Palynoassemblage- I. The Palynoassemblage- II has the dominance of *Striatopodocarpites* and subdominance of *Faunipollenites* with the appearance of *Arcautipollenites*, *Densoisporites*, *Lundbladispora*, *D. magnicarpus* species, etc., showing the younger affinities to late Permian equivalent to upper Raniganj age. Also undertook field trip to various localities of Ib-river Coalfield and collected surface and subsurface (bore-holes IBKAN-5, 6, 7, 8 and IBTK-1) samples for the palynological study.

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 bore-hole. RRK-1. The earliest Early Cretaceous Palynoassemblage 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 supports 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 areas Mandro, Dudkol in Rajmahal Basin, and Damodar river section in Bokaro Coalfield for collection of samples.

Vijaya

Morphotaxonomic study of spore-pollen in approx. 1185.00 m thick Gondwana sediments encountered in bore-hole EBM-1 from East Bokaro Coalfield is worked-out for its spore-pollen content. It has shown many levels of changing patterns in spore-pollen groups and relative occurrence of these taxa delimit varied levels in the palyno-sequence of the Barakar Formation. The assemblage suggests Early to Late Permian age. FAD'S of *Arcautipollenites pellucidus*, *Playfordiaspora cancellosa* (Lower Triassic taxa) at 51.50 and 66.70 m depths enhance the end Permian level. In addition, processed chemically samples encountered in bore-hole EBM-2 from the coalfield for recovery of spores-pollen.

Srikanta Murthy



Image showing occurrence of a fossil wood in clay sediments (Eocene) of Nal Clay Mine, Bikanar District, Rajasthan

Cenozoic Palaeofloristics Group

Project 4.1 : Tertiary floristics of Rajasthan and Gujarat

The carbonised wood samples (100) have been cut and studied from the Eocene sediments of Barmer (Rajasthan) and Rajpari (Gujarat) lignite mines. Further, sections of 15 petrified woods are studied from the Eocene and Plio-Pleistocene sediments of Bikaner. In addition, a gymnospermous wood has been identified from the Jaisalmer area and the result is finalized. Reported the rare occurrence of dinoflagellate and filamentous algae in a palm peduncle recovered from the offshore sediments of Gogha, near Bhavnagar (Gujarat). Study of the sections of woody material reveals that palm material has been invaded by marine micro-organisms. This indicates that either the sea has extended towards the coast or the material has been transported towards the sea. A detailed survey can throw light on the changes in shore-line during sub-Recent to Recent times.

J.S. Guleria & Anumeha Shukla

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

Investigated saprophytic fungus *Epicoccum* infected endogeneously an angiospermous fossil wood of *Barringtonia* of the family Lecythidaceae from Yavatmal district, Maharashtra. A paper on the aspect has been finalized. A number of fossil woods have been collected and studied from new locality Chiraidongri, near Niwas, Mandla district

(Madhya Pradesh). The genera identified are– *Ailanthus* (Simarubaceae), *Grewia* (Tiliaceae), *Barringtonia* (Lecythydaceae), *Canarium* (Burseraceae) along with number of palms. Further work is being done to finalize the results (with JS Guleria). Few large palm leaves are also collected from Umaria, Dindori district (Madhya Pradesh), and work is under progress.

Rashmi Srivastava

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

A large number of petrified woods, collected from several localities of Tipam Sandstone Formation of Dhemaji and North Lakhimpur districts (Assam) have been sectioned and their study is under progress. Besides, collected a large number of plant remains from the Makum Coalfield, Assam. They include root, both dicot and palm leaves and several fruits. Most of them are well-preserved. They have been cleared and photographed. In addition, two new fossil woods from the Surma Group of Lumding (Assam) are described. One of them, *Palmoxylon assamicum* sp. nov. forms the first record of a palm wood from the Neogene of northeast India (see front cover page). The other one, *Daniellia miocenica* sp. nov. is phytogeographically important as it is presently found in Africa.



Field photograph of Makum Coalfield showing shale chunk bearing leaf fossils

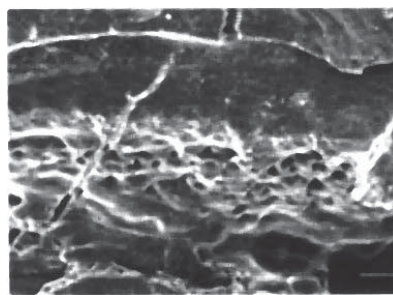
R.C. Mehrotra

Project 4.4 : Tertiary floristics of South India

Carried out sorting and photodocumentation of the fossil fruits/seeds and leaves collected from different localities. Sectioning of 27 carbonised and 8 petrified woods have been completed. Identified a fruit *Terminalia linnaeocarpon*, another fruit of *Terminalia*, and an Anacardiaceous fruit from Neyveli lignite deposits, Tamil Nadu. Study of 20 fossil



A carbonised fossil fruit of
Terminalia linnaeocarpon



SEM view of Canaliculae in the
outermost part of mesocarp

fruits/seeds from Ratnagiri is in progress. Comparative study of fruits with modern equivalents is made at CNH, Howrah. A carbonised fossil fruit comparable to extant species *Terminalia foetidissima* Griff. of the family Combretaceae has been described from the lignite bed overlying China clay at Payangadi Clay Mines, Cannanore (Kerala). This forms first report of the genus *Terminalia* from this area. Distribution of comparable living species has indicated presence of littoral swamp forests with warm humid climate around Payangadi during the deposition of lignites. A carbonised drupaceous fossil fruit belonging to family Anacardiaceae has been recorded for the first time from this lignite. The single loculed drupe with thin epicarp, spongy mesocarp and thin, compact endocarp indicates possible distribution of the seed through the agency of water.

Floristics of fossil leaf assemblages from upper, middle and lower levels of the Neyveli lignite seam based on the distribution of 339 specimens of 45 angiospermous species belonging to 30 genera of 17 families has been attempted. Assemblages from the three levels show distinctly different floristic composition and relative abundances of the species. Proportions of different forest types in the assemblages indicate general warm and humid climate during lignite deposition. Diversity of assemblages is studied using Shannon-Weaver Index (H') values. Species diversity increased from early to middle deposition and then markedly decreased during late deposition. It was highest during middle deposition. The study indicates different microclimatic conditions, owing possibly to changes in temperature and moisture regimes, during deposition of three levels of lignite. Seventeen new fossil leaf species of 15 genera belonging to 13 families have been added to the already described fossil leaf assemblage from Neyveli lignites (TN). Twelve species have been identified for the first time from the Indian Tertiary. Three genera, viz. *Holoarrhena* R. Br. (Apocynaceae), *Embelia* Burm. (Myrsinaceae) and *Bassia* Koenig ex Linn. (Sapotaceae) are recorded from the Tertiary sediments for the first time. Distribution of species in the upper, middle and lower levels of the lignite seam substantiated the earlier observation of much extinction and migration of species during the deposition of Neyveli lignites.

Compiled well known fossil fruit/seed species from the Tertiary sediments of India ranging from Maastrichtian-Danian to Pliocene-Pleistocene and attempted to throw light on their palaeoecological, palaeophytogeographical and evolutionary significances. 57 species from Palaeogene and 29 species from Neogene are taken into consideration. Most of the fossil fruits/seeds are drupaceous or capsular, while fabaceous fruits are lomentum or legume types. Fibrous nature of mesocarp in the fruits suggests their dispersal through water. Such plants might be growing in the coastal areas or near other water bodies. The capsular or other fruits with thin pericarp might belong to inland terrestrial zones. Many fruits of uncertain affinities, e.g. *Sahnioocarpon*, *Wingspermocarpon*, *Enigmocarpon* and *Viracarpon* pose questions about the evolution of angiosperms during the Tertiary in India. Also visited Ratnagiri, Sindhudurg, Sawanthwadi and adjoining areas of Maharashtra and collected plant megafossils— 30 carbonised woods, 2 fruits, one leaf from Rajan compound (Ratnagiri); 7 woods, 6 fruits, from Parchuri (Ratnagiri); 6 woods, 2 fruits from Devgad (Sindhudurg); and 52 woods, 25 fruits from Kalviwadi (Sindhudurg).

Anil Agarwal

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

A number of leaf impressions from Dharamsala and Kasauli sediments of Himachal Pradesh have been examined and some of them are found to represent the following genera, viz. *Donax* (Marantaceae), *Terminalia* (Combretaceae), *Syzygium* (Myrtaceae), *Semecarpus* (Anacardiaceae), palm leaves and some legume leaflets. A few large leaves

with wavy margins are new to the area. The assemblage indicates change in climate and vegetation from warm to cool since early Miocene time due to Himalaya uplift. In addition, finalized study on a fruiting axis of the genus *Acorus* Linn. (Family Acoraceae) from Beragua Coal Mines of Eocene age situated in Rajauri district, J&K. The genus indicates the existence of swampy conditions in the area at the time of deposition of vegetal material, which ultimately led to the formation of coal in the Subathu Formation (Palaeogene) in the region.

J.S. Guleria & Rashmi Srivastava

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

Studied the plant megafossils from Siwalik sediments of Tanakpur (Uttarakhand), Oodlabari (West Bengal) and Arjun Khola (western Nepal). Photodocumented identified leaf and fruit impressions from Tanakpur area. These belong to the genera *Clinogyne*, *Anona*, *Cananga*, *Flacourtia*, *Dipterocarpus*, *Hopea*, *Millettia*, *Humboldtia*, *Wagatea*, *Dalbergia*, *Derris*, *Randia*, *Mallotus*, *Ficus*, etc. On the basis of available data, the reconstruction of the palaeofloristics, palaeoclimate and phytogeography of the region have been interpreted. Systematic study on a rich and diversified assemblage of plant fossils recovered from Lower-Middle Siwalik sediments of Darjeeling district (WB) has been carried out. Identification of some more megafossils has been done with the modern taxa, *Uvaria hamiltonii*, *Gynocardia odorata*, *Pterospermum acerifolium*, *Filicium decipiens*, *Vatica sumatrana*, *Rhamnus crenulata*, *Sabia lanceolata*, *Sapindus montanus*, *Millettia brachycarpa*, *Paranephelium macrophylla* and *Terminalia bellerica*.

The investigation on plant fossils of Lower Siwalik sediments of Arjun Khola area in the Himalayan foot hills reveals the occurrence of wood, leaf and fruit of the genus *Dipterocarpus* Gaertn. Documentation of a paper dealing with fossils phytogeographical importance is in progress. Also collected plant fossils from the Siwalik sediments of Nahan, Nalagarh, Bilaspur and Jawalamukhi and near by area in the Himalayan foot hills of Himachal Pradesh for investigation.



Fossil leaf of *Pterospermum acerifolium* (L.) Willd. (Sterculiaceae) from Siwalik sequence of Sevok Road section, Darjeeling District, West Bengal

Mahesh Prasad



Middle Siwalik sequence Gasoti Village, Hamirpur, Himachal Pradesh showing fossil woods in thick sandstone beds

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 over 200 samples from 13 sections belonging to various Tertiary formations, exposed near Matanomadh, Narayan-Sarovar and Naliya. These also include lignite samples from the Panandhro and Matanomadh mines. Samples are also collected from a newly discovered exposure of Intertrappean Bed near Nareda village on Narayan Sarovar-Baranda Road. Samples (85) from Intertrappean bed and Matanomadh, Naredi and Sandhan formations have been macerated and permanent slides of productive samples were prepared. Scanning of these slides is being done. Samples from the Sandhan Formation (Pliocene) are palynologically unproductive. The samples from other formations yielded a variety of palynofossils. Their study is in progress. In general, the palynoflora contains a variety of fungal remains, pteridophytic spores, pollen of Poaceae and other angiosperms. The samples from the Matanomadh Formation yielded a good number of dinoflagellate cysts also. Besides, remains of fossilized insects have been traced from the samples of Intertrappean Bed and Naredi Formation.

R.K. Saxena & P.S. Ranhotra

Though the assemblage is poor, presence of mangrove, lowland and marshy vegetation is suggested by the recovered taxa.

J.P. Mandal

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

Palynological studies from the succession of Akli Formation, Barmer have been finalized. Based on the distribution and abundance of palynotaxa, the formation is divided into three palynozones. The dependable parameters taken into account to accomplish the biostratigraphic zonation are the presence of various palynotaxa, especially the pteridophytic spores and the angiospermous pollen (reflecting coastal environment). Three cenozones established in the studied succession are– the lower *Dandotiaspora dilata* Cenozone, the middle *Lycopodiumsporites eocenicus* Cenozone and the upper *Spinizonocolpites prominatus* Cenozone. Characteristic forms of lowermost Cenozone are: *Cyathidites australis*, *Dandotiaspora dilata*, *D. telonata*, *Lycopodiumsporites speciosus*, *Lygodiumsporites eocenicus*, *Liliacidites magnus*, *Proxapertites microreticulatus*, *Spinizonocolpites venkatachala*, *Acanthotricolpites karii*. The middle Cenozone is marked with profuse occurrence of *Lycopodiumsporites eocenicus*, *L. sahii*, *L. speciosus*, *Lygodiumsporites lakiensis*, *Matanomadhiasulcites major*, *Retiverrumonosulcites barmerensis*, *Proxapertites assamicus*, *P. hammenii*, *P. microreticulatus*, *Kapurdipollenites clavatus*, *Spinizonocolpites prominatus*, *Clavadiporopollenites raneriensis*, *Duplibaculatepollis pentacolpites*, *Ocimumpollenites indicus*. The uppermost Cenozone shows good representation of *Todisporites major*, *T. minor*, *Matanomadhiasulcites kutchensis*, *M. microreticulatus*, *M. major*, *Retiverrumonosulcites barmeriensis*, *Proxapertites assamicus*, *P. operculatus*, *P. microreticulatus*, *Spinizonocolpites bulbospinosus*, *S. venkatachala*, *S. prominatus*, *Acanthotricolpites complexus*, *A. karii*, *A. intermedius* and *Kapurdipollenites ovatus*.

Majority of the families represented in the Akli assemblage are tropical to subtropical in present-day distribution. Other families are cosmopolitan. The palaeoclimatic interpretations drawn from the studies are fully coincident with the available palaeogeographic reconstructions which suggest that at the beginning of the Tertiary India separated from Madagascar and started to drift in NNE direction. Such drift brought this subcontinent into a humid equatorial zone. In addition, chemical processing of 71 samples from subsurface sequences of Barmer and Matasukh, Nagaur have been done. Palynofossils contained in the productive samples are under investigation.

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 (30) belonging to Periakurichi Limestone, Adnankurichi Limestone and Reddiapalem mines of Cauvery Basin (TN). Scanning, photodocumentation of selected taxa have been done. Morphotaxonomy and identification of spore-pollen recovered from Periakurichi Limestone Mine have been taken up and continued. Some of the important genera recovered are: *Lygodiumsporites*, *Cyathidites*, *Palmidites*, *Lanagiopollis*, *Tricolpites*, *Retitrescolpites* and *Graminidites*. Additionally undertook field work to study and collect various rock samples from Cretaceous-Tertiary sediments exposed at Ariyalur, Trichinopoly and adjoining areas. About 60 samples have been collected from Ottakovil, Kallankurichi Limestone Mine, Reddiapalem Mine and Sindurai railway cutting for further palynological investigation. Thickness, lithology and contacts of these formations are studied and their contacts with the adjacent formations are 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

Palynological assemblages have been recovered from the sedimentary beds of the Deccan Intertrappean deposits exposed by the railway line cuttings of hillocks, near Anjar town, Gujarat. The assemblage includes *Mulleripollis bolpurensis*, *Ariadnaesporites intermedius*, *Triporoletes reticulatus*, *Gabonisorites vigourouxii*, *Azolla cretacea* and *Aquillapollenites bengalensis*, indicating a Maastrichtian age for these beds. However, samples from the upper parts of the sections are marked by the presence of *Proxapertites*, *Kielmeyerapollis*, *Matanomadhiasulcites*, "porate" and "colporate" pollen genus assigned to evolutionary advanced angiosperms. This indicates that the deposition continued in the Upper most part of the Maastrichtian. The palynoassemblages, in general, are dominated by the pteridophytic spores, viz. *Cyathidites*, *Triporoletes*, *Gabonisorites*, *Todisporites*, *Polypodiisporites*. Fungal remains (spores and fruiting bodies) are also abundantly represented in the assemblages indicating a warm and humid climate during the time of deposition of the sediments. The associated remains of aquatic freshwater ferns (*Ariadnaesporites*, *Azolla* and *Minerisporites*) belonging to Salviniaceae indicate that the sedimentation took place in small fresh water bodies.

Samples from the Lameta Formation exposed at Pisdura and Nand-Dongargaon villages, near Worora town, Maharashtra have been chemically processed and the recovered palynomorphs are being studied. Preliminary study reflects that the assemblages records taxa from all the plant groups along with the marker species of Late Cretaceous. Occurrence of gymnospermic pollen, viz. *Araucaiacites*, *Podocarpidites*, *Cycadopites*, *Belmiopsis* and *Caliallasporites* makes the assemblages distinct from the equivalent intertrappean assemblages recorded. Also rock samples associated with the Deccan traps are collected from sections exposed in Madhya Pradesh and Maharashtra.

R.S. Singh

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

Palynofacies and palynostratigraphic analyses of a 4.00 m thick sedimentary section exposed along eastern bank of Saraijan River (a tributary of Dhansiry River) in Upper Assam Basin have been done. The section shows coal at the bottom (50 cm thick), carbonaceous shale (30 cm), clay (40 cm), sandstone (50-60 cm) and upper alluvium deposits of varied thickness. The coal and shale beds contain rich spores and pollen grains of *Polypodiaceasporites levis*, *P. chatterjii*, *Dandotiaspora plicata*, *Cyathidites* spp., *Palmaepollenites nadhamunii*, *Longapertites vaneedenburgii*, *Proxapertites* spp, *Neocouperipollis magnus*, *Spinizonocolpites echinatus*, *S. wodehousei*, *Matanomadhiasulcites maximus*, *Clavaperiporites clavatus*, *C. jacobii*, *Lanagiopollis* spp., *Tricolpites reticulatus*, *Triangulorites bellus*, *Palaeocaesalpineacipites eocenicus* etc. The clayey deposit contains *Homotryblium vallum*, *H. tenuispinosum*, *Hystrichokolpoma rigaudae*, *Operculodinium major*, *O. israelianum*, *Spiniferites ramosus* and *Thalassifora pelagica*, etc. A rich assemblage of microforaminiferal linings have also been encountered in the clay bed. A few fungal fruiting bodies of *Phragmothyrites* sp., *Bicellaesporites* sp., etc., are recorded throughout the vertical sequence.

The frequency abundance of sedimentary organic matter shows increasing trends of structured terrestrial and decreasing trends of biodegraded terrestrial, amorphous and spore-pollen assemblage from bottom to top of the sequences, while dinoflagellate cysts have shown their abundance in clay bed only. The palynological contents have been compared with other contemporaneous subsurface deposits of Upper Assam Basin. It has been concluded that the studied section may belong to Tura Formation (Early Eocene) of Meghalaya and neighboring Mikir Hills. The coal and carbonaceous shale were deposited under lacustrine to deltaic conditions, while clayey unit deposited under transgressive phase of shallow marine condition. Additional collection of samples from various exposed coal seams of Tikak Parbat Formation (Chattian) in mines at Tikak, Tirap and Tipong collieries in Upper Assam has been made.

Madhav Kumar

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

Palynoassemblage recovered from Upper Bhuban Formation of Diltlang area south east Mizoram, are assigned to early Miocene based on occurrence of tropical-subtropical stratigraphical markers, such as *Malvacearumpollis*, *Pteridacidites*, *Hibisceapollenites* and *Compositoipollenites*. The presence of *Spinizonocolpites echinatus* referable to *Nypa* suggests proximity to shoreline. At the base of the exposure there is a gravel bed and the rest exhibits an alternation of the claystone and sandstone, occasionally some minor shale bands are also found in between them. The samples were collected from all lithological units but only the shales yielded the palynomorphs. The occurrence of salt loving taxon *Polyporina*, which belongs to a present day coastal marsh vegetational community, supports the presence of tidal swamps near the area of deposition. The diversity of angiosperm palynotaxa, which forms the bulk of the assemblage indicate a low land vegetational cover. The sequence was deposited in marginally marine setting as indicated by the presence of occasional dinoflagellates. The fossil fungal remains are about 25% of the total elements and consist of hyphae, spores and other forms, e.g. *Colletotrichum*, *Cucurbitariaceites*, *Phragmothyrites*, *Dicellaesporites*, etc.

B.D. Mandaokar

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

Undertook field work to North Cachar Hills district, Assam and collected rock samples belonging to Disang Group, exposed along Haflong-Silchar Road and Mahur-Jatinga Road sections for palaeopalynological study. Chemically processed the samples of Mahur-Jatinga Road section for recovery of spores-pollen.

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 Micropalaeontology 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

Processing of the samples from the Kynrem-Mausmai section has been completed for dinocyst and palynofacies investigations across Cretaceous-Paleogene interval. Better productivity is recovered in the middle part of the succession represented by carbonaceous mudstone, grey shales and silty-sandy shales covering the K-T boundary interval. The upper most Maastrichtian interval is characterized by a peak of *Aeroligera* species. Preliminary observation indicate that the section contains rich dinocyst assemblages and shows significant variation in the palynofacies assemblages

helpful in interpretation of T/R cycles and sea level changes in a more land ward section. Additionally dinocyst 'Eco-groups', viz. *Thalassiphora* Group, *Operculodinium* Group, *Polysphaeridium* Group, *Homotryblum* Group, *Cordosphaeridium* Group, *Spiniferites* Group, *Glaphyrocysta* Group, and *Impagidinium* Group are identified in the Lower-Middle Eocene (Ypresian-Bartonian) dinoflagellate cyst assemblage recovered from the upper part of Tura Formation and the Siju Limestone Formation exposed at Dilni River Section along Tura Dalu Road near Aduhuri, Garo Hills. Using variations in abundance of aforesaid dinocyst 'Eco-groups', together with palynofacies data, following conclusions are drawn: i) palynofacies fluctuation indicate shallowing and deepening cycles during Eocene interval, ii) the well-diversified dinocyst assemblage indicates mostly inner-outer neritic environment of deposition, iii) presence of predominance of *Homotryblum* group during Lutetian indicate prevalence of high salinity condition however, dominance of *Thalassiphora* dinocyst at certain level during Ypresian is indicative of low salinity conditions.

Rahul Garg, Khowaja Ateequzzaman & Vandana Prasad

Two shallow marine successions encompassing Paleocene-Eocene transition, from Jathang and Cherrapunji areas of Khasi Hills have been investigated for detailed statistical palynological analysis. The study involves dinocysts/palynofacies analyses of the coal bearing clastic sandstone (Lakadong Sandstone Formation) to characterize PETM interval and to enhance understanding of paleoecological and relative sea level changes associated with this event. Climate, vegetation, sediment supply and sea level fluctuation plays an integral role in the diversity and abundance of marine and terrestrial palynomorphs in the shallow marine region. Maximum distance cluster analysis has been performed to identify palynomorph clusters of paleoecological significance. Seven palynomorph clusters are identified in the present study reflecting varied paleoecological depositional regimes. The rarefaction and detrended correspondence statistical analysis are further used to assess the palynofloral diversity pattern as well as characterization of various sub-environments of the coastal marine region. The study reveals considerably low diversity of terrestrial palynoflora prior to PETM event and enhanced diversity pattern subsequent to the event. The depositional facies represent a shallow marine stratigraphic record reflecting sea level fluctuations, responsible for frequent facies related changes. The studies show that the high sediment supply as a result of excessive warm and humid climate of PETM in low equatorial zone during slowly rising sea level resulted in the conversion of carbonate ramp into a clastic dominated coastal marine set up with extensive development of fresh water marshes brackish lagoons and estuarine and bay fill deposits within a Transgressive Systems Tract.

Vandana Prasad, Rahul Garg & Khowaja Ateequzzaman

Rich and well-diversified nannofossil assemblages from the Langpar Formation revealed a succession of nannofossil events (FADs & LADs) closely comparable with globally well established low-latitude nannofossil zonation. Danian zonal markers of NTP1, NTP2, NTP3, NTP5 and NTP7 zones (corresponding to NP1-NP4 and CP1-CP3 zones) of Tethyan Intermediate Province, Europe and Tunisia have been recorded. The studied interval shows successive first appearance (FAD) of Danian markers *Biantholithus sparsus*, *Neobiscutum romeinii*, *N. parvulum*, *Cruciplacolithus primus*, *Futyania petalosa*, *Coccolithus pelagicus*, *Neochiatzozygus modestus*, *N. saepes* and *N. perfectus*. Four zones viz. *Neobiscutum romeinii* Zone, *Neobiscutum parvulum* Zone, *Cruciplacolithus primus* Zone and *Coccolithus pelagicus* Zone are proposed in the ascending order. A comparison of the important nannofossil events in the Um Sohryngkew section, lying just south of the palaeo-equator, with known global zonation and other low latitude nannofossil events is presented to highlight their biostratigraphic potential in this region.

Rahul Garg

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

The Patcham Island represents the westernmost highland amongst Island belt containing oldest rocks in Kutch Basin. The Patcham rocks are divided into an upper Goradongar and lower Kaladongar Formation (Biswas 1977). The oldest marine sedimentary rock, i.e. Kaladongar Formation is exposed in Kuar Bet Islet situated about one km NW of Patcham, which is the last outcrop within Indian Territory. The Kaladongar Formation is divided into lower Dingi Hill Member and upper Kaladongar Sandstone members. The Dingi Member is exposed here as intermittently broken small escarpment sections starting from Indira Bridge to the outer periphery of the Island. The sections indicate thinly bedded alternations of green and red siltstones and hard calcareous sandstones with abundant ichnotaxa. At Point 16



in Kuar Bet (=Mori Bet) the exposures are seen in a hillock. The top of the hill is full of pelyceps and rare gastropod shells and the lower part shows current and flaser bedding. In the middle of current lamination a sample (GPS location 23° 59'40"N: 69°42'28"E) has yielded calcareous nannofossils.

The list of nannotaxa recovered are— *Biscutum finchii*, *Biscutum* sp., *Bussonius prinsii*, *Crepidolithus crassus*, *C. plienschachensis*, *Crucirhabdus primulus*, *Diazmatolithus lehmanii*, *Discorhabdus criotus*, *Ethmorhabdus gallicus*, *Lotharingius contractus*, *Mitrolithus elegans*, *Octopodorhabdus* sp., *Schizosphaerella* sp., *Triscutum* sp., *Tubirhabdus patulus*, *Watznaueria barnesae*, *W. fossacincta*. Presence of *B. finchii* (FAD NJ5 - LAD NJ6), *B. prinsii* (NJ5B), *C. primulus* (NJ5B) and *D. criotus* (FAD NJ7) suggests the placement of assemblage in NJ5 to NJ7 zones of Pleinsbachian to Torcian age. NJ5 represents upper Pleinsbachian whereas NJ6-7 indicates lower Toarcian. This has wide palaeogeographical implication as it suggests that after faulting the transgressive event in Kutch Basin might have taken place during Pleinsbachian-Toarcian time i.e. about ?6-8 my. earlier than ?Bajocian. However, earliest transgressive event in Bajocian time in western India is suggested by many earlier workers. Record of upper Pleinsbachian age nannofossils from Masirah Island from Sultanat of Oman, Arabia strengthens this finding. Reworked Pleinsbachian-Aalenian age nannofossils were earlier recovered from Callovian age nannofossil assemblage of Jara Dome situated in the easternmost extremity of mainland. Besides this, record of stratigraphically leaked Albian, middle Eocene and Miocene age fossils is intriguing.

Jyotsana Rai

Subsurface Cretaceous age calcareous nannofossils biostratigraphy from Tanot Well-1, Jaisalmer Basin—pertinent literature related to Cretaceous age calcareous nannofossils is consulted and reference cards were prepared. Learnt the technique of permanent slide preparation of nannofossils and duplicate slides were prepared from 114 subsurface samples (procured from Oil India Limited) from Tanot Well-1, Jaisalmer Basin, Rajasthan area representing depths from 1899 to 1104 m.

Preliminary microscopic studies showed diversified assemblage with moderate preservation of nannofossils. Started scanning of slides and the work is in progress. Significant Cretaceous age nannotaxa, e.g. *Cretarhabdus* sp., *Cribrosphaerella ehrenbergii*, *Eiffelithus turriseiffelii*, *E. eximius*, *Watznaueria barnesae*, *W. biporata*, *Tranolithus phacelosus*, *Prediscosphaera* sp., *Chiastozygus litterarius*, *Nannoconus truiti*, *Braarudosphaera bigelowii* are recorded.

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 4 measured stratigraphic sections, viz. Meetha Nala (Havelock Island), Phulri Nala (Strait Island), North-east Coast and Wreck Point sections (Henry Island) are chemically processed for palynofossils. Samples from Meetha Nala and Wreck Point sections are proved to be productive in terms of diatoms and silicoflagellates. The recovery of palynofossils belonging to pteridophytic spores, gymnosperm and angiosperm pollen is extremely poor in all the sections. A typical marine diatom assemblage of deep water environment has been found from Meetha Nala Section. 21 genera with 37 species, varieties and forms of diatoms have been identified. Predominant diatom taxa of the assemblage are *Actinoptychus undulatus*, *Asterolampra punctifera*, *Coscinodiscus* spp., *Gramatophora maxima*, *Rossiella* sp., *Triceratium gallapangense*, etc. Selected palynofossils are photographed. On the basis of comparison of the present assemblage with the palynofloral assemblages known from Indian Tertiary sediments, a Middle Miocene to Late Miocene age has been assigned to the sediments of Long and English formations of the studied stratigraphic section at Meetha Nala of Havelock Island. Biostratigraphic potential of those recovered palynofossils is now being assessed.

Recorded a rich palynofloral assemblage from the Baratang Formation exposed in a nala section on the west side of the Baratang Forest Camp office at Baratang. Dinoflagellate cysts and acritarchs dominate the assemblage. Predominant dinocyst of the assemblage are— *Enneadocysta arcuatum*, *Deflandrea phosphoritica*, *Operculodinium exquisitum*, *Palaeocystodinium hampdenense*, *Homotryblium oceanicum* and *Achomosphaera multifurcata*. Associated palynofossils recorded from the sediments are *Cyathidites australis*, *Retitrisyncolpites thaungii*,

Spinozonocolpites baculatus, *Lakiapollis ovatus*, *Acanthotricolpites kutchensis*, *Neocouperipollis brevispinosus*, etc. A large number of reworked palynofossils (*Crescentipollenites fuscus*, *Lunbladispota* sp. *Falcisporites stabilis*, *Staurosaccites quadrifidus*, *Aequitriradites spinulosus*, etc.) have also been recorded from the basal part of the section. On the basis of dinocyst assemblage an Early Lutetian age has been assigned for the sediments. Detailed study is now being carried out. In addition, undertook field work in Baratang, Neill, Havelock and Hut Bay Islands, and studied 21 stratigraphic sections belonging to Baratang, Strait, Inglis, Long and Neil formations. 266 rock samples for palynological study are collected from these measured sections.

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 from the late Miocene sediments of Baratang Island and Middle Pliocene sediments of Car Nicobar Island for the study of calcareous algae have been prepared and microscopically analysed. A field work has been undertaken in the Wandoor and Chidyatapu areas (South Andaman), Hut Bay (Little Andaman) and Baratang Island (south of Middle Andaman) for the collection of rock samples pertaining to the study of calcareous algae. In all the localities of different islands outcrops are measured and samples are collected for thin section analysis.

A.K. Ghosh

Organic Petrology Group

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

Carried out petrological work on the coals intersected in bore-hole Q-448 from Yellendu area of the Godavari Valley Coalfield. The maceral study has indicated that the Queen Seam of the area is dominantly represented by mixed type of coals. The vitrinite reflectance study suggests that these coals have attained high-volatile bituminous C stage of the rank. Also visited various localities of the Wardha Valley Coalfield and collected coal samples for the study from new localities around Panwada, Dongargaon, Nandori and Makardhokada being explored for existence of coal in Chandrapur and Nagpur districts.

O.S. Sarate

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

Pertinent literatures are consulted for the project and undertook field work to collect the material from the Ratanagiri, Neyveli, Jayanmokundam areas. Several well sections are surveyed and 5 well sections are selected for the collection of lignitic samples from Ratnagiri and adjoining areas. The sediments are mainly horizontal bedded in nature and most of the lignite/ lignitic clays range from 3-5 feet in thickness and are of localized in nature. The in and around areas of Ratanagiri have shown the lensoied behavior of the lignitic clays and occurring in the pocket forms often pinching in nature. The lignites are mainly thin bedded showing the occurrences of various plant fossils. The lignites also contain resins specks. These lignites are underlain by clay beds. Four bore core samples are collected from Jayanmokandam and Mannarguddi areas representing north, south, east and west part of the basin. Mine I and Mine II of Neyveli areas are also visited and necessary collections are made.

Rakesh Saxena

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

Petrological and palaeobotanical information on Indian Tertiary (Eocene-Miocene) lignites have been compiled. The dominant huminite group is mainly represented by attrinite and densinite (humodetrinite) macerals, the vegetal degradational products. Humotelinite and humocollinite are occasionally rich in certain seams/ sections of Kutch and Cauvery basins. Resinite and liptodetrinite are the main macerals of liptinite group. Funginite (fungal spores/hyphae) and inertodetrinite are the chief inertinite macerals, however some of the seams in western India have predominance of structured inertinites. Associated inorganics are mainly syngenetic (biogenic) pyrite and calcite along with minor to



moderate amounts of argillaceous matter (clay, quartz). The variation in seam thickness and rank of the lignites were controlled by then existing tectonic conditions and geothermal gradients in different basins.

It is evident that the deposits accumulated primarily from deciduous/ evergreen angiospermous forest vegetation growing under humid tropical climate. The lignite-forming flora consisted of inland, coastal, beach, back mangrove, mangrove-associates and mangrove plant communities, in addition to moisture- and shade-loving angiosperms herbs and shrubs as well as those of pteridophytes, which grew profusely as under growths. Certain seams of Palana (Rajasthan) and Panandhro and Vastan (Gujarat) fields have definite marine and brackish-water elements (dinoflagellates, phytoplanktons). Thus, the lignites originated from wood dominated peat swamps accumulating in lagoons or near-shore back swamps with brackish water mileau in Palana, Panandhro and Vastan regions. The vegetal matter experienced both extensive anaerobic (mainly bacetrial) and high aerobic (fungal and bacterial) microbial degradation under neutral to mildly alkaline subaqueous conditions (under high water table to even submerged conditions). Shrubby vegetations growing in the vicinity of peat swamps were responsible for the major part of structured (semifusinite/fusinite) and detrital (inertodetrinite) inertinites. However, occasional natural cindering of peat surface produced relatively more structured inertinites in certain areas.

N.C. Mehrotra, Alpna Singh & B.D. Singh

Visited offices of Gujarat Mineral Development Corporation (Ahmedabad) and ONGC Regional Western Onshore Basin (Vadodara) and had discussions on the occurrences of lignite and black (oil) shale deposits in Cambay Basin. Undertook field work in lignite-bearing areas of Cambay Basin and collected lignite and associated sediments for organic petrological and palynological studies from working mines of Surat (Tadkeshwar, Vastan), Bharuch (Rajparadi-Amod) and Bhavnagar (Khadsalia) districts. The lignite seams in the area consist of dark brown/ brownish black and friable lignite, uniform in texture with yellow resinous material (see back cover) (as thin bands/ specks) and specks of pyrite and amber (rare). Processed samples for petrological (from Khadsalia) and DOM (from Tadkeshwar) studies.

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

Fossil Fuel Exploration Research Group

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

Group discussion was held with Sri D.K. Pande, Director (Exploration) and Dr. James Peters of ONGC for undertaking short-term projects for evaluation of hydrocarbon potential through detailed palynological investigations especially in Frontier Basins of India. Discussions were also held with Mineral Exploration Corporation Ltd., Nagpur to undertake Oil Shale related investigations in part of north-east India.

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

A presentation has been made at the Ministry of Petroleum and Natural Gas, New Delhi on a project proposal for establishemnt 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.

N.C. Mehrotra

Finalized study on the organic-walled microfossils comprising algae and acritarchs from the Gotan Limestone Formation (Bilara Group), Marwar Supergroup (Rajasthan). Rock samples used in this study were collected by Late Dr. Manoj Shukla during Field Workshop organized by GSI under the IGCP Project- 493. The thermal alteration index (TAI) of recovered Type I liptinites has been studied (at KDMIPE, Dehradun), indicating matured organic matter facies for prospect of hydrocarbon exploration. This is also supported by an occurrence of fossil invertebrate (petroleum fly *Helaeomyia petrolei* Kadavy). The study is significant as it opens an entirely new basin for hydrocarbon exploration from Neoproterozoic sediments in Rajasthan and other similar prospective basins in India.

**N.C. Mehrotra, Rupendra Babu, Neerja Jha, Rajni Tewari
& V.K. Singh [& Prabhat Kumar (Univ. of Lucknow)]**

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

A 360 cm sediment core (CHI-1) from north-eastern region of Chilika Lake (Orissa) dated back to $12,960 \pm 130$ yrs BP has been studied through pollen analysis in order to reconstruct mangrove development and to infer sea-level changes during late Quaternary. The geological information, radiocarbon dates and modern mangrove distribution have been integrated with the pollen record. Sedimentological and palynological investigations of CHI-1 revealed sequences rich in palynomorph assemblages mainly dominated by pollen of mangroves and freshwater swamps. Mangroves colonized in response to marine transgression before and during early Holocene (13,000-9,000 yrs BP) and are established as Rhizophora-dominated mangroves. However, in this span of time the fluctuation in qualitative and quantitative assemblage of mangroves is recorded owing to intermittent decline of marine influence. The other core and peripheral mangrove taxa recorded are— *Acanthus*, *Acrostichum*, *Aegialitis*, *Avicennia*, *Brownlowia*, *Excoecaria*, Fabaceae, *Heritiera Lumnitzera*, Meliaceae, *Nypa*, *Phoenix*, *Sonneratia*, *Terminalia*, *Xylocarpus*, etc. This ecosystem reached to its greatest extent as sea-level rise slowed towards 6,000 yrs BP, with a stillstand. The gradual decline in mangroves was registered in the period between 6,000 to 4,000 yrs BP. Thereafter, their development was halted as high freshwater input depressed salt water intrusion in the upper reaches of Chilka and prevented the development of hypersalinity in the northern zone around 2,000 yrs BP. Thus, the deposition at the site has been influenced by fresh water environment which have been interrupted by a minor sea-level transgression and were subsequently replaced by herbaceous vegetation (Chenopods, Cyperaceae and Poaceae) in recent past. Geochronological data indicate that Chilka Lake records one of the earliest ($12,960 \pm 130$ yrs BP) mangrove environments in southeast Asia.

The sediment core (CHI-1) is compared with 530 cm sediment core (CHI-51) from eastern region dated back to $11,130 \pm 90$ yrs BP of Chilika. The comparative analysis of palynodebris of two profiles showed difference in qualitative and quantitative abundance at different levels of sedimentation. The palynodebris data of CHI-1 revealed that mangroves flourished from 13,000 to 6,000 yrs BP, and then core mangroves started declining and almost disappeared at 2,000 yrs BP. On the contrary, core CHI-51 exhibited absence of pollen at the base of profile dated back to 11,000 yrs BP. Whereas, around 8,000 yrs BP extensive Rhizophora-dominated mangroves reached to their greatest extent and later on as sea-level rise slowed towards 6,000 yrs BP with a stillstand a return to terrestrial conditions at this site was registered. Gradually the mangroves were succeeded by freshwater swamp. The difference in composition of palynodebris at two different regimes of Chilika Lake is mainly governed by the influx of fresh water discharge in Lake and intermittent sea level changes over the Late Quaternary.

Asha Khandelwal & Shilpa Singh

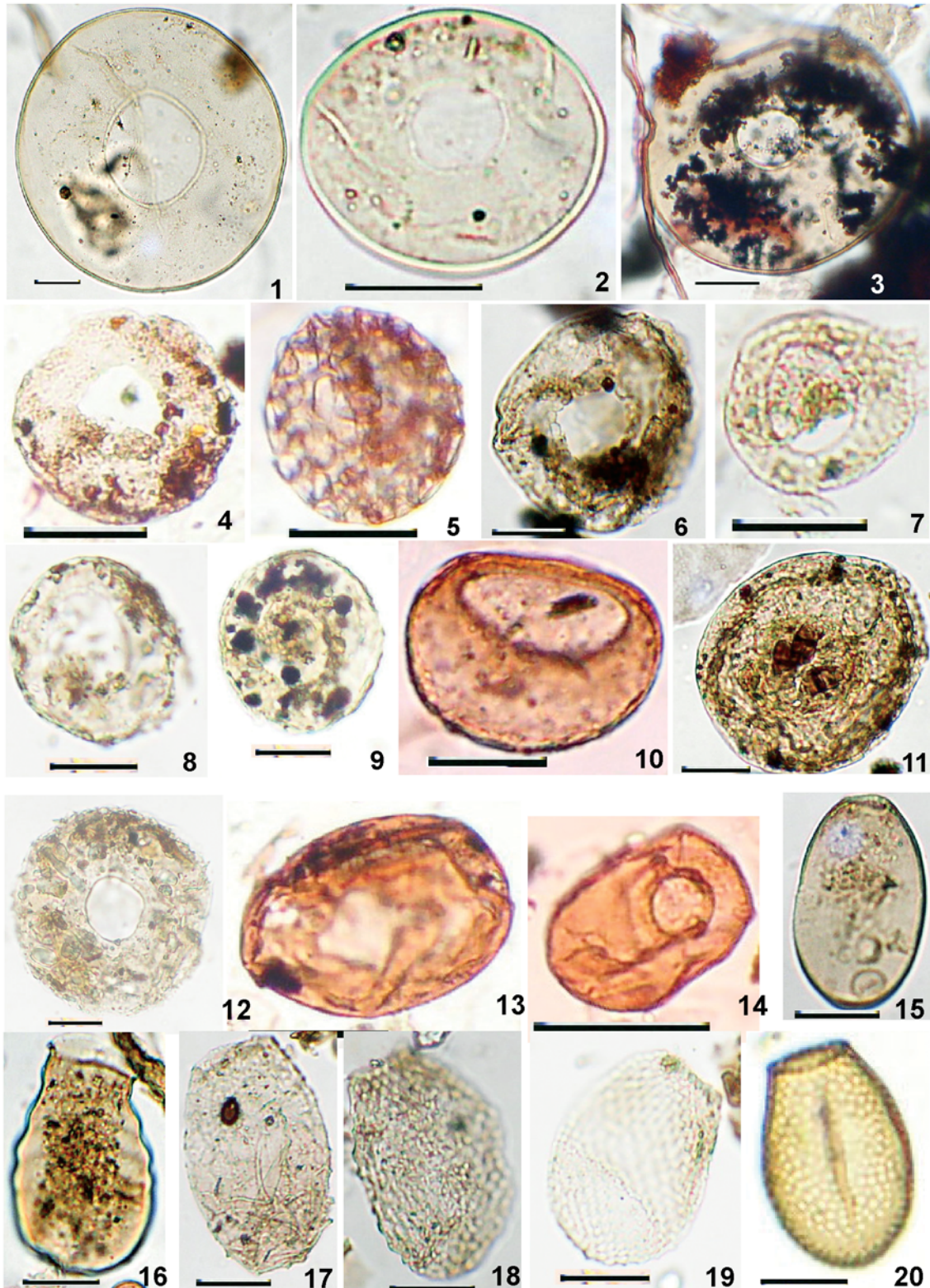
Project 9.2 : Evolution of Mangroves and Coastal Vegetation; Its implications in Palaeoclimate and sea-level studies during Quaternary

On the basis of pollen/spores and thecamoebian assemblage, broadly 3 phases of environmental change have been identified from four shallow cores and surface samples in Nilarevu river of Godavari Delta:

Phase-I (70-90 cm depth, ~100-150 yrs ago)— reveals open woodland type of vegetation constituting Fabaceae, Euphorbiaceae, Sapotaceae, *Solanum*, *Eriolaena*, *Sterculia*, *Withania*, *Schefflera*, *Syzigium*, Caryophyllaceae, Chenopodiaceae, Poaceae and Cyperaceae pollen grains of adjacent area. Five diverse forms of cryptogamic trilete spores are recorded. About 18 species of fresh water thecamoebians with low percentage of marine/estuarine forms are recorded. Dominant species are *Cyclopyxis intermedia*, *C. kahlii*, *Arcella discoides* and *Trigonopyxis arcula*.

Phase-II (20-60 cm depth)— in different cores reveal a sudden increase in salinity, low percentage of Arcellaceans.

Testate Amoebae recovered from Gautami-Godavari River, Andhra Pradesh



1- *Arcella vulgaris*; 2- *Arcella artocrea* type; 3- *A. arenaria*; 4- *A. dicoides*; 5- *A. excavata*; 6- *Diffflugia corona* type; 7 to 10 *Cyclopyxis kahli*; 11- *Cyclopyxis eurystoma* type; 12- *Trigonopyxis arcula* Type-1; 13- *T. arcula* Type-2; 14, 15; *Trinema*; 16- *Hyalosphenia* type; 17- *Euglypha*; 18, 19- *Assulina* spp.; 20- Unknown *Nebela* type.

Increase in foraminiferal chitinous linings of *Trochammina*, *Globigerina* and *Elphidium* along with the sudden unusual appearance of estuarine to marginal marine dinoflagellate cysts (*Spiniferitis* & *Operculodinium*). Pyrite inclusions in the pollen, leaf epidermal tissue, dinocysts, foraminifera linings in the sub-surface modern sediment about 10 km inland perhaps are reworked forms brought through sea-water ingress from the estuarine/marginal marine ecosystem.

Phase-III— low percentage, diversity (6 species) and reduced size of thecamoebians along with the toxic algae *Chatonella marina* and *C. antiqua* indicate increase in salinity or sub-optimal conditions induced by sea water intrusion ~10 km landwards. Sensitive species are *Centropyxis aculeata*, *C. aculeate* 'discoides', *C. aerophilla*, *C. corona*, *Schoebornia humicola* type, *Hyalosphenia subflava*, *Ellipsopyxis lamottei*, *Lamptopyxis*, *Cucurbitella* and *Trinema lineare*. Abundance of *Ankistrodesmus* in the surface sample along with the impoverished *Trigonopyxis arcuata* and *Arcella megastoma* in the southern flank indicates low turbulence and the surface fresh-water plume during seasonal hydroperiods favouring algal productivity.

In the river-sea confluence zone, the successional changes recorded in palynological and thecamoebian assemblage in the Nilarevu tributary indicates a change from fresh water to meso-saline–eurysaline ecosystem during a span of ~150-100 yrs induced by relative sea water ingress which is now evidenced up to ~10 km landwards near Yanam. Unusual presence of marine forms in the upstream sub-surface sediment probably hints about the episodic Tsunami event. Abundance of freshwater thecamoebians (18 species) was recorded in the past. Among all the species recorded here, it is evident that *Arcella vulgaris* and *A. megastoma* along with species of *Trigonopyxis* are robust and opportunistic forms that tend to survive in oligosaline–eurysaline habitat in the coastal wetland during seasonal hydroperiods along with the algal growth in the stratified surface fresh-water plume. Overall results from core and surface soil samples indicate that the sea water ingress and erosion is taking place in the northern flank of the river, while the southern flank is static favouring fresh water algal productivity during seasonal hydroperiods in stratified water column. Arcellaceans combined with palynological proxy variables in the river-sea transitional ecosystem in the present work is reported for the first time from such sub-optimal ecosystems in India. In addition, undertook field work in Godavari delta and Vellar estuary and collected fresh samples.

Anjum Farooqui

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

Detailed palynological study has been carried out on a 4.00 m gravity core (from 50 m depth) from the Arabian Sea near Karwar coast. Subsampling of the core at 2 cm interval was done for high resolution climatic fluctuation (samples were provided by Rajiv Nigam, NIO, Goa). The study shows rich assemblage of dinocyst and terrestrial organic matter debris. Several dinocyst paleoecological groups are identified. Peridinoid dinocyst dominates in the assemblage. Preliminary observation indicates cyclicity in the dinocyst and palynofacies distribution pattern which may reflect the runoff related monsoonal variation during Holocene times.

Rahul Garg & Vandana Prasad

Diatoms distribution has been studied from surface sediment samples of July and December months from the Alleppey and Mararikulam South, Vembanad lake, Kerala coast. Diatom population shows dominance of freshwater centric planktic forms (*Cyclotella* spp.) and few *Actinocyclus* sp., *Actinophytus undulates*. The freshwater benthic diatom assemblage comprises of abundant *Navicula* spp. with few forms of *Nitzschia* sp., *Cymbella* sp., *Surirella* sp., *Stauroneis* sp., *Triceratium* sp. and *Pinnularia* sp. The marine diatoms are noticeably fewer in number represented mainly by planktic *Thalassiosira* sp. (centric) and *Diploneis didyma* (pennate) species. Comparative distribution of freshwater planktic and benthic diatoms may be helpful in interpreting variation in the monsoon related freshwater runoff into the coastal region. The abundance of low diversity diatom population in all the sediment samples suggests enhanced primary productivity due to high nutrient availability during the SW monsoon (July) period. The abundance of *Cyclotella* and *Navicula* species from the coastal Arabian Sea is significant and intriguing as predominance of these taxa is supposed to indicate oligotrophic conditions in certain brackish estuarine/ lacustrine areas. Additionally, processed 30 surface sediment samples (ORV Sagar Kanya SK 237) off Kerala-Konkan coast for diatom, dinocysts and palynofacies studies. Preliminary observations indicate good productivity of diatoms and rich organic matter.

Biswajeet Thakur, Vandana Prasad & Rahul Garg

Study of the organic matter distribution from the same set of surface sediment samples, Kerala coast shows occurrence of phytoclasts (charcoal, black debris, brown degraded, structured matter), palynomorphs (spore/ pollen, peridinooid dinocysts, gonyaulacoid dinocysts, Cyanobacteria) and zooclasts (tintinnid lorica, copepod egg shells, scolecodonts, foram linings) derived from both terrestrial and marine source. The distribution of OM in the sediment samples from the transect shows high abundance of black oxidized, brown degraded as compared to the marine components, i.e. copepod egg, tintinnids foram lining, etc. Abundance of terrestrial matter in the sediments of July transect indicates enhanced runoff activity due to the SW monsoon in this region. The terrestrial abundance decreases as the depth increases from the coast to the deeper part. The marine components (copepod egg envelopes, foram linings, zooplanktons, labile OM) show an increasing trend in samples from greater depths. Dinocysts are fewer in number and mostly represented by *Bitectatodinium spongium* in all the stations which is relative to the SW monsoonal activity.

Vandana Prasad, Biswajeet Thakur & Rahul Garg

Participated in the ORV Sagar Kanya cruise SK-237 organised by Dr. Rajiv Nigam of NIO in the region off Kerala-Konkan coast during July-August 2007. The sediment samples from the Arabian Sea ranging in depth from 8 m to 3,150 m have been collected from 50 stations (9° to 14°N & 71° to 76°E) from the Kochi and Ponnani, the region lying between Ponnani and Mangalore and Mangalore and Bhatkal areas. A total number of 47 spade cores, 11 grab cores, 9 gravity cores and 1 piston core are collected. Spade cores provided to BSIP include surface sediments and shallow cores (10-38 cm). The sediments comprise of silty-clay along the coast, coarse sand is encountered along the depth range of 80 to 120 m and further deep grayish to light yellowish clay are observed.

Biswajeet Thakur

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

Analysed pollen of a 1.30 m deep sediment core from Dabi Swamp, Shahdol district and prepared pollen diagram. Based on the representation of major arboreals and non-arboreals, the pollen sequence is divisible in three phases. During the Phase-I, mixed tropical deciduous forests comprising *Madhuca indica*, *Aegle marmelos*, *Syzygium*, *Emblica officinalis*, *Shorea robusta*, *Holoptelea*, etc. occurred in the region under a warm and moderately humid climate. The herbaceous complex is largely composed of grasses and Asteraceae. Phase-II is marked by the formation of modern sal (*Shorea robusta*) forests as reflected by the consistent presence of sal pollen with increased frequencies together with its associates. This change in the forest floristic signifies inception of a warm and more humid climate in the region. Finally, the Phase-III demonstrates that the sal dominated forests continued to flourish, however they turned sparse as deciphered by the slight decline in *Shorea robusta* as well as its other allies particularly, *Madhuca indica*, *Adina cordifolia*, *Emblica officinalis*, *Syzygium*, etc. This apparent alteration in the vegetation mosaic is attributable to the prevalence of warm and relatively less humid climate in the region. The exploitation of the forests by the local populace can not be denied.

Carried out pollen analytical investigation of 18 surface samples comprising 6 from Paudi, Umari district and 12 from Amjhara, Hoshangabad district. The pollen rain composition has brought out much reduced frequencies of *Shorea robusta*, irrespective of being a high pollen producer. The under-representation of sal pollen could be inferred to its poor preservation in the sediments. Among the other trees viz., *Madhuca indica*, *Holoptelea*, *Mitrgyna* and *Acacia* are better represented in contrast to *Terminalia*, *Emblica officinalis*, *Sterculia*, *Sterculia*, *Adina cordifolia*, *Lagerstroemia*, *Adina cordifolia*, *Lagerstroemia*, etc., which are recovered sporadically. The erratic representation of most of the tree taxa, despite their good presence in the forest floristics could be attributed to their low pollen productivity since they exhibit a strong tendency of entomophily. The presence of non-arboreals taxa in the pollen rain corresponds with their composition in the ground flora.

Undertook a very exhaustive field excursion to Hoshangabad, Sehore and Harda districts (Madhya Pradesh) and collected 45 surface samples (moss pollsters & surface soils) from different forest stands to study the modern pollen/vegetation relationship in the region. A total number of 8 sedimentary profiles comprising 4 each from Hoshangabad and Sehore districts are also collected for the Quaternary pollen analytical investigations. A survey of various forest stands is also executed in ecological perspectives. Pollen analysed a 1.75 m deep sediment core from Amjhara Swamp.

The pollen assemblage has broadly depicted the presence of dense mixed tropical deciduous forests constituted of *Syzygium*, *Schleichera*, *Lannea coromandelica*, *Grewia*, *Mitragyna*, *Terminalia*, *Madhuca indica*, *Adina cordifolia*, etc. in the region under a warm and humid climate during the period of sedimentation with some intermittent fluctuations in climatic conditions as deduced from the fluctuating trends of the major arboreals and non-arboreals in the pollen sequence.

M.S. Chauhan & Md. Firoze Quamar

Project 9.5 : Studies on Quaternary vegetation and Climate from Himalaya

Carried out pollen analytical studies and accomplished a paper dealing with past vegetation and climate of temperate zone of Kumaun Himalaya since middle Holocene. The investigated profile shows reverse order of superposition but useful for the study because inversion of sediments is due to neotectonic disturbance which resulted displacement of rock but organic matter remain intact with neighbouring sediments, thus faithfully represent past history. Pollen analysis has shown that in the beginning of sequence, investigated area had dominance of non-arboreals with poor presence of broad-leaved arboreals which soon after enhanced and formed mixed oak forest with warm and humid climate. Such forest did not remain constant and showed alternate phases of depression and expansion, indicating fluctuating warm and humid climate during late Holocene.

Documented another paper on pollen analytical investigation which provides the account of past vegetation and climate of temperate zone of Kumaun since Early Holocene. In the beginning of sequence the investigated region had predominance of nonarboreals with poor presence of arboreals. Subsequently, arboreals flourished resulted establishment of mixed oak forest with corresponding fall in non-arboreals, indicating change in climate towards more warm and more humid. Such forest continued onwards but showed fluctuations resembling to abovenoted conditions. Also prepared a paper providing an account of palynological and palaeontological investigations of 2 profiles with their chronological comparison which has revealed concealed Neotectonic disturbance at the region. Profile from bore-core represents upper part of Late Holocene with normal order of superposition while from exposed-section from Middle Holocene–middle part of Late Holocene with reverse order of superposition. Data generated from different investigations indicates that the contemporary biozones of both profiles, situated at different elevations, consist similar bioremain, indicating continuation of same strata in two profiles.

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

Recovered *Areca catechu* pollen from 1,000 yrs BP sediment of Lekhapani Reserve forest, Tinsukia (Assam) for the first time where no such tree are found at present. Ten moss cushion and sub-surface sediments each from Dulung and Subansiri Reserve forests, depicts the presence of local arboreal and nonarboreal plant taxa within the average value of 10 and 25% respectively over the high value of exotics up to 40%. Ferns are encountered under the value of 20% signifying local in origin. Occurrence of degraded palynomorphs, including both angiosperms and ferns although in low value, a large number of fungal elements along with the same indicate biological degradation in sediments. The presence of exotic conifers and broad leaved taxa in the air catches suggests high wind velocity along the Singrijan river flowing through Dulung Rreserve forest. Palynoassemblage from 2 sedimentary profiles (1.2 m) one each from Dulung and Subansiri Reserve forests (pH 7.1-7.5), Assam predicts the existence of moist tropical forest under arid to on set of warm and humid climatic regime in recent past. Due to low carbon content radiocarbon dating is not feasible.

Studies on pollen morphology and phenological characteristics (flowering, fruiting, mode of pollination, etc.) of 48 economically important plant taxa under 31 families from Assam will be of great importance to generate a comprehensive database for pollen characters and palaeofloristic interpretation from lacustrine sediments of tropical region in northeast India. Also procured exposed sedimentary sections from Huliagaon, Kadamtola and Pabha Reserve forests of Dhemaji and North Lakhimpur districts. Twenty Tertiary wood fossils are also recovered from Singrijan and Dirpai river beds of Dulung and Subansiri Reserve forests.

S.K. Bera & S.K. Basumatary

Dendrochronology Group

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

Crossdating of 25 tree core samples of Himalayan cedar and 15 tree core samples of Himalayan pencil cedar collected from dry sites in Lahul, Himachal Pradesh during 2004 is done using pattern matching in ring-width sequences. The ring widths of crossdated samples are measured to develop the chronology. The chronology of Himalayan cedar extends back to the early part of the 16th century and Himalayan pencil cedar to the early part of the 13th century. The wedging of growth rings, very common in Himalayan pencil cedar, makes the crossdating difficult. This requires large number of samples to develop reliable chronology for climate studies. The chronologies, though need to be updated with more sample replications, are expected to provide valuable information on precipitation variability during the past several centuries.

R.R. Yadav

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

Tree-growth climate relationship of teak growing at Perambikulam, Kerala has been analyzed. Precipitation during May is recorded to be limiting factor for the growth of this tree at the region. Based on tree-ring data of this tree attempt has been made to reconstruct May precipitation during AD 1,590 to 2,000 and to establish its correlation with other global climate parameters, viz. sea surface temperature and sea level pressure. Detailed analyses are in progress.

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' continued from ancient site at Sanchankot/Ramkot, District Unnao (Uttar Pradesh) from cultural horizon of P.G.W., N.B.P.W., Sunga and Kushana Periods (approx. 1000 BC-300 AD) to build up plant economy practiced by the ancient settlers and the ecological conditions in the past. The site exhibits ancient plant economy comprising of the field-crop finds belonging to cereals– barley, rice, sawan, kodon-millet, italian millet and jowar millet; pulses– lentil, khesari/grass-pea, field pea, green gram, black gram, horse-gram/kulthi, aconite/moth bean; along with seeds of oil yielding plant– field brassica; jujube fruit-stones, seeds of custard apple and Leguminous fruiting pod; seeds of cotton and silk-cotton fibre. The remains of custard apple (*Annona squamosa*) from Kushana levels (100-300 AD) reveal the new evidence from this region in Ganga plain. Almost similar assemblage of weeds and wild taxa as recorded earlier has been encountered again in association with field-crop remains, belonging to wild grasses (Blue stem grass, Crow-foot grass, Goose grass, Panicum grass, Blue or Meadow grass) and sedges (Flat sedge, Spikerush sedge, 3 species of Fimbristylis sedge, Bulrush, etc.). Other finds are of *Desmodium gangeticum* (Tick-clover/Savivan), *Indigofera* sp. (Indigo), *Indigofera hirsuta* (Hairy Indigo), *Medicago* sp. (Blue alfalfa), *Melilotus alba* (Sweet clover, Safed Senjhi), *Asphodelus tenuifolius* (Piazi), *Verbascum thapsus* (Mullein), *Vicia sativa* (Common vetch), *Amaranthus* sp. (Pigweed), *Celosia* sp., *Chenopodium album* (white Goose-foot, Bathua), *Commelina benghalensis* (Day-flower faint), *Trianthema portulacastrum* (Lalsabuni), *Solanum* sp. (Night-shade); *Polygonum barbatum*, *Rumex dentatus* (Labbibi, Khat-palak), *Sida* sp., and some Convolvulaceae member.

Dactyloctenium aegyptium (Crow-foot grass) and all the sedges, *Commelina benghalensis*, *Trianthema portulacastrum* may have been the weeds in summer group crops like rice, whereas *Indigofera hirsuta*, *Melilotus alba*, *Vicia sativa*, *Amaranthus* sp., *Chenopodium album* represent the weed components in winter crops like wheat and barley in the ancient agriculture at the site. *Verbascum thapsus* (Mullein) is an occasional member along water

channels, whereas *Polygonum barbatum* and *Rumex dentatus* represent moist and swampy localities in the surrounding of ancient habitational deposits. Further, participated in the archaeological excavations at ancient site Namisharayan, District Sitapur (Uttar Pradesh) in collaboration with Department of Ancient Indian History and Archaeology, Lucknow University under the UGC-Project *Archaeology of Ganga Plain*, and collected fairly good amount of palaeo-ethnobotanical material for investigation and C¹⁴ dating from cultural deposits of Sunga-Kushana Periods to early Medieval times.

Chanchala Srivastava

Analysed archaeobotanical samples from a Harappan settlement at Kanmer datable to 2800-1500 BC. The finds include the remains of *Hordeum vulgare* (hulled barley), *Triticum aestivum* (bread wheat), *Triticum sphaerococcum* (dwarf wheat), *Oryza sativa* (rice), *Sorghum bicolor* (jowar-millet), *Pennisetum typhoides* (pearl millet), *Pisum arvense* (field-pea), *Lens culinaris* (lentil), *Macrotyloma uniflorum* (horse-gram), *Vigna radiata* (green-gram), and *Sesamum indicum* (sesame). In addition to cereals, pulses and an oil-seed, a fibre-crop is represented by the presence of seeds of Cotton at the site. Associated with these crop remains as an admixture, the remains of the seeds and fruits of weeds and other wild taxa have also been identified as *Vicia sativa*, *Setaria* cf. *glauca*, *Chenopodium album*, *Ziziphus nummularia*, *Trianthema triquetra*, *Trianthema portulacastrum*, *Citrullus* cf. *colocynthis*, *Coix lachrymajobi* and *Polygonum* sp. Also participated in the excavation and collected botanical remains from the Harappan site, Kanmer close to Little Rann in Kachchh District (Gujarat), a joint venture of the Institute of Rajasthan Studies (Udaipur), Gujarat State Department of Archaeology, and Research Institute for Humanity and Nature, Kyoto (Japan).

A.K. Pokharia

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

Collected about 638 plant specimens, 5 wood blocks and 58 fruits and seeds from Anuppur range in Anuppur (North) district. All plant specimens have been processed and poisoned with insecticides. Identification of species is in progress. Identified 21 plant species as new record for flora of Madhya Pradesh, and 2 plant species, namely *Ipomoea triloba* and *Cissus verticillata* as new record for India. In addition, Ethnobotanical information of about 75 plant species (51- medicinal, 9- food, 11- timber, 4- fibre and cordage) from Baigas and Gonds have been documented from Durga Dhara area in Anuppur district.

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

Multiple levels of soft-sediment deformation structures (seismites) of Late Quaternary times are recorded from the Spituk palaeolake near Leh town, along Indus Suture Zone (ISZ) and the Khalsar palaeolakes, along Shyok Suture Zone (SSZ) and Karakoram Fault (KF). 9 levels of seismites from Spituk-Leh and 8 levels from Khalsar sections are recorded. Deformation sediments are composed of alternations of clay, silts and sand and are restricted to single stratigraphic layers bounded by undeformed beds suggesting synsedimentary deformation. They are simple and complex convolutes, pinch and swell bedding, microfolds and microfaults, flame-like structures, pseudonodules, clay diapirs, ball and pillow structures, pillar structures, sedimentary dykes, mud lenses, etc. The release of stress along the ISZ, SSZ and KF, may have been responsible for inducing seismicity in the area during the Late Quaternary times which may have caused liquefaction as a direct consequence of permanent deformation of ground surface due to earthquakes of large magnitudes (>5 intensity). The release of stresses along ISZ, SSZ and KF in the form of earthquakes is concentrated between ~35,000 yr BP to approximately the Last Glacial Maxima (LGM). Based on the above a paper has been finalized.

High resolution environmental magnetic, mineralogical and geochemical data is also generated, under MOU between BSIP and WIHG, Dehradun, on the above mentioned Quaternary sedimentary sequences. Interpretation of data and

preparation of manuscript is partly completed. Water samples collected from Indus and Shyok-Nubra rivers are also analyzed to understand the control of lithology and earth surface processes on water quality, particularly in relation to the weathering of rocks in the region. 20 aerobiological samples collected on route by exposing glycerin smeared slides at regular intervals from Chandigarh *via* Manali to entire Spiti Valley are macerated for palynological studies. A few samples, studied so far, are showing good pollen assemblage and work is under progress. Besides, visited WIHG, Dehradun to carry out the mineralogical, geochemical and mineral magnetic studies on samples collected from different localities of Ladakh and Spiti regions. In addition, undertook a joint field work with WIHG scientists, primarily to get them acquainted, to Spiti Valley and collection of OSL dating samples to have a chronological control on understanding the evolution of the region during Quaternary times. Additional samples are collected from river channel to see the contribution of different lithological units in formation of glacio-fluvial-lacustrine sediments. A manuscript on geomorphological evolution of the Spiti-Valley is being prepared.

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 work included developmental work in the lab and also dating and geochemical analyses of samples for palaeoenvironmental reconstruction. A new combustion furnace is put in use to be able to handle larger amount of sample to date carbon-poor samples. The work on new benzene system progressed in terms of addition of new manometers, pressure-transducers, Lithium reaction vessel, vacuum, and electrical lines, etc. Newly procured elemental analyzer (HCNS- O) is being set up after arranging the pre-requisites of gases and accessories. The dating output of the laboratory has also increased. In all, 173 benzene preparations have been done (about half of them for Institute work) and a total of 138 samples counted and radiocarbon ages calculated for them catering to need of Quaternary workers.

Participated in the inter-laboratory comparison study and dated 10 international (VIRI) standards including 2 repeat measurements, yielding radiocarbon ages ranging from modern to about 49,310 yrs BP. Considering the potential of corals for proxy climatic data and with the aim of understanding the growth of corals, a field trip was undertaken to 5 coral islands (Narara, Poshitra, Kalubhar, Pirotan & Goose) off Jam Nagar coast (Gujarat) in the Gulf of Kutch. The work in association with GEER Foundation, Gandhi Nagar, led to collection of a number of exposed coral samples during the low tide. These also included samples displaying annual coral bands. The calibrated ages of the 4 dated (bulk) samples range from about 1,225 yrs BP (Kalubhar) to about 6,110 yrs BP (Pirotan). The samples from coral bands are being prepared for AMS dating for fine- resolution dating and deciphering the isotopic temperature records.

C.M. Nautiyal, S. Chakraborty (till August 2007) & A.K. Arya (till 26.08.2007)

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 : Late Quaternary climatic history of Schirmacher and Larsemann Oasis, East Antarctica and surrounding ocean: A multi-proxy approach based on polar lake sediments

The palynological study of 3 dry lake bed soil sections (clay lenses trapped between the sandy/silty layers) from Schirmacher oasis depicts the occurrence of palynodebris including diatoms (30%), desmids (15%) and exotic angiosperms (4%) only in clayey silt column dated back to 3,300 yrs BP indicating warm and humid climate. The air data (of 2006) indicates the less wind activity in contrast to the earlier data as evidenced by the palynodebris. The further detail study on more samples is in progress, to assess the distribution pattern of diatoms and other microbiota in various sediments since Holocene. Fifteen sediment samples are sent for AMS dating. Studied two soil sections (DLL & SP) for mineral magnetic parameters (at WIHG, Dehradun) from Schirmacher Oasis, showing good climatic variations

(magnetozones). Geochemical analysis from two sections (TS & LBM) collected during 26th Indian Antarctic Expedition is in progress. Samples for TL (OSL) dating were processed at WIHG. 45 lake water samples from Schirmacher and Larsemann Oasis are also processed at NCAOR, Goa. Processed 10 samples collected during the expedition for the study of diatoms and other palynodebris.

S.K. Bera, A. Bhattacharyya, Anupam Sharma & Binita Phartiyal

Participated in the XXVII Indian Expedition (during December 6, 2007-April 11, 2008) and collected samples (subsurface sediments, moss layer, algae and water from different lakes) for palaeoclimatic analyses from two major sites– Schirmacher Oasis and Larseman Hills. Subsurface sediments are collected either through sediment borer from glacio-lacustrine deposits or clearing upper surface of these exposed lacustrine sections along hill slopes for analyses of multi-proxy data. Besides, water samples from several lakes and some plant materials are also collected.

Amalava Bhattacharyya

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

A number of platyspermic and radiospermic seeds mainly belonging to genera *Samaropsis*, *Cordaicarpus*, *Nummulospermum* and *Rotundocarpus* from Barakar Formation of Makardhokra and Umrer OCPs, Umrer Coalfield, Wardha Basin (Maharashtra) have been studied. Additionally, a preliminary investigation on a number of specimens belonging to the genus *Noeggerathiopsis*, branched and unbranched equisetalean axes and glossopterid fructification *Scutum* has been carried out from the same area. Study is under progress.

Evolutionary tendencies of dispersed Gondwana megaspores and architectural radiation in exosporium in particular have been studied through Talchir, Karharbari, Barakar, Barren Measures, Raniganj, Early Triassic (Maitur, Panchet, LowerTiki), Late Triassic and Early Cretaceous (Jabalpur, Bhuj, Umia, Athgarh). Based on these studies a paper entitled 'Morphological evolution of Indian Gondwana megaspores' is finalized.

Palynological investigations in sub-surface sediments of bore-holes GSP-1 and 9 from Satrajpalli area, Mulug coal belt, Godavari sub-basin have revealed the presence of two palynoassemblages, one belonging to Early Permian (Barakar) palynoflora and other belonging to Late Permian (Raniganj) palynoflora. Assemblage-I is characterised by dominance of non-striate disaccate *Scheuringipollenites* and sub-dominance of striate disaccates, viz. *Striatopodocarpites* and *Faunipollenites*. The other taxa recorded in the assemblage include *Platysaccus*, *Ibisporites*, *Primuspollenites*, *Divarisaccus*, *Parasaccites*, *Indotriradites*, *Brevitriletes* and *Horriditriletes*. Assemblage-II is characterised by dominance of striate disaccates, chiefly *Striatopodocarpites* and *Faunipollenites* along with presence of rare but stratigraphically significant taxa, viz. *Strotersporites*, *Verticypollenites*, *Corisaccites*, *Hamiapollenites*, *Falcisporites*, *Crescentipollenites*, *Lunatisporites*, *Weylandites*, *Lundbladispota*. The presence of the Lower Raniganj palynoflora has been demarcated in lithologically designated Barren Measure Formation. In addition, processing of samples from MMK-19 of Mamakannu area is being carried out.

Undertook field work in the areas Kothagudem, Manuguru, Sattupalli of Khammam District, Godavari Graben (Andhra Pradesh), and collected plant megafossils from Barakar Formation, Prakash Khani OCP II, Manuguru Area. Rock samples for recovery of megaspores, seeds, etc. are also collected from Jalgaon Vengalrao OCP I, Sattupalli Area; besides bore-core samples for palynological studies. The megafossils include species of the genera *Glossopteris*, *Noeggerathiopsis* and *Gangamopteris*, besides *Phyllothea*, equisetalean axes and *Vertebraria*. Additionally, rock samples for study of megaspores, seeds, etc. are collected from Raniganj Formation, Kothagudem 5B Incline. Also visited inclines of Gautam Khani and Venkatesh Khani of Kothagudem, but the shales were devoid of plant impressions in these mines.

N.C. Mehrotra, Neerja Jha, Rajni Tewari & Neha Goel

**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

Project yet to be initiated.

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

Project 14.2 : Megaflora and Palynology of the Kargil Molasse

Project yet to be initiated.

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

Project yet to be initiated.

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

Project 14.4 : Neyveli lignites: Biostratigraphy and Palaeoecology

In an effort to resolve the age controversy of the Neyveli lignite succession and its palaeoenvironmental set up, a field study on the exposures was carried out in various open cast mines. Besides detailed sampling of the sedimentary succession associated with the lignite, significant sedimentological features suggesting coastal environment have been logged. Occurrence of possible rooting structures is the most significant finding.

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

Additional Research Contributions

Chemically processed samples of Sirbu Shale Formation (Bhander Group), Vindhyan Supergroup, exposed on >200 m in height Kusla hill Section, Satna district (Madhya Pradesh), yielded rich, well-preserved and diversified (24 taxa) organic-walled microfossils, representing 20 taxa of protists (acritarchs) and 4 taxa of cyanobacterial algae (unicellular to multicellular). The acritarchs dominate with ornamented simple sphaeromorphs followed by acanthomorphs belonging to Sphaeromorphitae, Netromorphitae, Acanthomorphitae, Pteromorphitae, Herkomorphitae and Polygonomorphitae subgroups. The cyanobacterial taxa are both solitary and aggregated spheroidal cells with septate, aseptate and helically coiled trichomes with or without mucilaginous sheath showing close resemblance with modern Chroococcaceae, Nostocaceae/ Oscillatoriaceae orders. The recovered assemblage is comparable with the assemblages known from the equivalent sedimentaries of the world. The present OWM assemblage from the Sirbu Shale Formation clearly supports the Pre-Ediacaran age and shallow marine water depositional condition.

Recovered well-preserved fossil palynoassemblage of planktonic and benthic biocommunities for the first time from the Gotan Limestone Formation (Bilara Group), Marwar Supergroup exposed in and around Haras and Bilara townships in Jodhpur district (Rajasthan). Rock samples used in this study were collected by Late Dr. Manoj Shukla during Field Workshop organized by GSI under the IGCP Project- 493 "The rise and fall of Vendian biota". The recovered assemblage comprised of 12 taxa of the acritarchs belonging to Sphaeromorphida, Sphaerohystrichomorphida and Edromorphida subgroups; and 4 taxa of cyanobacterial remains both solitary and aggregated sphaeroidal cells with septate and aseptate filaments with/ without mucilaginous sheaths comparable to modern Chroococcaceae, Nostocaceae, Oscillatoriaceae and Chlorococcaceae.

Studied metazoan (Ediacaran remains) fossils from the Jodhpur Group and stromatolites, micro-macro invertebrate fossils (planktonic and benthic) belonging to families Bivalves, Gastropods, Ammonites, Echinoids, Ostracods, Foraminifers, Conodonts and fragments of larval stage insects (arthropod) from the Bilara Group exposed in and around Jodhpur district (jointly with Prof. Prabhat Kumar). The recovered assemblage strongly suggests the deposition of Marwar sedimentaries under the moderately deep marine water with high salinity conditions. The bonafide phanerozoic invertebrates bearing sediments in Bilara Group might be migrated/ transported from the younger sediments through the geological complex dynamics.

Rupendra Babu & V.K. Singh

The available records of insect-plant activities in different floristic regions have been compiled and analyzed to discuss the dynamic role of insects in fossil flora. Also a field work was undertaken (during abroad visit) in amber localities and collection of insect embedded amber samples were made from Penacerrada, Spain.

A.K.Srivastava

The Shemshak Formation of Elburz Mountain occurs in N of Iran, embodies well-preserved plant fossils in dark blackish-grey shale of Mesozoic sediments. Assereto (1966) named this Formation after the village which occurs in the E of the mountain. The floral assemblage of the formation comprises number of plant fossils of Pteridophyta (*Todites*), Bennettitales (species of *Ptilophyllum* and *Pterophyllum*) and Coniferales (species of *Elatocladus* and *Pagiophyllum*). The assemblage is dominated by Bennettitales and Coniferales while pteridophytes are in paucity. While comparing and analyzing the data of the Shemshak flora with the well established assemblage zones of India, it has been observed that although flora corresponds to some extent to assemblage zone-8 (because of the preponderance of broad leaved cycadophytes) and also resembles to assemblage-9 (Gangapur assemblage -1) in having common bennettitalean remains but differ in non occurrence of pteridophytic remains which are quite common in assemblage zone-9. Although, Shemshak assemblage represents floral remains of both the assemblages, but is closer to assemblage zone-9 and belongs to an Upper Jurassic-Early Cretaceous Age.

Neeru Prakash

Systematically analysed megaspores from Jabalpur Formation (Early Cretaceous), exposed along Sher River near Sehora Village, Narsinghpur district (Madhya Pradesh). The assemblage includes 10 genera and 14 species, viz.

Duosporites congoensis, *D. multipunctatus*, *Banksisporites utkalensis*, *Banksisporites* sp. *Biharisporites* sp., *Erlansonisporites mineri*, *Horstisporites areolatus*, *H. biswasii*, *Saccarisporites lurzeri*, *Cystosporites* sp., *Manumisporites* sp., *Trikonina emarginata*, and 2 new species, viz. *Bacutriteles sherensis* and *Saccarisporites satpuraensis*. Except for *Erlansonisporites mineri* and *Saccarisporites lurzeri*, rests of the taxa are described for the first time from these sedimentary deposits. Different kinds of megaspores (azonate, zonate, alete, trilete) with diverse exosporium ornamentations like grana, verrucae, bacula, rods and rodlets, coni, spines and reticulations indicate structural diversity and complexity; thus reflecting on the richness of the megaspore assemblage. The occurrence of megaspores *vis a vis* other palynomorphs and palynofacies in the stratigraphic sequences has been evaluated.

Rajni Tewari, Madhav Kumar & Neeru Prakash

Consulted palynological literatures and compiled palynological data to prepare catalogue on Cretaceous spores.

Vijaya & Archana Tripathi

Results on morphotaxonomy and quantitative analysis of palynoassemblage recovered from the bore-hole BGG-3 drilled in Birbhum Coalfield (WB) have been finalized. Rich assemblage consists of 194 species belonging to 129 genera of which 3 genera and 18 species are described as new. Among these taxa floral groups are represented by pteridophytic spores (19 genera & 24 species), pollen grains (68 genera & 103 species), fungal remains (35 genera & 60 species), algal spore (4 genera & 4 species) and *incertae sedis* (3 genera & 2 species). The recovered stratigraphic significant taxa like *Incrotonipollis burdwanensis*, *Clavaperiporites homoclavatus*, *Arengapollenites* spp., *Spinizonocolpites thanikaimonii*, *Minutitricolporites minutus* suggest an early Eocene (Ypresian) age of the subsurface supratrappean sediments of the coalfield. A comparison of the present assemblage with other contemporaneous Tertiary deposits of India reveals close similarity with floras of Bengal, Kutch and Cambay basins.

J.P. Mandal & Vijaya

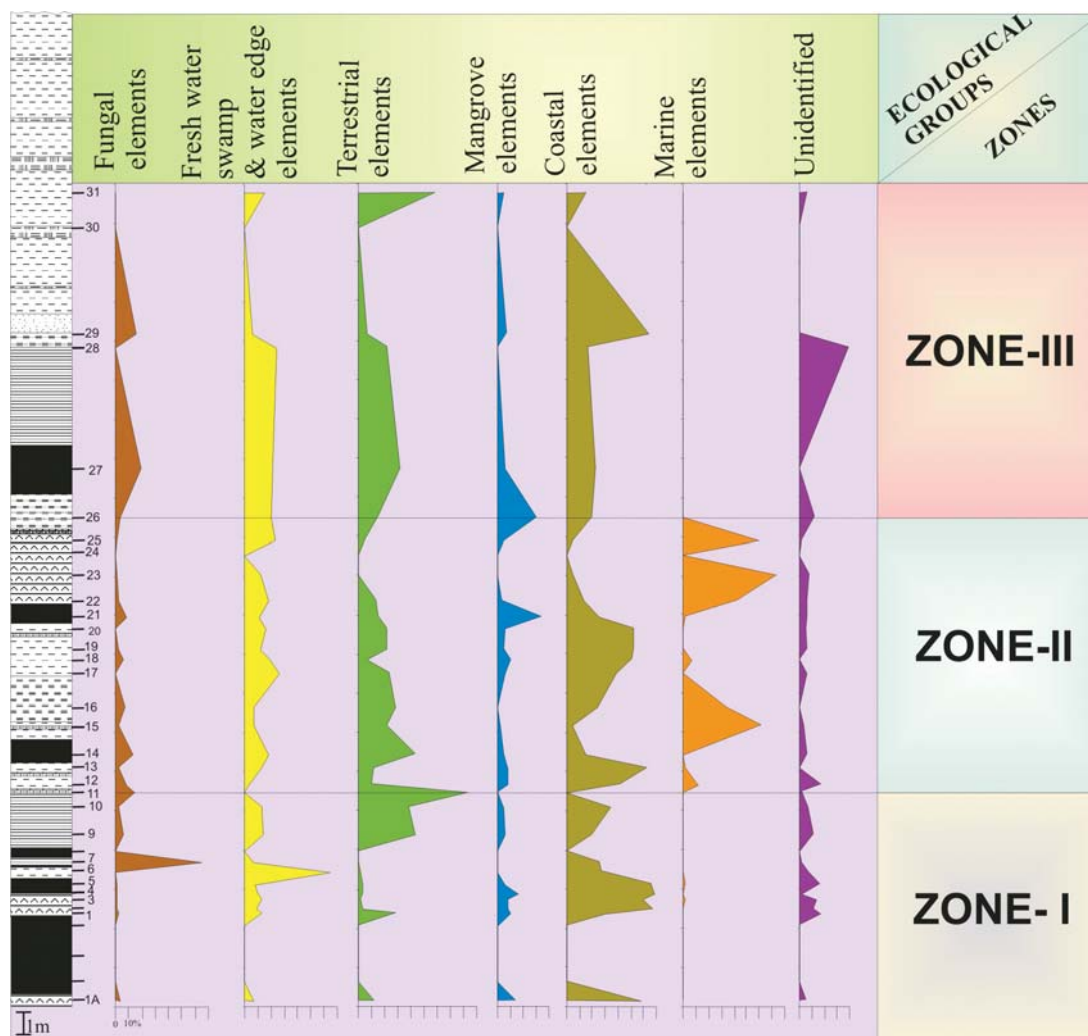
Studied a fossil wood collected for the first time from the Deccan Intertrappean beds of Shibli, Yeotmal (Maharashtra). It shows close resemblance with the modern woods of *Ailanthus excelsa* Roxb. of the family Simarubaceae which suggests the existence of a mixed, mesophytic tropical forest in the region during early Tertiary period. (jointly with Dr. D.K. Kapgate)

Mahesh Prasad & B.D. Mndaokar

A rich palynological assemblage has been recovered from Vastan Lignite Mine of Cambay Basin, Gujarat. The palynoassemblage consists of 80 genera and 95 species of algal remains (7 genera & 7 species, including dinoflagellate cysts), fungal remains (6 genera & 8 species), pteridophytic spores (14 genera & 20 species) and angiosperm pollen (53 genera & 65 species). Reworked elements (3 genera & 3 species) have also been recorded. Qualitative and quantitative analyses reveal that the angiosperm pollen is dominant over pteridophytic spores followed by dinoflagellate cysts. The palynomorphs in the assemblage has been compared with the spores and pollen of modern taxa and the distribution of the families, being dominated by elements of family Araceae.

The prevalence of tropical-subtropical (warm and humid) climate during the sedimentation of lignite mine is evident from the composition of the assemblage and the present day distribution of their extant families. The representation of fungal remains and pteridophytic spores are also corroborates the above view. On the basis of first appearance, maximum development and decline of the various palynofossils, 3 cenozones (Zone I to Zone III) have been recognized in the sequence. Palynomorphs belonging to low-land (*Lanagiopollis*, *Margocolporites*, *Lakiapollis*, *Triangulorites*, *Sastriipollenites*, *Retitrescolpites*, *Minutitricolpites* and *Proteacidites*), freshwater swamp and water edge (*Polypodiaceasporites*, *Polypodiisporites*, *Schizaeoisporites*, *Lygodiumsporites*, *Todisporites* and *Droseridites*), mangrove (*Spinizonocolpites*, *Palaeosantalaceae* and *Barringtoniapollenites*) and coastal floras (*Neocouperipollis*, *Palmidites*, *Palmaepollenites*, *Arengapollenites*, *Proxapertites*) have been identified. The presence of dinoflagellate cysts (*Operculodinium*, *Homotryblium*, *Glapharocysta*, *Achomosphaera*, *Spiniferites* and *Lejeunecysta*) and mangrove elements (*Nypa*, *Rhizophora* and *Barringtonia*) in the palynoassemblage indicates the influence of brackish water during deposition. On the basis of high frequency of *Nypa* and also representation of *Rhizophora* and *Barringtonia* pollen, it is inferred that the sediments were deposited in an area which was fringed by thick mangrove vegetation.

M.R. Rao & Poonam Verma



Representation of different ecological groups in Vastan Lignite Mine, Cambay Basin, Gujarat.

Three microfaunal assemblages are recognized in the rich and diversified microfauna, comprising almost exclusively of agglutinated foraminifera with simple interiors, recovered from the Rupsi Shale (Kimmeridgian-Early Tithonian) of Jaisalmer– *Bathysiphon-Rhabdammina-Rhizammina* Assemblage, *Trochammina-Reophax-Ammobaculites* Assemblage, and *Ammobaculites-Haplophragmoides* Assemblage in ascending order. Near shore hyposaline marshy conditions and anoxic muddy substrate with low pH is interpreted in the lower part of Rupsi Shale due to the coarse agglutination and poorly cemented tests, often with organic cements, with evidences of distortion and deflation/compression of tests in predominantly simple tubular agglutinated assemblage of low diversity and large populations. Occurrence of fossil wood fragments and organic matter-rich layers in the lower part further attests to paralic setting with enhanced terrestrial run-off. The change from *Bathysiphon-Rhabdammina-Rhizammina* Assemblage to diverse microfauna of *Trochammina-Reophax-Ammobaculites* Assemblage with appearance of several coiled and multiserial forms, suggests increased salinity and depth, leading to brackish estuarine environment with open-sea connections facilitating influx of nekto-benthic ammonites and belemnites. Absence of other benthonic marine biotope is attributed to lower than normal salinity. The overlying assemblage is much impoverished and occurrence of moulds of ostracods and polymorphinid and lenticulinid foraminifers suggests a decalcified assemblage. Occurrence of ammonites and belemnites in interspersed harder bands suggests open-sea connections with periodic marine incursions in overall salinity stressed conditions.

Rahul Garg

Nannofossil assemblage from the Siju Limestone Formation exposed in the Dilni river section, Garo Hills, Meghalaya

have been investigated in detail and a manuscript on their stratigraphic in demarcation of Lutetian-Bartonian boundary is finalized.

Jyotsana Rai & Rahul Garg

Prepared a poster entitled 'Role of microfossils and organic petrology in petroleum exploration' for providing basic lessons on energy efficiency for students education at Pre-conference Workshop (Feb.18-19, 2008) at an International Conference held at the Geology Department, Jammu University, Jammu.

Jyotsana Rai

Recorded rich palynofloral assemblages from the Dagshai and Kasauli formations (Early Miocene) exposed at Sarahan, Sirmaur district, Himachal Pradesh. The palynoflora is dominated mainly by fungal spores and ascostromata followed by angiosperm pollen and pteridophytic spores. Gymnosperm pollen is scarcely present in the assemblage. The important palynotaxa of the assemblage are— *Neocouperipollis*, *Palmaepollenites*, *Palmidites*, *Monoporopollenites*, *Pinuspollenites*, *Lycopodiumsporites*, *Tetraploa*, etc. The occurrences of *Neocouperipollis*, *Palmaepollenites* and several trilete spores indicate coastal–transitional environment of deposition for the older horizons of Dagshai Formation, however the abundance of Zygnemataceous zygospores in the younger horizons suggests that top of the formation were deposited under fresh water condition. The palynoflora recorded from the overlying Kasauli Formation is qualitatively very poor. The recorded palynoflora mainly consist of Zygnemataceous zygospores followed by bisaccate pollen of *Pinuspollenites* and *Monoporopollenites*. Poorly preserved triporate pollen grains, fungal spores and degraded type of organic matter suggests that the sediments were deposited under fluvio-deltaic environment of deposition in a fast sinking basin. The recorded palynofloral assemblages though not diversified qualitatively clearly indicates that the majority of its constituents belong to tropical to subtropical climate. The abundance of gymnospermous bisaccate pollen grains in the present assemblage seems to be due to the wind blown elements from the elevated uplands surroundings.

Samir Sarkar & O.P.Thakur

Photomicrography, description and identification of the Palaeocene algal taxa from Pondicherry and Ariyalur areas of Tamil Nadu (Cauvery Basin) have been done and interpretation on palaeoenvironmental significance has been made. Finalization of the manuscript is in progress with special emphasis on palaeoenvironment and growth form analysis.

A.K. Ghosh

Finalized macerals and rank data of the Barakar coals encountered in bore-hole RJP-11 of Pachwara Coalfield, Rajmahal Basin. Macerals of vitrinite group (collotelinite and collodetrinite) are common in these coals. Almost all the macerals of inertinite group are well-represented in the coals. Observations under fluorescence show manifold increase in liptinite contents, chiefly constituted by sporinite (spores-pollen), liptodetrinite (detritus) and alginite (algae). High amounts of hydrogen-rich macerals (liptinite + perhydrous vitrinite) render these coals suitable for hydrogenation. The vitrinite reflectance ($R_{o\ max}$ %) suggests that these coals are of sub-bituminous A to high-volatile bituminous C rank. Evidently, the coal seams have originated dominantly from woody vegetation in rapid seasonal fluctuations.

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

The pollen analysis of Sunderban honey (collected during International Conference on DELTAS in Bangladesh) revealed rich assemblage of pollen grains both qualitatively and quantitatively. The pollen grains of *Sonneratia* (19.8%) are dominant, followed by members of Rhizophoraceae (14%). The other pollen grains are of *Xylocarpus* (11.6%), *Excoecaria* (10.4%), *Laguncularia* (8.8%), *Avicennia* (5.8%), *Osbornia* (4.2%), *Aegiceras* (4.1%), Meliaceae (4%), *Lumnitzera* (3%), *Heritiera* (2.3%), *Acanthus* (2%), Malvaceae (1%), besides unidentified pollen grains (9%). Collected water sample exhibited poor pollen assemblage. However, pollen grains of *Sonneratia*, *Acanthus*, *Potamogeton*, *Excoecaria*, *Avicennia*, Poaceae, etc. are registered in low frequencies, whereas the dinoflagellate cysts, monolete, *Pediastrum* and *Tetraploa* are recorded in moderate frequencies.

Asha Khandelwal & Shilpa Singh

Undertook a field excursion to ancient dried Hulashkhara Lake, Mohanlalganj, Lucknow and collected a 2.60 m

deep sediment profile comprising 26 pollen samples and 9 samples for radiocarbon dating. In addition, 6 surface samples are also taken from the catchment of the lake to understand pollen deposition pattern. The preliminary investigation of the 5 profile samples has demonstrated a good pollen assemblage comprising mainly grasses, sedges, Chenopodiaceae/Amaranthaceae, Asteraceae, *Polygonum*, etc. together with sporadic presence of trees viz., *Madhuca indica*, *Acacia*, *Syzygium*, *Holoptelea*, etc. depicting thereby the presence of open grassland vegetation during the period of deposition of the sediments. The retrieval of *Botryococcus* colonies together with zygospores of *Spirogyra* and *Zygnema* and abundance of diatoms indicates the existence of lake in the past.

M.S. Chauhan, A.K. Pokharia & Md. Feroze Quamar

Palyno-taxonomy of bryophytes shows that spores of bryophytes provide tangible morphological features with great diversity which is of immense application in the elucidation of taxonomy. There are numerous liverworts which have been typified on the basis of spore morphology. Besides, various taxa in which vegetative characters are similar, taxonomic considerations have been made on the basis of spore morphology alone.

Asha Gupta

Six species of *Rhododendron* from Northeast India have been processed for SEM study. LM study reflects variation in both aperture and surface ornamentation (jointly with R. Gogoi & A.A. Mao).

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

Palynological study of one sedimentary profile (3.00 m deep) from Dzuko Valley, Nagaland reflects the mixed pollen assemblage comprising of Angiosperms, Gymnosperms and Pteridophytic elements indicating subtropical to temperate forest under arid to warm and humid climatic regime. Radiometric dates are expected shortly (jointly with R. Gogoi & A.A. Mao).

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

The study of 5 squeezed honey samples from Kamrup reserve forest, Assam were carried out. The majority of the honey samples were found to be unifloral with *Brassica nigra*, *Salmalia malabaricum*, *Coriandrum sativum*, *Mimosa pudica* and *Syzygium cumunii*. Other reliable nectar sources for honey bee are also identified (jointly with G.C. Sarma).

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

Carried out the LM and SEM studies of pollen morphology of *Nepenthes khasiana* from Garo Hills, Meghalaya. The interesting pollen morphological details of the rare endangered species shall be of great significance for interspecific classification, pollination ecology and cytological studies. Studies (jointly with **R.C. Mehrotra**) on 20 Tertiary wood fossils procured from Dirpai and Singrijan river bed, Dhemaji and North Lakhimpur district, Assam are in progress.

S.K. Bera & S.K. Basumatary

Supervised two Ph.D theses, one is of Mr. P.S. Ranhotra entitled 'Vegetational and climatic changes in the Himalayan and trans-Himalayan region since late Pleistocene' and the other one is of Mr. S.K. Shah entitled 'Analysis of climatic changes in Northeast Himalaya and its comparison with Western Himalaya during Late Quaternary'.

A. Bhattacharyya

SEM studies on some new species of the genus *Rhododendron* (Ericaceae) to be continued on some more species of seeds to know the morphological features.

Usha Bajpai

The joint work (on radiocarbon dating) with several groups from within and outside Institute has been initiated on palaeoclimatic and archaeological problems. Three charcoal samples from an ancient site Khanjanwar, Saharanpur (received from Dr. VC Thakur, WIHG) were dated to be in the range 1,813 to 2,604 yrs BP and are being examined for evidence of flooding. Samples from another ancient site Indorekheda, Bulandshahar (received from AMU, Aligarh through Chanchala Srivastava) were also dated and 3 dates (2169, 2291, and 2902 yrs BP) determined, and is expected to throw light of the history of the area during around 2,500 yrs ago.

C.M. Nautiyal

Collaborative Work

Studied well-preserved 8 organic-walled microfossils, comprising 5 acritarchs and 3 cyanobacterial remains, from the silicified carbonaceous/ black shales associated with chert nodules in limestone of Buxa Group (Ranjit Valley of Sikkim), Lesser Himalaya. The acritarchs are large sized, both simple and few ornamented sphaeromorphs associated with few cyanobacterial remains with/ without mucilaginous sheath representing solitary cells; group of sphaeroidal cells and thin sized trichomes. The present assemblage assigned to Neoproterozoic age for this window.

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

Compiled the generated data on excellent preserved organic-walled microfossils, belonging to 40 taxa of prokaryotes, acritarchs, VSM and Rhodophyta, recorded from the shales/ cherts of Baliana-Krol groups exposed in Eight Synclines of Krol belts, Lesser Himalaya. The recovered assemblages have close affinities with those microfossils known from the Ediacaran sedimentaries exposed elsewhere in world. The microbiotic assemblages also support the view that these formations were laid down in tidal flat conditions.

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

Palynological study of subsurface material from bore-holes TRBD-3 (511.55 m deep) of Tatapani-Ramkola and SKB-1 (552.00 m deep) of South Karanpura coalfields, and outcrop samples from Batuka Nala and Bhawani Nala, S Karanpura Coalfield has been carried out.

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

About 10 carbonised dicot wood samples from Late Holocene of Mosco and Ponpally area of Meenachil River Basin, Kottayam district, Kerala have been investigated. The anatomical study of the woods has revealed the occurrence of 8 types of woods. The assemblage consists of 6 genera, viz. *Artocarpus* (Family Moraceae), *Calophyllum* 2 spp. (Clusiaceae/ Guttiferae), *Canarium* (Burseraceae), *Holigarna* (Anacardiaceae), *Sonneratia* (Sonneratiaceae) and *Spondias* (Family Anacardiaceae) comprising 7 species representing 5 families. In addition, one wood sample could only be identified as dicot wood due to poor preservation.

J.S. Guleria & Rashmi Srivastava [& **A.B. Kumar** & **R. Satheesh** (School of Environmental Sciences, Mahatma Gandhi Univ., Kerala)]

CLAMP (Climate Leaf Analysis Multivariate Program) is a proven, powerful, but underdeveloped multivariate palaeoclimate proxy that exploits the intimate relationship between leaf form in woody dicotyledonous flowering plants and various climate parameters. CLAMP has been used successfully to explore terrestrial palaeoclimate variables such as mean annual temperature, cold and warm month mean temperatures (and thereby mean annual range of temperature), precipitation during the growing season as well as seasonal variations in precipitation and mean annual humidity. Of particular significance is that CLAMP can yield values for ancient enthalpy that in turn can provide an estimate of palaeoelevation. Worked on the aspect to strengthen the CLAMP study and its application on fossils in the Tertiary of India.

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

The plant megafossils including carbonised wood and leaf impressions from Lower-Middle Siwalik sediments of West Bengal have been studied. Preparation of a paper on a Fabaceous fossil wood resembling the modern wood of *Cynometra ramiflora* is in progress.

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

Finalized data on the leaf impressions collected from the Middle Miocene sediments of the sub-Himalayan zone exposed near the Seria Naka and Koilabas, western Nepal. It includes 9 genera, viz. *Donax* (Marantaceae), *Uvaria* (Anonaceae), *Qualea* (Polygalaceae), *Flacourtia* (Flacourtiaceae), *Shorea* (Dipterocarpaceae), *Iodes* (Icacinaceae), *Ochna* (Ochnaceae) and *Paranephelium* and *Arytera* (Sapindaceae). The genera *Qualea*, *Iodes* and *Arytera* are new to the Tertiary sediments of Indian subcontinent. The present day distribution of comparable extant taxa indicates

the existence of an evergreen to moist deciduous forest under tropical, warm humid climate in and around the study areas as compared to mixed deciduous forest there at present.

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

Monsoon intensification and Neogene-Quaternary Siwalik Biodiversity— processed 40 samples of Upper Siwalik sediments exposed at Nadah and adjoining areas (Haryana), Lower-Middle Siwalik sediments of Moginand and Kantro, Himachal Pradesh and recorded an assemblage consisting of algal and fungal remains, pteridophytic spores, gymnosperm and angiosperm pollen. Some of the important palynotaxa are— *Zygnema*, *Polyadosporites*, *Lygodiumsporites*, *Lycopodiumsporites*, *Leptolepidites*, *Pinuspollenites*, *Abiespollenites*, *Lakiapollis*, *Compositoipollenites*, *Retitrescolpites* and *Graminidites*. Data interpretation has been taken up and continued. Also undertook a field work in Ranital and adjoining areas of HP to study and sample the Lower-Upper Siwalik succession. 40 rock samples have been collected from Takli, Ranital, Nurpur and Harital areas for palynological investigation.

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

Multidisciplinary investigation of the K/T boundary interval exposed in the Umsohryngkew section, Therriaghat area (Meghalaya) involving phytoplankton, palynofacies, foraminifera and geochemistry, trace element, stable isotope and mineralogy have been taken up for studying biotic turnover, environmental and sea level changes in a shallow neritic depositional setup in the paleoequatorial region. Biotic evidence suggests extended periods of environmental stress during Late Maastrichtian interval probably due to low oxygen conditions. Further studies are in progress.

Rahul Garg, Khowaja Ateequzaman & Vandana Prasad
[& **Gerta Keller** & collaborators (Princeton University, USA)]

Palynological and palynofacies investigations of the early Paleogene succession of the Vastan Lignite Mine (Gujarat) revealed a moderately rich dinocyst assemblage including some stratigraphically significant taxa. Based on dinocysts latest Thanetian/ Sparnacian to middle Ypresian age is derived for the lignite bearing part of the Vastan succession. The palynofacies distribution pattern shows a remarkable correspondence with sedimentological interpretations for microlevel depositional sub-environments in a coastal marine setup. The integrated dataset is utilized to reconstruct relative sea level changes, T/R cycles to decipher 4th and 5th order cycles within a firm biostratigraphic framework.

Vandana Prasad, Rahul Garg & Khowaja Ateequzaman
[& **I.B. Singh** & collaborators (Geology Dept., Lucknow University)]

Palynofacies analysis and dinocyst distribution pattern studied in 6 late Quaternary shallow wells— SH 2, SH 18, SH 24, SH 26, SH 28, SH 29 (443 samples) from Krishna-Godavari delta region shows significant variations in terrestrial and marine organic matter content. Vertical distribution patterns of dinocysts, pollen-spores, various OM constituents (charcoal, degraded brown, well preserved cuticles, amorphous) and algal components (*Botryococcus*, *Pediastrum*, cyanobacteria) have been documented. Changes in the relative abundance of these parameters help to identify transgressive/regressive phases. The marine incursions are identified towards the base and top of the studied successions. The older marine pulse shows predominance of protoperidinioid dinocysts indicative of relatively high productivity conditions.

Synthesis of data from all the six shallow wells of the K-G deltaic region demonstrates 5 fluctuating transgressive/ regressive phases that can be laterally correlated in different wells on palynofacies criteria. Microdepositional environments identified herein include prodelta, distributary mouth bar, channel deposits, bay fill deposits, supratidal mud flat, mangrove swamp and fresh water swamp. These micro environments and their palynofacies characters are considered important to understand and identify the geometry of reservoir and source rocks. Prodelta, bay fill deposits, mud flats and swamps with algal blooms are good precursors for hydrocarbons. Significance of the work is highlighted as multi-parameter palynofacies studies of recent delta provide key to interpret depositional environments. Modern delta in K-G Basin can, thus, be an ideal analogue to the present day exploration backup. Based on palynofacies characteristics, hidden subsurface delta and its sub-environments may be easily identified, interpreted and applied for understanding depositional framework and modelling. The report has been presented and submitted to ONGC.

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

A comparative study of most typical palynotaxa from the early Paleogene of India have been compared against the neotropical fossil pollen-spore collection housed at the Smithsonian Institute at Panama to find similarities between Indian and South American palynoflora during the early Paleogene, since both widely placed continents lay at similar paleoequatorial zone during Paleocene-Eocene time interval. Due to comparatively more landward depositional setting of the available South American section and coastal marine setting of the Indian sections, the palynomorphs belonging to coastal vegetation showed great similarity as compared to the other hinterland palynomorph assemblage of South America. A joint study has helped in better understanding of the climate dynamics of the tropics during PETM (Paleocene Eocene Thermal Maxima) event.

Vandana Prasad [& **Carlos Jaramillo** (Smithsonian Tropical Research Institute, Panama)]

Endoskeletal siliceous dinoflagellates characterized by monotypic assemblage of *Actiniscus pentasterias* have been investigated from Southern Ocean sediments from upper 1 m of a core. A paper on their occurrence has been prepared.

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

Work has been carried out 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 has been done to carry out nannofossil data with isotopic studies of K/T section of Cauvery Basin.

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

Work has been initiated for integrated ammonite-nannofossil studies in a sequence stratigraphic framework of Mesozoic of western Indian basins. Conducted field work in Jaisalmer area and collected samples from Lathi (Thaiyat Member), Jaisalmer (Joyan, Fort, Bara Bagh, Kuldhara and Jajiya members) and Baisakhi and Bahadrasar formations. Samples from Mataji ka dungar Formation and Lathi formation from Barmer basin are also collected for recovery of calcareous nannofossils.

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

A rich palynofloral assemblage has been recorded from a measured stratigraphic section (Kalapathar) of Havelock Island, Andaman Islands. 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. Preliminary data interpretation suggests an Early Miocene age to the assemblage. The palynoflora has been compared with modern equivalents and it indicates a subtropical humid climate with high degree of rainfall during the deposition of the sequence in the studied area. Detailed morphotaxonomic study of the recovered palynofossils is now being carried out.

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

Analysis of the algal rich facies from the 3 members, i.e. Lakadong, Umlatdoh and Prang Limestone of Shella Formation (Jaintia Group, Meghalaya) has been done. Thin section analysis of Umlatdoh Limestone exposed in the southern part of Jaintia Hills yielded well-preserved calcareous green algae belonging to families Udoteaceae and Halimedaceae. Draft manuscripts on the geniculate and non-geniculate coralline red algal assemblage from the Lakadong and Prang members have been prepared.

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

Prepared the 'Status report on coal bed methane investigations in India during last four years (2003-07)' for the incorporation in INSA Report to be presented at IUGS.

Rakesh Saxena [& **M.P. Singh** (Lucknow Univ., Lucknow)]

Reviewed the information on coal bed methane (CBM) genesis and its status in Indian context, with discussing the issues, like how methane gassiness in the mines develops, how it is coal rank dependent, can methane gassiness be predicted even before mine development, etc. Genesis of methane in coal beds mainly occur during biochemical and

geochemical stages of coal formation (throughout entire coalification series) and also during post depositional phases at the time of magmatic intrusions. Intrusions in Cretaceous Period baked most of the Indian Gondwana coal seams. Of course, geothermal gradient also played a significant role. Evidently, it is indicated that most of the occluded methane (CBM, coal mine methane- CMM, abandoned mine methane-AMM), formed today in Indian coalfields, had its origin mostly during the geochemical stage (of coalification) and magmatic intrusion periods. During geochemical phases followed by volcanism, due to prevalence of high temperature and pressure the rank of coal enhanced and huge amount of thermogenic methane gas evolved.

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

Palynological study in two onshore cores (QG-I & II) from Krishna delta is carried out. QG-II bore-hole of 200 m deep reveals Pleistocene to Holocene vegetational change responding to climatic fluctuation and was not affected by sea level changes during the period. However, studies in QG-I reveal evidence of Middle Holocene transgressive phase and mangrove vegetation. The study is under progress.

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

Palynological study in 2 m samples (100 samples) in general reveals herbaceous pollen taxa in the surface to sub-surface samples along with burned charcoal and Poaceae, Cyperaceae. The sediments between 1-2 m reveal occurrence of *Pinus*, *Casuarina*, *Hibiscus*, *Capparis*, Asteraceae, Brassicaceae and other shrubby elements indicating that the climate was although arid but moister than present day. This may be attributed to increased anthropogenic pressure in the recent years. The study is under progress.

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

Morphological investigation of palaeo-ethnobotanical remains from ancient multi-period (Painted Grey Ware, Northern Black Polished Ware & Sunga to Kushana) site Indor-Khera in District Bulandshahr (Uttar Pradesh) is being continued. Three samples have been radiocarbon dated. The botanical finds reveal well-preserved cultivated species of Jujube in dominance along with fruit remains of amla, mango, jamun, etc. Other finds are of cereals like rice, barley, bread wheat, dwarf wheat; kodon millet, pulses of lentil, black gram, green gram, grass-pea and horse-gram; seeds of cotton and silk-cotton fibre plant, etc. A number of weeds and wild taxa have also been encountered in association with field crop remains like common-vetch (*Vicia sativa*) and sedges like *Carex* species. The find of holy beads of Rudraksha (*Elaeocarpus sphaericus/ganitrus*) of Himalayan origin from the Kushana levels in this region of Ganga plain is the significant one. A well settled agricultural practice was observed by the ancient settlers along with the know-how for medicinal plants like amla and jamun. In addition, participated in the excavations at this ancient site (Indor-Khera) and collected botanical remains from varied cultural horizons.

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

Analyses of tree-ring chronologies from the 'High Asia' region of the Himalayas, Karakoram, Tien Shan and Tibetan Plateau for the reconstruction of large-scale summer monsoon drought variability over India and the Tibetan Plateau are in progress.

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

Carried out chemical analysis of subsurface sediments collected from Rukti, Kinnaur district, Himachal Pradesh. Different elements, viz. Al, Fe, Mn, Ca, Mg, Ti, Na, K, Ba, Sr, Li, Cr, Co and Cu are analysed at different depths of the profile.

A. Bhattacharyya & Jyoti Sharma [& **V.K. Banakar** (NIO, Goa)]

Several parameters of environmental geomagnetic experiments, viz. Magnetic susceptibility, induced remanent magnetization, Anhysteretic remanent magnetization, SIRM, S-ratio, etc. have been generated from subsurface sediments collected from Rukti, Kinnaur district, Himachal Pradesh.

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

A manuscript entitled 'Atmospheric ^{14}C variability recorded in tree rings from Peninsular India: Implications for fossil fuel CO_2 emission and atmospheric transport' has been finalized.

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

Completed processing of samples from different bore-cores of Godavari Basin for recovery of palynomorphs. Quantitative and qualitative studies of samples from bore-hole MCP-7 of Chintalapudi area, Chintalapudi sub-basin revealed 5 distinct palynoassemblages, which essentially fall under 2 groups– one group (Assemblage-I, II & III) having dominance of striate disaccates along with presence of some stratigraphically significant taxa, belongs to Late Permian (Raniganj) palynoflora, while the other group (Palynoassemblages IV & V) shows sharp decline in percentage of striate disaccates, and consequent rise or dominance of taeniate disaccate and cingulate cavate spores, belongs to Early Triassic. Early Triassic palynoflora has been recorded for the first time in Chintalapudi area indicating existence of Panchet sediments in the sub-basin as in Sattupalli area. The study further supports the earlier studies of Jha & Srivastava (1996) that Kamthi Formation represents Early Triassic (=Panchet Formation) overlying Raniganj equivalent sediments with a gradational contact. Results communicated to SCCL.

Neerja Jha [& SCCL (Kothagudem, AP)]

Carried out processing of palynological samples from bore-core KPK-1 for recovery of palynomorphs. Quantitative and qualitative study of yielding samples is in progress.

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

Macerated rock samples from Westphalian and Kazimovian (Pennsylvanian) of Itararé Subgroup of Campinas and Monte Mor, São Paulo, Paraná Basin, Brazil. A rich assemblage of azonate and gulate dispersed fossil megaspores has been recorded. The assemblage includes the taxa *Bokarosporites rotundus*, *Banksisporites utkalensis*, *B. indicus*, *Jhariatrilletes baculosus*, *J. srivastavae*, *Biharisporites spinosus*, *Valvisisporites stephanensis*, *Lagenicula barakerensis*, *Lagenicula* cf. *levis*, *Lagenoisporites brasiliensis* (= *Sublagenicula brasiliensis*), *L. sinuatus* (= *Sublagenicula sinuata*), *Lagenoisporites* cf. *hispanicus* from Middle Carboniferous (Westphalian) and *Lagenoisporites brasiliensis*, *Lagenoisporites* sp., *Lagenoisporites* cf. *hispanicus*, *Bokarosporites rotundus*, *Banksisporites utkalensis* and *Duosporites* sp. from Upper Carboniferous (Kazimovian). The work is under progress.

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



Professor Samir K. Brahmachari, Director, Institute of Genomics and Integrative Biology, Delhi visiting Museum.



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)

Finalization of research report is in progress. A manuscript on dendrochronological potentiality of sub-fossil pine wood collected from swampy deposits at Ziro Valley, north-east Himalaya has been finalized. This includes the construction of two pine floating tree-ring chronologies covering time span of 331 and 83 yrs. Two C^{14} dates 300 ± 130 BP (calibrated age: AD 1,444-1,676) and $1,420 \pm 110$ BP (calibrated age: AD 530-720) from some inner most rings of two woods, one each component of these long and short chronologies suggest that these tree-ring data could provide data base for making millennium year long tree-ring chronology from this region.

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)

Palynofacies, dinocyst and diatom studies— Palynofacies and recent phytoplankton communities (dinoflagellates and diatoms) have been studied in surface sediments collected from present day Harshad Estuary (lies in the north-western part of Saurashtra Coast), with a view to monitor paleomonsoonal fluctuations and to develop better understanding of effect of environmental factors on phytoplankton communities. Cores were raised from various parts (proximal-distal) of the estuary, X ray radiographed to screen bioturbation as well as major lithological changes and were closely sampled at 1 cm interval to monitor decadal scale paleomonsoonal fluctuations. The sediment cores consist of distinct light and dark colored laminae of 1-cm in thickness. The dark colored laminae (organic rich) consist of phytoplankton's mostly protoperidinioids dinoflagellate cyst zooplanktons, tintinids, copepod egg shells and hence indicate high nutrient discharge probably deposited during enhanced summer monsoon. However the light colored laminae (clastic rich) is less in organic content, dinoflagellate cyst mostly belongs to Gonyaulacoid with less number of zooplanktons and other planktons indicate low runoff hence could be deposited during periods of low SW monsoon.

Cysts of both gonyaulacoid and peridinioid dinoflagellates have been studied for their ecological significance. Both centric as well as pennate diatom communities are studied in detail. Maximum distance cluster and detrended correspondence analyses are performed to identify phytoplankton associations that corresponded to nutrient related environmental changes, and possible relationships between various paleoecological groups amongst phytoplankton communities are drawn. The study shows that the diatoms and protoperidinioids dominate during periods of high river discharge (high SW monsoonal activity), however gonyaulacoid dinocyst predominates under the influence of marine tidal activity during low river runoff (low SW monsoonal activity). The detail decadal scale paleomonsoonal variability is expected after PB 210 dating.

Vandana Prasad & Vartika Singh

Climatic and sea level fluctuation studies— Dinoflagellate cysts, nannoplanktons and palynofacies studies have been performed on Holocene sediments of Medha Creek, Harshad, Saurashtra coast to document climatic and sea level fluctuations. For Palynofacies studies, a zonation scheme is applied that involves characterization of various OM types, identification of marine/ terrestrial palynomorphs and their relative proportion, size, spectra and preservation state for the gradual change in the depositional environment in terms of salinity (freshwater, brackish, marine) redox condition, productivity and stability of the water column (stratified/ mixed). Abundance of nannofossils along with marine dinocysts in the 90 cm sediment profile of Medha Creek (near Harshad) has been documented. The studies show dominance of gonyaulacoid dinocysts. Copepod eggs, zooplanktons and nannofossils in the lower 30 cm sequence. However, at few selected levels low organic matter and high carbonate content is marked with abundance of nannofossils. Palynofacies studies combined with nannofossils studies shows two marine flooding event around ~ 5130 and ~ 2000 cal yr bp. The upper part of the sequence shows gradual increase in freshwater limnic conditions with influx of land derived organic matter and freshwater algae. The upper 0-3 cm shows increased fluvial activity.

Vandana Prasad, Jyotsana Rai & Vartika Singh

Study on Lacustrine sediments— A combined study of palynology, phytoliths and magnetic susceptibility studies have been done on 3.70 cm lacustrine profile of Wadhvana pond, Dhadhar River Basin, Mainland Gujarat. These studies have been pursued with a view to monitor high resolution palaeoclimatic interpretation of Holocene age (samples have been done at 3 cm interval). With the help of pollen/ spores, fresh water algae and Arcellaceans/ testate amoebae and phytoliths and magnetic susceptibility and clay mineralogy studies, 5 climatic phases are identified from bottom to top. Phase-I (~ 9,000 yrs BP) shows dominance of both SW and winter precipitation activity, Phase-II (~8,000 yrs BP) dry phase followed by humid Phase-III (~ 6,000 yrs BP). Phase-IV (~3,000 yrs BP) is a dry phase leading to fluctuating warm and dry climate of Phase-V.

**Vandana Prasad, Anjum Farooqui, Binita Phartiyal,
Anupam Sharma & Vartika Singh**

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

Palynological and palynofacies studies have been carried out from a lignite bearing sequences of Vastan, Surat district, Gujarat (latitude 21° 25' 47" & longitude 73° 7' 30") with particular emphasis on environment of deposition. Both terrestrial as well as marine microfossils are recovered but this work focuses on terrestrial palynofossils only. The palynoflora is indicative of sedimentation in varied environments. Based on the frequency and distribution of recorded palynofossils, the studied sequence has been divided into two palynozones, viz. *Acanthotricolpites kutchensis* Cenozoone and *Lakiapollis ovatus* Cenozoone. Rich representation of Arecaceous pollen in lower part of sequence suggests its deposition in coastal environment. This part is also rich in pteridophytic spores of the families Osmundaceae and Schizaeaceae. Upper part of the sequence is rich in pollen of the family Bombacaceae. Of these, the fossil pollen *Lakiapollis ovatus* shows affinity with the extant plant *Durio* which is a member of Indo-Malayan Tropics. These plants grow in swampy evergreen forests. 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. Faunal evidences and the presence of pyritized wood fragments suggest that lower half part of the sequence was deposited in estuarine to lagoon environment. The upper half of the section is characterized by high frequency of bombacaceous pollen along with the profuse occurrence of dinocysts indicating deposition in shallow marine environment. Palynofacies studies indicate that deposition of the studied sequence took place under moderately to deep anoxic conditions.

S.K.M Tripathi & Divya Srivastava

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

Finalization of report on completion of palynological investigation is in progress. This study was carried out from three profiles which provide information on late Quaternary vegetation since last 18,000 to 6,000 yrs BP with hiatus around 14,000 to 13,000 yrs BP and 12,000 to 6000 yrs BP of Durung Drung glacier area, Trans Himalayan region. Analysis from exposed varved clay deposit of this region at Pensi La (4,400 m amsl) reveals that around 17,721 to 17,100 yrs BP climatic was arid as supported by the dominance of steppe elements over the other taxa. Subsequently, around 16,000 yrs BP climate was comparatively less arid which extends till 15,000 yrs BP. The other two profiles (DP1 & DP2) analyzed from dry lake bed of proglacial lakes close to snout (4,170 m amsl) of glacier provides vegetational history of that region since Pleistocene Holocene transition phase to mid Holocene. During 13,000 yrs BP climate was comparatively less arid which was followed by a cool and dry phase around 12,258 yrs B.P. This dry condition can be correlated with Younger Dryas event. Another profile (DP2) from Durung Drung covering time span of around 6,632 yrs BP. The pollen diagram reveals that there were at least two phases of climate ameliorations in the region since prior to 6,632 yrs BP interrupted by a phase when the climate was comparatively more arid in relation to the period before and after it.

A. Bhattacharyya & Jyoti Sharma

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

During the last year visit, lichen thalli of *R. geographicum* were marked at 7 places from Badrinath to Vasudhara Fall at an interval of 1 km approx. The marked lichen thalli was numbered with paint and measured with the help of vernier caliper. All the thalli were traced out on a cellophane paper for further study. During the study no historical age of substratum was found from which the probable age of the largest lichen thalli can be calibrated hence the second method was followed in which the marked lichen thalli have been left untouched in natural condition for further growth and the same to be measured next year. The second field trip to the area is undertaken to collect the repeated data of lichen growth marked thalli at same 7 places to establish a growth curve of lichen regarding the lichenometric studies of glacier. All the lichen thalli marked is measured again and traced out on cellophane to get precise data regarding the growth rate. The calculation of growth rate of the *R. geographicum* is being in progress to draw a growth curve to access the rate of glacier recession per year in the region.

Shantanu Chatterjee

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

Pollen analysis of trench KA on the outwash plain has revealed two zones. The lower and middle parts of the trench (samples KA-1–4) is mostly dominated by the non-arboreal taxa mainly comprising of members of Brassicaceae, Asteraceae, Saxifragaceae, Poaceae and Chenopodiaceae. The upper part of the trench (KA-5–8) is dominated by arboreal taxa, of which *Cedrus*, *Abies*, *Betula*, *Pinus* and *Rhododendron* are the main elements. Ferns and *Potamogeton* are also quite abundant. Thus, the lower and middle parts of the profile represents a phase when the climate was drier and cold, while the upper part represents a moist and cool climate. However, the palynological data has to be fit within the chronological timeframe when the ^{14}C dates of the profile are available. Also studies on profile KC were continued. The lower part of the profile is marked by the dominance of arboreal taxa, monolete ferns and aquatic taxa *Potamogeton*. This zone corresponds to a radiocarbon age of 2,358 to 1,160 BP and is indicative of a cool and moist climate during that time. The ^{14}C dates of the samples from middle and upper parts of the trench are awaited. Once the ^{14}C dates for the complete profile are available, it will be possible to tag the palynological data within a specific time frame.

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)

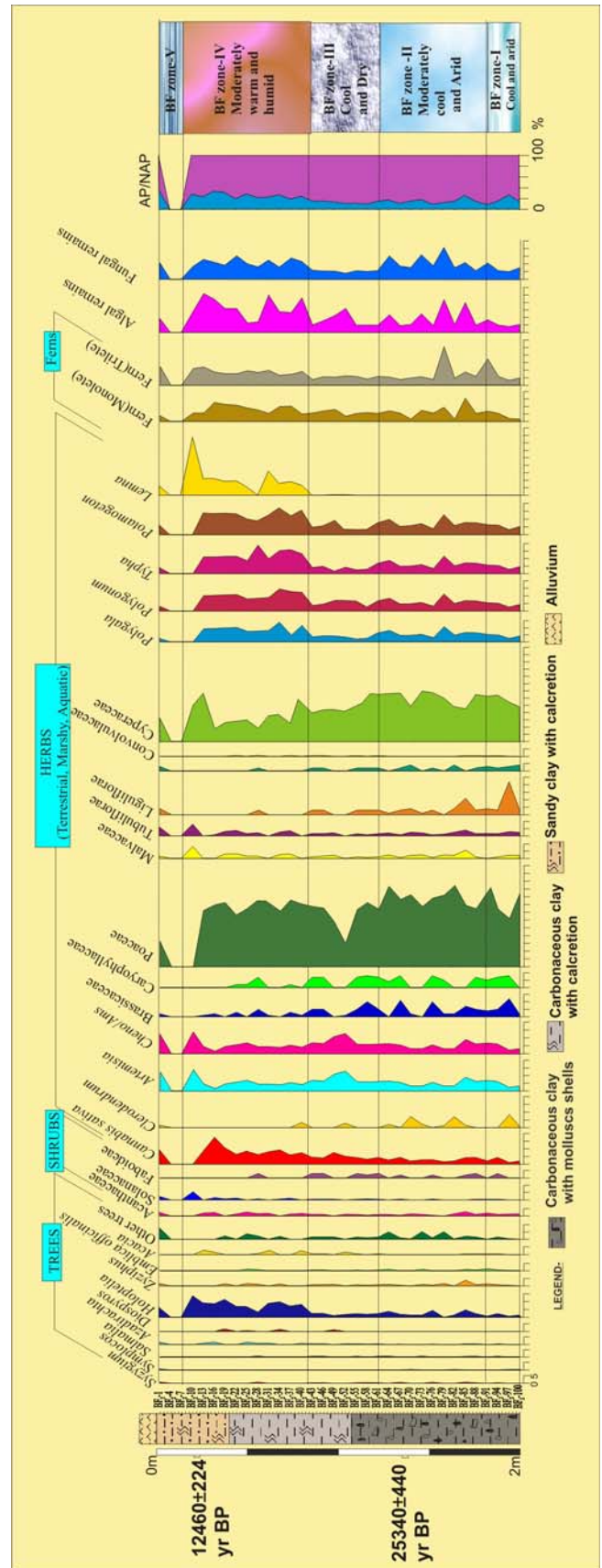
Pollen analysis of Baneta Formation exposed at Hathnora, Sehore district (Madhya Pradesh) inferred between 12,460 to 25340 yr BP reveals that the area was covered with open vegetation constituting the grasses, Chenopodiaceae/Amaranthaceae, Asteraceae and *Artemisia* along with sparsely distributed trees, viz. *Syzygium*, *Symplocos*, *Azadirachta*, *Diospyros*, *Embllica*, *Acacia* and *Holoptelea*. The marshy elements (Cyperaceae and *Polygonum*), aquatic elements (*Potamogeton* and *Typha*) and algal spores (*Spirogyra* and *Zygnema*) have also been recorded. In order to understand the sequential alternations in the vegetation and climate, the pollen diagram of Baneta Formation has been divided in to 5 distinct pollen zones (BF I–BF V) from bottom to top, on the basis of fluctuations in the values of some prominent arboreal and non-arboreal taxa.

The pollen BF Zone-I exhibits the presence of Poaceae, Cyperaceae, Liguliflorae, Brassicaceae, Caryophyllaceae, *Artemisia*, Chen/Ams in low frequencies, with a few trees like *Azadirachta*, *Holoptelea* and some shrubs, suggesting the open grassland type vegetation flourished in cool and arid climatic conditions. The BF Zone-II shows appearance of few more trees, viz. *Syzygium*, *Diospyros*, *Embllica* with increased percentage of *Acacia*, *Azadirachta*, *Holoptelea*, *Zyziphus* and *Symplocos*, with increased shrubs of Acanthaceae, Solanaceae, Fabaceae, etc. The frequency of Poaceae, Cyperaceae increased with decreased number of *Clerodendron*, Chen/Ams, *Artemisia* are suggestive of moderately warmer and arid condition. The BF Zone-III reveals the depletion in total vegetation. Trees were almost

vanished except a few, viz. *Diospyros*, *Embllica*, *Acacia*, *Zyziphus* and *Holoptelea*. Similarly shrubs and herbs are also showing fluctuating decreasing trends with decreased percentage of aquatics, ferns and algal fungal remains except a few herbs like *Artemisia* and Chen/Ams, which are showing increased percentage. Such a vegetation mosaic shows that area was covered by open grassland and experiencing cool and dry conditions. This vegetation scenario and corresponding climatic event is equivalent to the Last Glacial Maximum (LGM). The pollen BF Zone-IV exhibits that the arboreals *Syzygium*, *Symplocos*, *Salmalia*, *Alianthus*, *Azadirachta*, *Diospyros*, *Embllica*, *Acacia*, *Zyziphus* and *Holoptelea* are markedly increased. Pollen percentage of arboreal with fluctuating upgrading values of Acanthaceae, Fabaceae are indicative of moderately warm and humid climate. Percentage of grasses also increased with the new addition of *Lemna*, an aquatic element. The overall assemblage shows tree savannah type vegetation prevailed in the region. The BF Zone-V exhibits more or less similar pollen assemblage as in pollen zone-IV with increased percentage of trees suggesting tree savannah type vegetation flourished in warm and humid climate.

The interpretation is further corroborated by the presence of *Darwinula*, *Cypridopsis*, *Ilyocypris*, *Candona* (Ostrocods) pupillidae indet, *Gyraulus* (gastropods) and vertebrate assemblages like *Hippopotamus palaeindicus*, *Elephas hysudricus* in the Baneta Formation. The recorded data are indicating Early to Middle Upper Pleistocene in age and also indicate a warm climate, but the terminal part of the Upper Pleistocene may have become dryer as indicated by the presence of wild ass (*Equus hemionus khur*) and ostrich (*Struthio camelus*). At Baneta, the location of the type section, a sample from the carbonaceous clay layer dated of 8740 ±450 yrs BP. The palynological assemblage recorded include *Lemna*, *Artemisia*, *Terminalia*, *Mimosa*, *Pongamia*, *Holoptelea*, *Symplocos*, *Lagerstroemia*, *Poaceae*, *Cyperaceae*, aquatics, ferns and algal remains suggesting existence of tropical deciduous forest and warm and humid climate in the area. In addition, undertook field work (twice) in central Narmada Valley (Madhya Pradesh) to study and collect various profile samples from Quaternary sediments exposed at Hathnora and adjoining areas. 434 samples have been collected from Dhansi, Surajkund, Hathnora, Baneta, Khariaghat, Kusumelli, Ramnagar, Khargabali dhana and Kaharanjikheda to generate palynological data for interpreting palaeoclimate.

M.R. Rao & Poonam Verma



Pollen diagram of Baneta Formation, exposed at Hathnora, Sehore district, Madhya Pradesh

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 geological field work is conducted in Mainland Gujarat region. Detailed sampling has been carried out from Rayka, Pratappura, Jaspur, Mujpur, Dabka, and Kavi localities. Quaternary sediment samples are collected by making trenches, pits or by coring methods. Water samples are also collected at regular intervals from the entire stretch of Mahi River as well as ground water at several other locations and several physico-chemical parameters are recorded in the field itself using soil water analysis kit. To understand the contemporary phytoplankton community in the region, samples are collected from ponds, river and estuary using plankton net. Based on limited data generated so far on geochemistry, environmental magnetism, pollen and phytolith studies two abstracts have been published and work is presented in two national seminars. The work on recently collected samples is in progress. Besides, visited NIO (Goa), IIT (Roorkee) and JNU (New Delhi) for discussion with respective scientists.

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

A multi proxy study including phytolith, palynofacies, magnetic susceptibility and clay mineralogy has been carried out on the Kothiyakhad sedimentary sequence of Mahi estuary in mainland Gujarat. It contains valuable information on late- to mid-Holocene climatic regimes. In 3 phases recorded, Phase I (3,660~3,400 yr BP) shows a gradual weakening of SW monsoonal activity, though overlapped by enhanced western disturbances which led to the development of cool climatic conditions. The coupled effect of SW monsoon and enhanced winter precipitation produced improved hydrological conditions, which supported the agrarian society of the Indus Valley civilization until the beginning of Phase II (~3,400~3,000 yr BP). During Phase II the SW monsoon was in a state of severe recession, leading to severe drought-like conditions, other than for a brief but intensely warm and humid pulse recorded at ~3,320 yr BP, associated with SW monsoonal activity. In Phase III (~3,000-2,850 yr BP), SW precipitation fluctuated greatly with a considerable increase in warm summer conditions, similar to present-day conditions. The weak SW monsoonal activity ~3,500 yr BP also coincided with a global cool and arid phase and this probably explains the timing as well as the cause of why the population of the Indus civilization migrated to more humid areas to sustain their livelihoods.

Vandana Prasad, Binita Phartiyal & Anupam Sharma

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)

Cross dating of tree ring samples of *Larix griffithiana* and *Abies densa* collected from North Sikkim has been done. As the samples are derived from close canopy forests the tree-ring series contain high frequency signals. The crossdating of *Juniperus indica* samples are in progress.

R.R. Yadav & 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)

The cross dating of tree ring samples of *Juniperus macropoda* collected from Lahul, Himachal Pradesh has been completed. The ring-width measurement series are being analysed to prepare the chronology for climate studies.

R.R. Yadav & K.G. Misra

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)

Consultations of the Precambrian palaeobiological literature have helped in further identification of 44 genera and 168 species useful for the treatise which have potential in tracing the evolutionary history of Precambrian microorganisms. During the visit (in May-June 2007) to Geological Institute of Russian Academy of Sciences (Moscow), first draft of the project has been finalized. 30 Plates of the Type Form Genera and Species have been prepared for line

sketches. A number of microfossil descriptions and palaeontological plates have been prepared, and worked on them. Only genera and type species are dealt with examined, discussed and characteristics for these genera are also refined. At present, we have provided the comprehensive remarks on almost all the earlier described genera. The other type specimens of these genera are being provided in table format with necessary details. A need is also felt to revise the oldest cyanobacterial remains from Archaean rocks. Besides, examined and digitally recorded the type species and specimens housed in the Geological Institute (GIN RAS), Moscow. An effort is being made to obtain information, viz. photographs and necessary details regarding the other type species and specimens to be incorporated in the treatise. Preparation of plates and line diagrams elucidating the characteristic features are in progress. A research paper entitled "Mesoproterozoic silicified microbiotas of Russia and India-Characteristics and Contrasts" is under revision.

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)

Surveyed and procured polliniferous samples and sedimentary profiles from Dibrugarh Reserve forest, Upper Assam. Palynological studies of 15 subsurface soil samples from Tropical deciduous forest, Jeypore Reserve (Dibrugarh district) indicates relatively higher frequency of nonarboreals over arboreals. High land exotic taxa signifies high wind speed activity in the study area. Air surveys support the surface sample data. Degraded pollen and spore especially ferns with fungal remains signify the biological degradation during sedimentation. The abundance of rich fern and fungal spores also indicate the warm and humid climatic condition. Palynological study of two 1.2 m sedimentary soil profiles from Tipling and Merbeel (Dibrugarh district) reveal two distinct climatic zones, i.e. warm and humid to warm and more humid as evidenced by mixed palynoassemblage. Pollen analysis of remaining samples and radiometric dating is in progress.

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)

Attended the National Field Workshop in Neogene Succession of Mizoram during November 1-3, 2007 organized by the Dept. of Geology, Mizoram University, Aizawl. Collected a few samples for palynological study from Aizawl-Tuirial road and Aizawl-Sairang road sections. However, the pollen grains could not be found in the samples. Described a new fossil wood from the Tipam Group of Hlimen (Mizoram).

R.C. Mehrotra & Gaurav Srivastava



Dr. Sankar Chatterjee, Museum of Texas Tech University, Lubbock, Texas, USA delivering a lecture on December 24, 2007

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A view of Republic Day Celebrations (January 26, 2008)

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A view of Dr. B.S. Venkatachala Memorial Lecture held on January 2, 2008

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- Basumatary SK & Bera SK – Pollen rain from the vegetation of tropical moist deciduous forest, East Garo Hill, Meghalaya. *J. Palynol.*
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- Mehrotra NC, Babu R, Tewari R, Jha N, Kumar P, Singh VK & Shukla M – New global opportunities for hydrocarbon exploration in Neoproterozoic basins of Indian subcontinent. *J. Geol. Soc. India.*
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- Prasad M – Angiospermous fossil leaves from the Siwalik foreland basins and its palaeoclimatic implications. *Palaeobotanist.*
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Consultancy / Technical Assistance Rendered

The **Radiocarbon laboratory** processed 88 samples for various organizations across the country as well as from abroad dating materials like sediments, charcoal, shells and other carbonates etc. under consultancy. Scientists from the following organizations/ individuals availed of the consultancy:

Agharkar Research Institute, Pune (Maharashtra)
Archaeological Survey of India, Nagpur (Maharashtra)
Banaras Hindu University, Varanasi (Uttar Pradesh)
Centre for Earth Science Studies, Trivandrum (Kerala)
Cochin University of Science and Technology, Cochin (Kerala)
Deccan College, Pune (Maharashtra)
Division of Soil Resource Studies, NBSS & LUP, Nagpur
Geological Survey of India, Northern Region, Lucknow (Uttar Pradesh)
KP Jaiswal Research Institute, Patna (Bihar)
National Institute of Oceanography, Dauna Paula (Goa)
PG Institute of Archaeology, Columbo, Srilanka
Visva Bharati University, Shantiniketan, Birbhum (WB)
Water and Land Management Institute, Bhopal (Madhya Pradesh)
Dr. Madhulika Samant, New Delhi

Critical Point dryer has been installed in the **SEM Unit** for critically drying biological sample (living cells/tissues) for investigation. The drying of the sample is done at specific temperature and pressure with resulting density. This condition of zero surface tension can be used to dry biological specimen avoiding the damaging effect of surface tension. The unit has developed techniques for cement and building material investigated for the intermolecular binding of particles for homogeneous distribution of particles for strength and compactness; besides techniques to investigate nano-particles, nano-films, polymers, semi-conducting material, resins and sample from pharmaceuticals. Drugs effect on the microbiological samples has also been introduced.

Studies have been carried out to investigate the ultra structural morphology and micro-analysis of samples received from both in-house as well as from external agencies. Investigators belonging to different organization have also availed facilities for morphological investigation of their samples (fossil/living) and distribution of trace

elements at nano level using EDS techniques. Scientific expertise pertaining to the various techniques adapted for sample preparation as well as interpretation of data at sub-cellular level is offered to the investigators. All the different agencies, organizations, universities, total number of samples and nature of samples are listed below-

Department of Botany, Lucknow University, Lucknow (Botanical samples- 5)
Department of Physics, Lucknow University, Lucknow (Nanofilm/powder- 20)
Department of Geology, Lucknow University, Lucknow (Zoological sample- 6)
Department of Botany, University of Allahabad, Allahabad (Botanical samples- 16)
National Botanical Research Institute, Lucknow (Botanical, Microbiological samples- 29)
Department of Botany, BHU, Varanasi (Botanical/ Dental/ Pharmaceutical/ Cement /Building material samples- 52)
Department of Botany, Guwahati University, Guwahati (Botanical samples- 39)
G.B. Pant University of Agricultural & Technology, Garampani, Nainital (Zoological samples-2)
Amity Institute of Biotechnology, Lucknow (Microbiology- 2)
Central Drug Research Institute, Lucknow (Microbiology- 4)
Sardar Patel PG Institute of Dental Sciences, Lucknow (Dental material- 36)
K.G. Dental University, Lucknow (Dental material- 20)
Saraswati Dental College, Lucknow (Dental material- 4)
Rajeev Gandhi Prodyogiki Vishwavidhyalaya, Bhopal (Pharmaceutical/polymer samples- 23)
Babu Banarsi Das National Institute of Technology and Management, Lucknow (Pharmaceutical- 7)
Guru Gasi Das University, Bilaspur (Pharmaceutical- 2)
Institute of Pharmacy, Bundelkhand University, Jhansi (Pharmaceutical- 9)
Institute of Engineering and Technology, Lucknow (Pharmaceutical- 7)
Central Institute for Plastic Engineering and Technology, Lucknow (Polymer samples-7)



Department of Chemistry, UP College, Varanasi (Cement/
Building material- 20)

Central Institute of Mining and Fuel Research, Dhanbad
(Coal samples- 5)

N.C. Mehrotra, Rupendra Babu & V.K. Singh processed and studied samples of Morni hill, provided by ONGC, Dehradun, for the palynological studies both in thin sections and macerated residue through standard techniques.

A.K. Srivastava provided suggestions, guidance and technical expertise to the Jharkhand Government for the construction and development of Birbal Sahni Memorial Fossil Park and Museum in Sahebganj district of the State.

J.S. Guleria and **Rashmi Srivastava** visited Ghughua National Fossil Park (in June 2007) and rendered expert opinion and technical assistance to Mr. Kiran Desai (Programme Director), Centre for Environmental Education, Ahmedabad and his team for the development of Interpretation Centre at the Fossil Park in Madhya Pradesh by identifying a number of fossil woods forming part of fossil trail in

the park. This information is also provided to Mr. K. Nayak, Field Director, Kanha Tiger Reserve, Mandla under whose jurisdiction the fossil park falls.

B.D. Singh and **Alpana Singh** provided scientific assistance in observation of coal samples under Scanning Electron Microscope to Dr. A.K. Singh of Central Fuel Research Institute, Dhanbad. Scientific assistance in categorization of macerals in lignite samples is provided to Mr. Shashikant Dhanoria of School of Studies in Geology, Vikram University, Ujjain.

Samir Sarkar provided palynological training to Ms. Bhagyapati, Research Scholar of Geology Department, Delhi University, Delhi.

Rakesh Saxena processed coal samples received from ONGC for petrological characterization. The work is in progress.

The **Library** staff provided training to two Apprentice Trainees— Miss Anita Kushwaha and Mrs. Rashmi Bala Dixit sent by the Board of Apprenticeship Training (Northern Region), Kanpur.

Papers presented at Conferences/Symposia/Meetings

- Agarwal A & Ambwani K – Affinities of *Trilatiporites* Ramanujam (= *Sclerosperma*): SEM study from the Neyveli Lignite deposits, Tamil Nadu, India. *XXI Indian Colloq. Micropalaeontol. Stratigr.*, BSIP, Lucknow, November 2007.
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- Bera SK, Khare N, Sharma A, Bhattacharya A & Phartiyal B – Palaeoclimatic conditions in late Quaternary lakes, East Antarctica: A multi-disciplinary study using limnological, sedimentological, palynological, geochemical, mineral magnetic and chronological parameters. *Nat. Workshop Assessment of research programmes XXVI Indian Antarctic expedition & planning of XXVII IAE'*, NCAOR, Goa, June 2007.
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- Guleria JS, Srivastava R, Kumar AB & Satheesh R – Late Holocene vegetation and environment of Meenachil River Basin, Kottayam District, Kerala, India. *Int. Workshop Climate Change & its Impact on Flora in the South Asia Region*, NBRI, Lucknow, March 2008.
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Deputation/Training/Study/Visit in India/Abroad

Vandana Prasad

Visited Smithsonian Tropical Research Institute, Panama under a Smithsonian Fellowship for two months (May 01-June 30, 2007) to undertake a comparative study of low latitude Palaeogene flora of Indian and South American subcontinents within a framework of inter-institutional collaboration with Dr Carlos Jaramillo.

Visited Department of Geosciences, Princeton University, USA (on July 02, 2007) for discussions with Dr. Gerta Keller on the integrative multi proxy studies on KT boundary problem of low equatorial latitudes under the ongoing collaborative project. Subsequently visited (on July 3rd) Smithsonian Institute Washington DC for discussions with Professor Caroline Stromberg on evolution of grasses.

A.K. Srivastava

Visited Alava Museum of Natural Sciences at Vitoria, Spain on May 5 and 6th, 2007. Also visited National Natural Science Museum at Madrid, Spain from May 10-11, 2007 and examined the type and figured specimens of *Cordaites* sp.

Visited and examined the type and figured specimens of *Glossopteris* and insect fossils at National Museum of Natural History, Paleontology Department, Paris from May 12-15, 2007.

Attended Coordination Committee Meeting of Birbal Sahni Memorial Fossil Park and Museum organized at Ranchi, Jharkhand on June 12, 2007.

Mukund Sharma & Yogmaya Shukla

Visited Geological Institute of Russian Academy of Sciences, Moscow under a running ILTP Project for 45 (MS) and 30 (YS) days (in May-June, 2007), respectively for discussion and finalization of treatise of microfossils from Precambrian sequences within a framework of project with Dr V.N. Sergeev.

D.C. Saini & M.S. Chauhan

Participated in the Conference on *Biodiversity and Climate Change* organized by UP State Biodiversity Board and held on the International Day for Biological Diversity on May 22, 2007.

A. Rajanikanth

Attended Scientists and Administrative Interface

Training Programme held at Lal Bahadur Shastri National Academy of Administration at Mussorie from June 25-29, 2007.

C.M. Nautiyal

Attended Regional Meeting of Coordinators for Planet Earth Programme as a resource person at IVRI, Bareilly, catalysed and supported by RVPSP-DST (from July 7-10, 2007).

Attended and lectured at Rashtriya Vaigyanik Sangosthi on '*Paadap Vigyan Dvaara Swasthya evam Samridha Samaj*' at CIMAP, Lucknow (from November 29-30, 2007).

Attended the Regional Workshop on *Popularising Science* (as coordinator and resource person) held at Regional Training Institute (AIR), Lucknow (from February 4-8, 2008).

Attended National Workshop on *Changing Trends in Science Communication* held at Institute of Management Studies, Noida (from February 9-10, 2008).

A. Bhattacharyya

Participated in the ISRO-GBP Sub-working Brainstorming Workshop on High Resolution Monsoon Reconstruction since the Last Glacial Maximum ('21ka) held at the Cochin University of Science and Technology, Cochin from July 20-21, 2007.

Rajni Tewari

Attended DST sponsored programme on Leadership for Senior Women Scientists held at Administrative Staff College of India, Hyderabad from July 23-27, 2007.

S.K. Bera

Attended and coordinated the pre-induction Training Programme at Auli during August, 2007 as a part of XXVII Indian Antarctic Expedition.

S.K.M. Tripathi

Attended 3rd Proficiency Course on Modern Practices in Petroleum Exploration organized by Petrotech Society and held at DKMIPE, ONGC, Dehradun from September 24-28, 2007.

Anupam Sharma

Participated in the meeting of Shallow Subsurface Studies group held at Visakhapattanam during October



04-05, 2007 and presented and discussed the progress of our DST sponsored project.

Archana Tripathi

Visited Department of Botany and Department of Palaeobiology, Smithsonian Institution, and Natural History Museum, Washington (USA).

R.C. Mehrotra & Gaurav Srivastava

Attended National Field Workshop in the Neogene Succession of Mezoram held at and around Aizawl during October 31 to November 4, 2007.

Amalava Bhattacharyya

Deputed to participate (as nominated one of the team members by the National Committee, NCAOR) in XXVII Indian Scientific Antarctica Expedition during December 06, 2007 to April 11, 2008.

Mukund Sharma

Participated in the International Field Conference on Vindhyan Basin held at Satna, Maihar and Khajuraho, organized by Department of Earth Sciences, IIT Bombay, Mumbai from December 14-17, 2007.

Attended 5th Meeting of IGCP Project 493, "Rise and Fall of Vendian Biota" held at Geological Survey of India, Kolkata on January 22, 2008.

Participated in the Pre-Conference Field Trip in Rajasthan Ediacaran Sections of Marwar Supergroup during February 15-18, 2008. The trip was associated with the International Conference on Geology and Hydrocarbon Potential of the Neoproterozoic-Cambrian Basins in India, Pakistan and Middle East, organized at Jammu.

N.C. Mehrotra & Rajni Tewari

Attended *R&D Conclave-II* of Petroleum Industry organized by Petrotech Society and held at Goa during January 9-11, 2008. Also visited NCAOR, Goa for study and consultation on fossil material of Arctic region.

Visited Reliance Industries Ltd., Mumbai in connection with discussion on Palynology in Hydrocarbon Exploration. Director (NCM) delivered lecture (on February 20, 2008) on the subject highlighting the role of BSIP in this context.

Neerja Jha & Rajni Tewari

Visited KDMIPE, ONGC, Dehradun during January 21-25, 2008 for discussion on palynology in oil exploration and acquired data on organic matter maturation studies.

Attended National Conference on *Showcasing Cutting Edge Science & Technology by Women- An initiative of the National Task Force for Women in Science* held at Vigyan Bhavan, New Delhi during March 8-9, 2008.

Chanchala Srivastava

Attended 26th Annual Conference (NATCON-2008) on *Towards Cutting Edge Organisations-HR Issues and Challenges* organized by Petrotech Society and held at Vadodara from February 07-09, 2008.

Binita Phartiyal

Visited NCAOR, Goa for presentation and discussions on mutual collaborative project on Antarctic programme on February 19, 2008, during Project Evaluation Committee meeting.

Anil Agarwal

Visited Faculty of Sciences, Institute of Geology and Palaeontology, Charles University, Prague, Czech Republic under INSA Exchange Programme during February-March, 2008 and worked with Prof. Kvacek on leaf cuticles recovered from lignites of Neyveli, Ratnagiri and Sindhudurg districts under new low vacuum SEM and interference contrast light microscopy aiming at systematic evaluation and identification. Examined Lauraceous foliage from Early Miocene of North Bohemian Basin at National Museum, Prague. In addition, undertook study of some fossil woods from Neyveli Lignite (India) and from European localities in collaboration with Dr. Jakub Sakala.

Exchanged ideas about role of epidermal studies viz. statistical analyses of stomatal indices in reconstructing past atmospheric CO₂ levels and their impact on global climate and identified possible complementary approaches in palaeoclimatic reconstructions for various Tertiary floras in India and Europe towards assessment of climatic changes and gradients throughout Cenozoic. Possible new approaches towards use of megafossil studies in studies of atmospheric CO₂ concentrations of the past, palaeoclimatic changes and gradients are identified. Also attended exhibition of Dinosauria from Argentina at National Museum, Prague.

Asha Gupta

Attended National Symposium on *Rashtriya Vikas ki 21vi Sadi mein Jaiv Prodyogiki ki Bhumika* held at Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut from March 15-16, 2008.

S.K. Shah

On invitation, visited Thailand and worked on tree-ring aspect jointly with Dr. Edward R. Cook and Brenden Buckley at Kesatsart University School of Forestry, Bangkok from March 15-23, 2008

Jyotsana Rai

Visited UK from 21th March, 2008 onwards for 3 months under the INSA Exchange Programme to work at the Natural History Museum with Drs. Jeremy R. Young and Susanne F. Burkhardt of University College London and Dr. Paul Bown for comparative study of Indian Jurassic nannofossils of western India with European Jurassic stratotypic material.

S.C. Bajpai

Attended Seminar on *Changing Trends in Energy Generation Sources* held at the Institute of Environment and Management, Lucknow on June 09, 2007.

Attended National Conference on *Scientific and Legal Challenges on Global Warming* held at Brahmanand College, Kanpur during February 25-26, 2008.

Y.P. Singh

Participated in the National Conference on *Network Security and Management (NCNSM-2007)* held at the University of Lucknow, Lucknow during October 5-6, 2007.



Inauguration of Changing Trends in Energy Generation Sources held at the Institute of Environment and Management, Lucknow on June 09, 2007 by Dr. S.C. Bajpai

Deputation to Scientific Meets

Jyotsana Rai & Binita Phartiyal

- *International Conference on Geo-environment-Challenges Ahead* held at Jammu University, Jammu during April 23-25, 2007.

A.K. Srivastava

- *IV International Congress of Palaeoentomology, III World Congress on the Amber Inclusion & III International Meeting on Continental Palaeoarthropodology (Fossils X3)* held at Vitoria-Gasteiz, Spain during May 04-09, 2007.
- *VIII Discussion Meeting in Entomology on Facets of Cecidology: Intricacies of Insect-Plant Interactions* held at Entomology Academy of India, Chennai on December 05, 2007.

Ram Awatar

- *22nd Himalaya-Karakoram-Tibet Workshop* held at University of Hong Kong, Hong Kong SAR, China during May 22-25, 2007.

C.M. Nautiyal & Binita Phartiyal

- *Humboldt Kellog Workshop on Global Warming* held at Nainital during June 08-10, 2007.

S.K. Bera & Amlava Bhattacharyya

- *National Workshop on Assessment of Research Programmes of XXVI Indian Antarctic Expedition and Planning of XXVII IAE* held at NCAOR, Goa during June 27-28, 2007.

M.R. Rao, Binita Phartiyal & K.G. Misra

- *XVII INQUA (International Union for Quaternary*

Research) Congress on The Tropics: Heat Engine of the Quaternary held at Cairns (Queensland), Australia during July 28-August 03, 2007.

R.R. Yadav & S.K. Shah

- *First Asian Dendrochronology Association Conference and Workshop on Environmental Change and Human Activity* held at River Side, Bangkok, Thailand during September 09-15, 2007.

M.R. Rao, Anjum Farooqui, Binita Phartiyal, Poonam Verma & Kamlesh Kumar

- *International Conference on Asian Monsoon Variability in Past Global Changes (AMS-PGS)* held at Kumaun University, Nainital during September 11-14, 2007.

Anupam Sharma

- *Workshop on Collision Zone Geodynamic (Geocollision-2007)* held at WIHG, Dehradun during September 20-21, 2007.

A. Rajanikanth, Mukund Sharma, Rupendra Babu, A.K. Ghosh, V.K. Singh & Yogmaya Shukla

- *Workshop on Algae* sponsored by Ministry of Environment and Forest, New Delhi and held at University of Lucknow during September 27-28, 2007.

R.C. Mehrotra

- *International Symposium on Paleontology and Stratigraphy in Benxi of Liaoning* held at Benxi, China during October 04-07, 2007.



A view of Unveiling Ceremony as a part of International Symposium on Paleontology and Stratigraphy in Benxi of Liaoning held at Benxi, China during October 04-07, 2007.



C.M. Nautiyal

- *Workshop on Accelerator Mass Spectrometry* held at Inter-University Accelerator Centre, New Delhi on October 05, 2007.

N.C. Mehrotra & Rajni Tewari

- *XX Brazilian Congress of Palaeontology* held at Buzios, Brazil during October 21-26, 2007.

25 Scientists

- *Symposium on Palynology in Fossil Fuel Exploration* held at BSIP, Lucknow during November 14-15, 2007.

All the Scientific staff

- *XXI Indian Colloquium on Micropalaeontology and Stratigraphy* held at BSIP, Lucknow during November 16-17, 2007.

Ram Awatar & Srikanta Murthy

- *International Seminar on Crustal Evolution, Sedimentary Processes and Metallogeny* held at Dharwad, Karnataka during November 28-30, 2007.

Asha Gupta

- *XXX Botanical Conference of Indian Botanical Society; National Seminar on Emerging trends in Plant Science: Biodiversity, Biotechnology & Environmental Conservation and Symposium on Relevance of Linnaean Legacy and Thoughts on Plant Diversity in his Tercentenary year* held at Jiwaji University, Gwalior during November 28-30, 2007.
- *Workshop on Bryophyte Taxonomy* held at Botany Department, Lucknow University, Lucknow from March 7-8, 2008.

Chanchala Srivastava

- *Joint Annual Conference of Indian Archaeological Society (41st), Indian Society for Prehistoric & Quaternary Studies (35th) and Indian History & Culture Society (31st)* held at Raipur during December 01-04, 2007.

Asha Khandelwal

- *41st Annual Conference of the Indian College of Allergy, Asthma and Applied Immunology* held at Delhi during December 09-12, 2007.

Mukund Sharma & Yogmaya Shukla

- *International Conference on Precambrian Sedimentation and Tectonics and Second GPSS Meeting* held at IIT Bombay, Mumbai during December 10-12, 2007.

N.C. Mehrotra & A.K. Ghosh

- *95th Session of Indian Science Congress Association* held at Visakhapatnam during January 03-07, 2008.

Asha Khandelwal & Shilpa Singh

- *International Conference on DELTAS (Bangladesh Venue): Deltaic Gateways– Linking Source to Sink* held at Dhaka, Bangladesh during January 06-13, 2008.

N.C. Mehrotra, Rahul Garg, Neerja Jha & B.D. Singh

- *International Conference on Gas Hydrates* (under the aegis of National Gas Hydrate Program) held at Noida (Uttar Pradesh) during February 06-08, 2008.

Jyotsana Rai

- *International Conference on Geology and Hydrocarbon Potential of Neoproterozoic-Cambrian Basins in India, Pakistan and the Middle East* held at University of Jammu, Jammu during February 20-22, 2008, and Pre-conference Workshop (Feb. 18-19).

A.K. Srivastava, O.P. Thakur & Deepa Agnihotri

- *Indian Association of Sedimentologists XXIV Convention & National Seminar on Sedimentary Basins of India and their Economic Resources* held at AMU, Aligarh during March 04-06, 2008.

A. Rajanikanth

- *National Workshop on Global Climate Change and Sustainable Environment* held at BBA Central University, Lucknow during March 04-05, 2008.

S.K. Shah

- *Brainstorming Session on Dynamics of Glaciers in the Himalaya* held at Jawaharlal Nehru University, New Delhi on March 08, 2008.

J.S. Guleria, Rashmi Srivastava & S.K. Shah

- *International Workshop on Climate Change and its Impact on Flora in the South Asia region* held at NBRI, Lucknow during March 09-12, 2008.

R.R. Yadav, Anupam Sharma, Binita Phartiyal, S.K. Shah, P.S. Ranhotra & Ratan Kar

- *National Seminar on Glacial Geomorphology and Palaeoglaciation in Himalaya* held at Lucknow University, Lucknow during March 13-14, 2008.

B. Sekar

- *5th International Symposium on Radiocarbon and Archaeology* held at Zurich, Switzerland during March 26-28, 2008.

Lectures Delivered

N.C. Mehrotra

- *Earth and Plant Life: Origin of Fossil Fuels* at INSA, New Delhi (October 3, 2007).
- *High Impact Palynology in Hydrocarbon Exploration in Commercially Producing Basins of India: Present status* at XX Brazilian Congress of Palaeontology, Buzios, Brazil (October 2007).
- *High-Impact Palynology in Upstream R&D: Indian Scenario* at R&D Conclave of Petroleum Industry organized by Petrotech Society at Goa (January 9, 2008).
- *High-Impact Palynological Services in Hydrocarbon Exploration: Present Status and Future Perspectives* at Reliance Industries Ltd., Mumbai (February 20, 2008)
- *BSIP: Setting up of National Centre of Applied Palynology and Stratigraphy for Fossil Fuels exploration & "Central Core Lab Facility" offering Palynology as a Tool to the Industry in Hydrocarbon Exploration Research* at Ministry of Petroleum & Natural Gas, New Delhi (February 26, 2008)

A.K. Srivastava

- *Glossopteris flora of India* at Botany Department, Madras Christian College, Chennai (December 6, 2007)

Amalava Bhattacharyya

- *Palaeoclimatic scenario of Antarctica during Quaternary: Emphasis to Indian Research* at the meeting of North Indian Chapter of Geological Society held at Centre of Advanced Study in Geology, University of Lucknow (June 8, 2007).

A. Rajanikanth

- *Three P's— Planet, Past and Plants* (Guest Lecture) at National Workshop at BBA Central University, Lucknow (March 4, 2008).
- *Symbiosis and Green Planet* at Osmania University, Hyderabad (March 22, 2008).
- *Global Warming and Climate Change* at Bharatidasan University, Tiruchirapalli (March 31, 2008)

Chanchala Srivastava

- *Palaeo-ethnobotanical investigations and field techniques for recovering of macro-remains* at

Dept. of Ancient Indian History & Archaeology, Lucknow University (April 13, 16 & 18, 2007).

C.M. Nautiyal

- Two lectures in the *Science Communication Workshop* organized by KC Misra Vichar Manch, Deoria, catalysed and supported by RVPSP-DST (June 23-24, 2007).
- *Rajbhasha Hindi: Dasha aur Disha* on Hindi Divas at Lucknow Doordarshan (September 14, 2007).
- *Purana kitana Purana* at Sacred Heart Academy, Sitapur (September 26, 2007).
- *Radiocarbon Vidhi se Aayu Nirdharan* at Central Institute for Medicinal and Aromatic Plants, Lucknow (September 30, 2007).
- *Paudhon ka itihās samajhane me carbon ke samasthaniko ka mahatva* at Rashtriya Vaigyanik Sangosthi, CIMAP, Lucknow (November 29, 2007).
- *Carbon ke samasthaniko me jalavayu tatha sabhyata ke hastakshar* (Invited talk) at ITRC, Lucknow (December 19, 2007).
- A script on *Planet Earth* theme was broadcast as an episode of the radio serial 'Dharti Meri Dharti' by Vigyan Prasar on national channel (January, 2008).
- *Life in the Universe* at Regional Science City, Lucknow (February 2, 2008).
- Ten lectures in a Workshop for 4 states on *Popularising Science* at Regional Training Institute (AIR), Lucknow (February 4-8, 2008).
- *Scientist's View: Role in Science Communication* at National Workshop on Changing trends in Science Communication, Noida (February 9, 2008).
- *Possibilities of Life in the Universe* at Fatima Public School, Gonda organised by District Science Club (February 23, 2008).
- *Aayu Nirdharan ki Vidhi: Radiocarbon* at Vigyan Parishad, Prayag (February 27, 2008).

Asha Gupta

- *Palynology— Introduction and applications* (in Hindi) at Vigyan Lekhan Prashikshan Karyashala, BSIP, Lucknow (June 30, 2007).
- *Himalaya, Palaeobotany and Past Climate* (in Hindi) at J.P. Convent High School, Dhanva, Lucknow (July 13, 2007).

- *Palyno-Taxonomy of Bryophytes* at the Workshop on Bryophyte Taxonomy, Lucknow University, Lucknow (March 08, 2008).

Vandana Prasad

- *Climatic Shifts, Evolution, Extinction and Biotic Turnover in a 15My Time Span during northward journey of India* (Invited talk) at Department of Science and Technology, New Delhi (July 24, 2007).

Jyotsana Rai

- *Calcareous Nannofossils* at the Geology Department, University of Rajasthan, Jaipur (December 05, 2007).

S.K. Shah

- *Late Quaternary climate change in the Himalayas:*

A multi-proxy approach (Memorial Lecture) on the occasion of first BS Venkatachala Memorial Gold Medal award function at BSIP (January 2, 2008).

S.C. Bajpai

- *Ambient Energy utilization in Buildings: Prospects in India* (Guest Lecture) at the Seminar on Changing Trend in Energy Generation Sources, Lucknow (June 2007).
- *Master Plan for the Green Buildings in the Campus* located at 53-University Road, Lucknow at the Seminar at BSIP (November 2007).
- *Energy Conservation in Buildings: A tool for Combating Global Warming* at National Conference on Scientific & Legal Challenges on Global Warming, Kanpur (February 2008).

By Outside Scientists:

Dr. Sankar Chatterjee, Museum of Texas Tech University, Lubbock, Texas, USA

- *Feathered Dinosaurs from the Early Cretaceous of China and the Origin of Avian Flight* (December 24, 2007)

Dr. Andrew C. Rozefelds, Tasmanian Museum and Art Gallery, Hobart, Tasmania, Australia

- *The Endemic Plant Genera of Tasmania: Phylogenetic and Biogeographical relationships* (January 16, 2008)



Recognition

A.K. Srivastava

Rapporteur, at XXIV Convention IAS & National Seminar on Sedimentary Basins of India and their Economic Resources, AMU, Aligarh (March 2008).

M.R. Rao

Co-chaired a Technical Session at the International Conference 'Asian Monsoon Variability during the Past Global Changes' held at Dept. of Geology, Kumaun University, Nainital in September 2007.

A. Rajanikanth

Resource Judge & Guest Speaker, Session on Global Change and Sustainable Development, National Workshop 'Global Climate Change and Sustainable Environment' held at Dept. Environmental Science, BBA Central University, Lucknow in March 2008.

Ram Awatar & G.K. Trivedi

Elected Fellows of Geological Society of India, Bangalore.

C.M. Nautiyal

Coordinator (Academic), Workshop on Science Journalism, organized under the joint auspices of District Science Club and BSIP during June 30-July 01, 2007.

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

Jyotsana Rai

Coordinator, International Conference on Geology and Hydrocarbon Potential of the Neoproterozoic-Cambrian Basins in India, Pakistan and the Middle East, held at University of Jammu, Jammu during February 20-21, 2008.

Anupam Sharma

Won "3rd Prize" in the Best Poster for paper *Quaternary deposits in the Spiti Valley: Key to palaeoclimate and tectonics* (co-authored with Yogesh Ray, **Binita Phartiyal** & Pradeep Srivastava) presented at 'National Workshop Geocollision-2007', Dehradun in September 2007.

Binita Phartiyal

Won "D.N. Wadia Best Poster Award" for paper

Palaeoclimatic importance of the Quaternary deposits of Ladakh, NW Himalayas; Khalsar palaeolake a case study (co-authored with **Anupam Sharma & Ram Awatar**) presented at 'International Conference Geo-environment- Challenges ahead', Jammu in April 2007.

S.K. Shah

Awarded first "B.S. Venkatachala Memorial Gold Medal" for the best piece of research work among the young scientists of the BSIP.

Md. Firoze Quamar

Awarded "Consolation Certificate" for poster *Modern pollen rain study in the tropical deciduous forest in District Umariya, Madhya Pradesh* (co-authored with **M.S. Chauhan**) presented at 'XXI Indian Colloquium on Micropalaeontology and Stratigraphy' held at BSIP, Lucknow in November 2007.

Poonam Verma

Awarded "Best Poster Certificate" for poster *Climate change in central Narmada Valley during hominin bearing Quaternary sediments through proxy records* (co-authored with **M.R. Rao**) presented at 'XXI Indian Colloquium on Micropalaeontology and Stratigraphy' held at BSIP, Lucknow in November 2007.

Vartika Singh

Awarded "Best Poster Certificate" for poster *Phytoplankton variability in Harshad Estuary, Saurashtra Coast and its implications in palaeomonsoonal fluctuations* (co-authored with **Vandana Prasad**) presented at 'XXI Indian Colloquium on Micropalaeontology and Stratigraphy' held at BSIP, Lucknow in November 2007.

S.C. Bajpai

- Guest Faculty, M.Sc. Programme on Renewable Energy, Dept. of Physics, Univ. of Lucknow (2007-2008)
- Judge, Create your Taste/ Model Making Event, National Geography Olympiad (Geofest Int.-2007), CMS Degree College, Lucknow (November 2007).
- Co-Chairperson, Technical Session, National Conference on Scientific and Legal Challenges on Global Warming, Kanpur (February 2008)

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, *Symposium on Palynology in Fossil Fuel Exploration and XXI Indian Colloquium on Micropalaeontology & Stratigraphy*, BSIP, Lucknow (November 2007).
- Member, Project Evaluation Committee, Antarctic-Arctic Research Program, NCAOR, Goa.
- Member, Local Advisory Council, Regional Science Centre, Lucknow (Ministry of Culture).

Rahul Garg

- Vice President, The Palaeobotanical Society, Lucknow.
- Organising Secretary, *Symposium on Palynology in Fossil Fuel Exploration*.
- Convener, *XXI Indian Colloquium on Micropalaeontology and Stratigraphy*, BSIP, Lucknow (November 2007).
- Joint Secretary, The Palaeontological Society of India.
- Convener, Research Planning and Coordination Cell, BSIP.
- Co-ordinator, Joint Research Committee (BSIP-NIO).

J.S. Guleria

- Chief Editor, The Palaeobotanical Society & *Geophytology*.
- 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, *Symposium on Palynology in Fossil Fuel Exploration and XXI Indian Colloquium on Micropalaeontology & Stratigraphy*, BSIP, Lucknow (November 2007).

A.K. Srivastava

- Organising Secretary, Conference on *Plant Life through the Ages* (at BSIP in November 2008)
- Editor, *The Palaeobotanist*.
- Secretary, The Palaeobotanical Society of India, Lucknow.
- Member, Editorial Board and Treasurer, Indian Society of Geoscientists.
- Member, Steering Committee, Project- Conservation Education for Critically Important National Parks and Wildlife Sanctuaries through a Comprehensive Education Programme (Bharati Vidyapeeth Institute of Environment Education and Research, a Deemed University, Pune).
- Member, Coordination Committee for the establishment of Birbal Sahni Memorial Fossil Park and Museum, Dept. S&T, Govt. of Jharkhand, Ranchi.

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.

J.P. Mandal

- Joint Editor, *The Palaeobotanist*.

S.K. Bera

- Councilor, Executive Council, The Palaeobotanical Society, Lucknow.
- Coordinator, Pre-Antarctic High Altitude Training, Auli & Mana, XXVII IAE, NCAOR.

Usha Bajpai

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



Asha Khandelwal

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

Madhav Kumar

- Councilor, Executive Council, The Palaeobotanical Society, Lucknow.
- Member, Programming Committee, *Symposium on Palynology in Fossil Fuel Exploration and XXI Indian Colloquium on Micropalaeontology and Stratigraphy*, BSIP, Lucknow (November 2007).

R.C. Mehrotra

- 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.
- Member, International Organization of Palaeobotany (India Chapter), Kolkata

M.R. Rao

- Member, Programming Committee, *Symposium on Palynology in Fossil Fuel Exploration and XXI Indian Colloquium on Micropalaeontology and Stratigraphy*, BSIP, Lucknow (November 2007).

D.C. Saini

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

Rakesh Saxena

- Member, Paper Setter Panel (for II year M.Tech.), 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, 3rd International Students' Science Fair (August 2007), CMS Degree College, Lucknow.

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

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

Khowaja Ateequzzaman

- Member, Programming Committee, *Symposium on Palynology in Fossil Fuel Exploration and XXI Indian Colloquium on Micropalaeontology and Stratigraphy*, BSIP, Lucknow (November 2007).

C.M. Nautiyal

- Member (Outstation) Executive, Vigyan Parishad, Prayag.
- Member, Committee for Satellite-based Distance Education Centre, Council of Science and Technology, Uttar Pradesh.
- Member, Organising Committee, International Conference Polychar16 at Lucknow (February 17-21, 2008)
- Member, Project Selection and Project Monitoring Committees, Uttarakhand Council of Science and Technology, Dehradun.
- Advisor, Coordination Committee, National Children's Science Congress, Uttar Pradesh
- Member of Jury, Central Academy, Indira Nagar for model competition during the Annual Exhibition (December 25, 2007)
- Member, Evaluation Committee for State and District Coordinators for NCSC- 2007.

Jyotsana Rai

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

- Member, Programming Committee, *Symposium on Palynology in Fossil Fuel Exploration and XXI Indian Colloquium on Micropalaeontology and Stratigraphy*, BSIP, Lucknow (November 2007).

Alpana Singh

- Member, Bureau of Indian Standards, Solid Mineral Fuel Sectional Committee– PCD-7.4: Methods of Analysis Subcommittee.
- Member, Programming Committee, *Symposium on Palynology in Fossil Fuel Exploration and XXI Indian Colloquium on Micropalaeontology and Stratigraphy*, BSIP, Lucknow (November 2007).

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, *Symposium on Palynology in Fossil Fuel Exploration and XXI Indian Colloquium on Micropalaeontology and Stratigraphy*, BSIP, Lucknow (November 2007).
- 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 Environmental, 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 Uttar Pradesh at NBRI, Lucknow (sponsored by Air India and Dainik Jagran on September 1, 2007).
- Member, Programming Committee, *Symposium on Palynology in Fossil Fuel Exploration and XXI Indian Colloquium on Micropalaeontology and Stratigraphy*, BSIP, Lucknow (November 2007).
- Judge, National Children's Science Congress (District level) at Lucknow (November 3, 2007).
- Judge, National Children's Science Congress (State level) at Lucknow (November 27, 2007).

Vandana Prasad

- Member, Programming Committee, *Symposium on Palynology in Fossil Fuel Exploration and XXI Indian Colloquium on Micropalaeontology and Stratigraphy*, BSIP, Lucknow (November 2007).

Doctoral Degree Awarded

Name	Subject	Date	University	Supervisor	Title of Ph.D. Thesis
Parminder S. Ranhotra	Geology	June 13, 2007	Lucknow University	Prof. I.B. Singh, Dr. Amalava Bhattacharyya	Vegetational and climatic changes in the Himalayan and Trans-Himalayan regions since Late Pleistocene
Santosh K. Shah	Botany	August 11, 2007	Lucknow University	Dr. Amalava Bhattacharyya	Analysis of climatic changes in north-east Himalaya and its comparison with western Himalaya during Late Quaternary
Suresh C. Bajpai	Physics	December 31, 2007	Lucknow University	Prof. R.C. Gupta	A study on electrical characterization of Photovoltaic Generators and Systems



Publication

Journal—*The Palaeobotanist*

The journal Volume 56(1-3) was published with state of the art printing technology. The volume contains articles covering the different disciplines like Gondwana seeds and megaspores from Brazil and India, Triassic conifer wood, Calcareous green algae from Jaintia Group (Meghalaya), Middle Eocene calcareous nannofossils from Kutch Basin, Significance of fossil leaves in Tertiary beds of Nepal, and vegetation and climatic changes in Trans Himalayan region during the last 35 kyr BP. Papers for the Volume 57 are being processed.

Annual Report—English and Hindi versions of Annual Report were published with a new page design incorporating the research work carried out in different research projects during the period 2006-2007 of X Five Year Plan. The reports of collaborative projects, and sponsored projects of DST, CSIR, etc were also included in the report. 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.

BSIP Newsletter—Annual BSIP Newsletter 2007 (No. 10) was published with information on important activities of the Institute during the period July 1st, 2006 to June 30th, 2007.

Catalogue—A Catalogue entitled “A Catalogue of Calcareous Nannoplankton from India” by Jyotsana Rai was published.

Abstract Volume—An Abstract volume for “XXI Indian Colloquium on Micropalaeontology and Stratigraphy” was published with information on Abstract content (250 pages), various committees and author index.

Souvenir—A Souvenir for “Symposium on Palynology in Fossil Fuel Exploration” and “XXI Indian Colloquium on Micropalaeontology and Stratigraphy” 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:

Dr. S.K. Brahmachari — Human Genome Research: The Road Ahead (11th Jubilee Lecture, September 2007)

Dr. P.K. Seth — Bharat main jaiv prodyogiki evam jaiv vyapar ke avasar (Hindi Pakhwara Inaugural Lecture, September 2007)

Prof. Harsh K. Gupta — Earthquake Precursors: Indian Scenario (53rd Sir AC Seward Memorial Lecture, November 2007)

Sri Rasik Ravindra — Polar Research: Indian Contributions (37th Birbal Sahni Memorial Lecture, November 2007)

Sri Jokhan Ram — Multiple applications of Palynology in Hydrocarbon Exploration (Theme Lecture: Symposium on Palynology, November 2007)

Prof. Ashok Sahni — Biomaterials to Nanomaterials: A new dimension for Micropalaeontologists (Presidential Address: XXI ICMS, November 2007)

Dr. Sankar Chatterjee — Feathered Dinosaurs from the Early Cretaceous of China and the Origin of Avian Flight (Invited Lecture, December 24, 2007)

Invitation Cards— Invitation cards for Foundation Day, Founders Day, Symposium and Colloquium were printed.

Library

Library and information services at BSIP play an important role in facilitating research in the Institute by making available latest books, journals and e-journals in the respective areas and committed to serve its users efficiently.

The current holdings of library are as under:

Particulars	Additions during 2007-08	Total
Books	108	5,772
Journals (bound volumes)	252	15078
Reprints	381	39,802
Reference Books	04	337
Hindi Books	56	355
Ph.D. Thesis	-	91
Reports	-	46
Maps & Atlases	-	61
Microfilm/ Fisches	-	294
CD	-	72

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

Exchange Facility

Institutions on exchange list	63
Individuals on exchange list	146
Journals received on exchange basis	74
Reprints sent out in exchange	835
Reprints of research papers purchased for exchange	30

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

Automation

The foremost aim of the library is to build up its documentation and information dissemination services using the existing information technology. Entire literature of the library is now in Libsys software, the integrated library automation software that enables working in integrated multi-user and networked environment. Activities like circulation, cataloging, serials control, binding etc are carried out through this software. The holdings are accessible by a computerized on-line catalogue. It allows searches for material by author, title, subject, call number and key words. Efforts are being made so that the OPAC is web enabled and accessible over the Internet.

e-Journals

The Library has entered into an electronic information age. In addition to providing latest books and journals, it has subscribed for full text scientific database "Science Direct". Online access to this database has been provided through the Institute's LAN. Through this facility 21 Elsevier journals from 1995 onwards are available to the users (within the campus).



Other Facilities

Current Awareness Service— To keep the 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 and Xeroxing— To preserve the old and rare literatures, lamination and xeroxing of such publications is done. Library has provided xeroxing facility to scientists.

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

The following Institutions/Organizations availed the library facilities:

Department of Botany, Lucknow University, Lucknow

Centre of Advance Studies in Geology, Lucknow University, Lucknow

Institute of Management Sciences, Lucknow University, Lucknow

Department of Botany Mahila Vidyalaya, P.G. College, Lucknow

Department of Geology, Vikram University, Ujjain

Department of Botany, Allahabad University, Allahabad

INS Kunjali and Naval Provost Marshal (WNC), Mumbai

Department of Geology, Delhi University, Delhi

Museum

The Museum is a nodal center for popularizing and dissemination of palaeobotanical knowledge. The Institute displayed its activities at City Montessori Degree College, Kanpur Road, Lucknow on November 3, 2007. BSIP also participated in an exhibition "India R&D 2007 Innovation– Advantage India" organized during December 5-6, 2007 at FICCI, New Delhi. The exhibition was inaugurated by Shri Kapil Sibal, Hon'ble Minister for Science & Technology and Earth Sciences, Govt. of India. The Institute also participated in National Science exhibition "Biodiversity India" which was setup at Malabar Botanical Garden at Kozhikode during February 9-13, 2008. This exhibition was inaugurated by Shri V.S. Achuthanandan, Hon'ble Chief Minister of Kerala.

Work on Inventory (Part IV) of the type and figured specimens is under progress. Research materials collected by the Institute's scientists from 287 localities of the country under different projects, sponsored projects and collaborative researches were deposited in the Museum. Details of additions to the type and figured specimens/ slides are as follows:

Holdings

Particulars Type	Addition during 2007-2008	Total
Type and figured specimens	377	7,056
Type and figured slides	82	12,822
Negatives of above	50	17,554

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

Project	Specimens	Samples
Project- 1	-	313
Project- 2	1058	54
Project- 3	-	72
Project- 4	937	8
Project- 5	-	645
Project- 6	-	649
Project- 7	-	126
Project- 9	24	915
Project- 11	-	25
Project- 12	-	14
Project- 13	-	728

Samples deposited under Sponsored/ Collaborative Projects:

DST Sponsored (SR/S4/ES-138/2005)	-	434 samples
DST Sponsored (ESS/16/254(4)/2005)	-	21 samples
DST Sponsored (SR/S4/ES2-Brahmaputra-1/2005)	-	26 samples
DST (SR/S4/ES-21/Baroda window/PI)	-	1246 samples
CSIR Pool Scientist Project	-	43 samples
BSIP and SCCL Collaborative	-	240 samples



Fossil specimens gifted within the country to the following centers:

Department of Earth Sciences, Tamil University, Thanjavur
Department of Botany, P.G.V. College, Jiwaji Ganj Lashkar, Gwalior
Department of Geology, University of Rajasthan, Jaipur
School of Environmental & Earth Sciences, North Maharashtra University, Jalgaon
Kerala University of Council for Science, Technology and Environment, Thiruananthapuram
Homi Bhabha Centre for Science Education, Tata Institute of Fundamental Research, Mumbai
Department of Geology, Banaras Hindu University, Varanasi
South Calcutta Girls' College, Kolkata

Institutional Visitors

Forest Range Officers Training Institute Kanpur (Uttar Pradesh)
Department of Botany, Darjeeling District (West Bengal)
Department of Botany, Scottish Church College, Kolkata (West Bengal)
Department of Botany, A.N.K.P.G. College, Gudivada (Andhra Pradesh)
Department of Zoology, Tripura University, Agartala (Mizoram)
Department of Botany, Amravati University, Amravati, Nagpur (Maharashtra)
Garhwal University of Srinagar (Uttarakhand)
R.R.P.G. College, Amethi, Sultanpur (Uttar Pradesh)
St. Anns Inter College, Kanpur Road, Lucknow (Uttar Pradesh)
Participants of 3rd International Science Fair organized by C.M.S., Mahanagar, Lucknow (Uttar Pradesh)
Students of I.E.T., Lucknow (Uttar Pradesh)

Herbarium

About 212 plant specimens have been identified, mounted on herbarium sheets and registered. About 58 samples of fruits and seeds are also processed and identified. All the plant materials are incorporated in their respective families and sections. Inventory of Herbarium pollen slides (215), plant specimens (300), wood blocks and wood slides (42) is prepared, providing botanical name of each species with family, place of collection, accession number and date of preparation.

Holdings

Particulars	Addition during 2007-2008	Total
Herbarium		
Plant specimens	212	23,083
Leaf specimens	-	973
Laminated mounts of venation pattern	-	66
Xylarium		
Wood blocks	5	4,158
Wood discs	-	68
Wood cores	438	7,270
Wood slides	-	4,180
Palm slides (stem, leaf, petiole, root.)	-	3,195
Sporothek		
Polleniferous materials	-	3,016
Pollen slides	-	12,237
Carpothek		
Fruits & seeds	58	4,554
Museum Samples		
Medicinal & food plant	-	91

Visitors

Dr. Manish Manda, Institute of Pharmacy, Jodhpur (Rajasthan)
 Dr. Akhilesh, Rohil Khand University, Jhansi (Uttar Pradesh)
 Dr. A.R. Saxena, D.A.V. College, Azamgarh (Uttar Pradesh)
 Dr. S.N. Srivastava, D.A.V. College, Azamgarh (Uttar Pradesh)
 Prof. Anupam Dixit, Botany Dept., Allahabad University, Allahabad (Uttar Pradesh)
 Prof. K.N. Dubey, Botany Dept., BHU, Varanasi (Uttar Pradesh)
 Dr. S.S. Khatri, B.G.R.C., Pauri (Uttarakhand)
 Dr. Gunfam Klegi, B.G.R.C., Pauri (Uttarakhand)
 Forest Guards (Trainees) of Forestry Training Institute, Kanpur (Uttar Pradesh)
 Teachers Attending Refresher Course, Academic Staff College, Lucknow University, Lucknow (Uttar Pradesh)



Electronic Data Processing

Internet connection with Radio-link facility from Software Technology Park of India, Lucknow has been upgraded from 1 MBPS (1:4) to 3 MBPS (1:1) in the Institute. Proxy, Mail and DNS Servers are successfully configured on Sun V440, Sun V240 having Solaris Operating System. This provides 24 hours Internet facility to the staff. At present 117 Computers are connected with the LAN.

An anti-virus program 'F-Prot' has been renewed with 100 user license to protect the systems from viruses and worms. This year Institute has procured 5 laptop and 4 Compaq P-IV systems with UPS and Laser Printers, 6 KVA online UPS and one 'all in one Laser Printer'. Institute has procured 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 (WI-FI) connectivity has become functional within the campus.

Payroll, Form 16 and Pension packages are also modified as per the requirements. Section is providing help to the scientists in preparing the multimedia presentations, charts, graphs, lithologies 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 640 samples were cut and about 1860 slides were prepared. In addition, 136 slices were made and polished for detailed examination by the scientists.

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

Reservations and Concessions

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

Status of Official Language

BSIP is ever functioning towards achieving the set target for official language. The Institute participated in the meetings of Nagar Rajbhasha Kaaryaanvayan Samiti (N R K S) in August 2007 and February 2008, respectively. District Science Club, Lucknow organized 5 days Workshop on *Hindi mein Vigyan lekhan* with the co-operation of the Institute. N R K S bestowed Appreciation Certificate as BSIP conducting Hindi Workshop and publishing Annual Report in official language. The Director, Dr. N.C. Mehrotra and Member-Secretary, Dr. C.M. Nautiyal participated in the meeting of Joint Hindi Advisory Committee, New Delhi organized in Vigyan Sadan on 11th August 2007. The staff of the Institute took active part in science communication in Hindi through various media.

Hindi Pakhwara

Hindi Pakhwara was inaugurated on 10th September 2007 by Dr. Prahlad Kishore Seth, Chief Executive Officer, Biotechnology Park, Lucknow by delivering an interesting lecture on *Biotechnology in India and Opportunities in Biobusiness*. The Director introduced the Speaker and Dr. Ashwini Kumar Srivastava proposed the vote of thanks. The Director cheered up the competitors during the competitions too and the programme concluded in a good spirit.

Fifty-eight competitors participated in the series of competitions on Hindi Typing (Computer), Find the Mistakes, Poetry, Travel-Report, Noting, Antyaakshari, Quiz and Debate competitions were organized. Prize distribution was held on September 24, 2007 in the auditorium, in which Hindi books of reputed authors were given away. Results of various competitions are:

<i>Typing</i>	I- Km. Sudha Kureel, II- Sri Ajay Kumar Srivastava, III- Sri Rajesh Kumar
<i>Find the Mistakes</i>	I- Smt. Abha Singh, II- Sri Avinesh Kumar Srivastava, III- Dr. (Mrs) Jyotsana Rai
<i>Poetry</i>	I- Dr. (Mrs) Jyotsana Rai, II- Dr. Ramesh Kumar Saxena, III- Dr. (Mrs) Alpana Singh
<i>Travel-Report</i>	I- Sri Prem Prakash
<i>Noting</i>	I- Dr. (Mrs) Asha Khandelwal, II- Sri Prem Prakash, III- Sri Avinesh Kumar Srivastava
<i>Antyaakshary</i>	I- Dr (Mrs) Rajni Tewari & Dr. (Mrs) Rashmi Srivastava, II- Sri Vijay Pratap Singh & Sri Rajesh Kumar Awasthi, III- Dr. Sanjai Kumar Singh & Sri Dharendra Kumar Pal
<i>Quiz</i>	I- Dr. Amit Kumar Ghosh, Mrs. Kavita Kumar & Km. Deepa Agnihotri, II- Dr. Mukund Sharma, Sri Syed Rashid Ali & Km. Yogmaya Shukla, III- Dr. A. Rajanikanth, Sri Dharendra Kumar Pal & Km. Swati Dixit
<i>Debate</i>	I- Km. Shilpa Singh, II- Dr. A. Rajanikanth, III- Sri K.C. Chandola

Hindi Encouragement Prizes

To promote the use of Hindi in the office work cash prizes were awarded to the followings:

- I- Dr (Mrs) Asha Khandelwal & Sri I.J.S. Bedi
- II- Sri Prem Prakash, Dr. (Mrs) Rajni Tewari and Dr. (Km.) Asha Gupta
- III- Sri Avinesh Kumar Srivastava, Mrs. Swapna Mazumdar, Sri Shailendra Singh Panwar,
Km. Chitra Chatterjee & Sri K.K. Bajpai



Hindi Workshop

Hindi Workshop was organized in each quarter:

- (a) *Hindi Software ki Upyogita* { Sri Manindar Kapoor, Aryan Softwares, New Delhi }
- (b) *Inke Prayog mein Samasyaon ka Vayaavaharik Hal*
- (a) *Hindi- Vijnan Prodaugiki ki Bhasha ke Roop mein* { Sri Ved Prakash Rawat, Member, Joint Hindi Advisory Committee, Ministry of Science and Technology, New Delhi }
- (b) *Hindi Antarrashtriya Bhasha kaise bane*
- (a) *Anuwad- Kala evam Siddhant* { Prof. Satyadev Mishra, Lucknow University, Lucknow }
- (b) *Sarkaree Tantra mein Rajbhasha ki Bhoomika*
- (a) *Hindi Saraansh Software ki Upyogita* { Sri Manish Malhotra, Bhasha Soft Services, Lucknow }
- (b) *Samasyaon ko kaise Suljhaen*

Deputation in the Workshops

Asha Khandelwal, Rashmi Srivastava, D.K. Dutta, S.K. Singh & Ajay K. Srivastava

Participated in the Training Workshop organized by N R K S at CDRI, Lucknow from September 27-28, 2007.

Murukan Pillai

Attended the 12th Akhil Bhartiya Rajbhasha Sammelan held at Kovalam, Thiruvananthapuram during October 02-04, 2007.

Miscellaneous

84 Computers of the Institute have been facilitated with bilingual (Software). The process of making forms bilingual is now completed. Annual Report of the Institute was published in Hindi. Abstracts of the research papers in Hindi were also published in the international magazine of the Institute 'The Palaeobotanist'. In adherence to the Official Language Act-1963, implementation Section 3(3), correspondence in Hindi is also improving continuously.

Thus, the Institute is continuously abiding by the rules and direction of the Official Language *in extenso*.



A view of Hindi Pakhwara Celebrations



Staff

Director

Dr. Naresh C. Mehrotra

Scientists

Scientist 'G'

Dr (Ms) Jayasri Banerji (retired w.e.f. 31.05.2007)

Scientist 'F'

Dr Rahul Garg
Dr Jaswant S. Guleria
Dr Jagannath P. Mandal
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 for one year)
Dr (Mrs) Anjum Farooqui
Dr Amit K. Ghosh
Dr Anupam Sharma

Scientist 'B'

Mr Ajay K. Arya (resigned w.e.f. 27.08.2007)
Mr Sadhan K. Basumatary
Dr Srikanta Murthy
Dr Hukam Singh
Mr Veeru K. Singh
Mr Biswajeet Thakur

Scientist 'A'

Dr (Mrs) Binita Phartiyal
Dr Anil K. Pokharia

Birbal Sahni Research Associate

Dr Parminder S. Ranhotra
Dr Santosh K. Shah

Birbal Sahni Research Scholar

Mrs Anumeha Shukla

Technical Personnel

Technical Officer 'D'

Dr B. Sekar

Technical Officer 'C'

Mr P.K. Bajpai
Dr (Mrs) Madhabi Chakraborty
Mrs Indra Goel
Mrs Asha Guleria (retired w.e.f. 31.08.2007)
Mr P.S. Katiyar
Dr E.G. Khare
Mr T.K. Mandal
Mr V.K. Singh

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

Technical Officer 'B'

Mrs Reeta Banerjee
Mrs Sunita Khanna
Mrs Kavita Kumar
Mr Chandra Pal
Mr Prem Prakash
Mr V.P. Singh
Mr Y.P. Singh (revoked w.e.f. 07.05.2007 FN)
Mr Avinesh K. Srivastava

Technical Officer 'A'

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

Technical Assistant 'E'

Mr Chandra Bali

Technical Assistant 'D'

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

Technical Assistant 'B'

Mr Avanish Kumar
Mr Madan S. Rana
Mr Subhash C. Singh
Mr Ajay K. Srivastava

Technical Assistant 'A'

Mr Pawan Kumar
Mr Om Prakash

Section Officer

Mr I.J.S. Bedi (retired w.e.f. 31.01.2008)
Mr R.K. Kapoor
Mrs V. Nirmala

Accountant

Mr Dhoom Singh (w.e.f. 11.06.2007)

Stenographer

Mr Murukan Pillai

Assistant

Mrs Ruchita Bose
Mr Hari Lal
Mrs Swapna Mazumdar (w.e.f. 16.07.2007)
Mr Gopal Singh (w.e.f. 16.07.2007)
Mr K.P. Singh (w.e.f. 16.07.2007)
Mr Koshy Thomas (w.e.f. 16.07.2007)
Mrs Pennamma Thomas

Hindi Translator

Mr Ashok Kumar

Upper Division Clerk

Ms Chitra Chatterjee (w.e.f. 16.07.2007)
Mr Mishri Lal
Mr S.S. Panwar
Mr Rameshwar Prasad (w.e.f. 16.07.2007)
Mrs Shail S. Rathore
Mr Avinash K. Srivastava
Mrs Renu Srivastava
Mr N.Unni Kannan

Lower Division Clerk

Mrs Sudha Kureel
Ms Manisha Tharu

Driver

Mr Nafis Ahmed ('IV')
Mr D.K. Mishra ('III' w.e.f. 06.06.2007)
Mr M.M. Mishra ('II')
Mr V.P. Singh ('II')
Mr P.K. Mishra ('I')

Administrative Personnel**Registrar**

Dr Suresh C. Bajpai

Accounts Officer

Mr Dipak K. Dutta

Private Secretary

Mrs M. Jagath Janani

Class 'D' Personnel**Attendant 'IV' (Technical)**

Mr K.C. Chandola

Attendant 'III'

Mr Kesho Ram
Mr Haradhan Mahanti
Mrs Munni
Mr Prem Chandra

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



Mr Ram Deen
Mr Ram Kishan
Mr Ram Singh
Mr Shree Ram

Attendant 'II'

Mr K.K. Bajpai
Mrs Maya Devi
Mr Hari Kishan
Mr Kailash Nath
Mr Dhan B. Kunwar
Mr Mani Lal Pal
Mr Ram Dheeraj
Mr Ram Ujagar
Mr Mohammad Shakil
Mr Bam Singh
Mr Kedar N. Yadav

Attendant 'I'

Mr R.K. Awasthi
Mrs Beena
Mr Deepak Kumar
Mr Vishwanath S. Gaikwad
Mr Inder Kumar
Mr Subhash C. Mishra
Ms Nandani
Mrs Ram Kali
Mr Ramesh Kumar
Mr Ravi Shanker

Mali

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

Sponsored Project Personnel

Dr Ratan Kar, CSIR SRA
Dr Shantanu Chatterjee, CSIR SRA
Mr K.G. Mishra, SRF
Ms Divya Srivastava, SRF
Ms Vartika Singh, SRF (tenure expired
w.e.f. 04.02.2008)
Ms Jyoti Sharma, SRF (resigned w.e.f. 20.11.2007 AN)
Mrs Poonam Verma, JRF
Mr Kamlesh Kumar, JRF
Mrs Yogmaya Shukla, JRF
Mr Gaurav Srivastava, JRF (resigned w.e.f. 08.05.2007)
Mr Akhilesh K. Yadav, JRF (resigned w.e.f. 26.06.2007)
Mr Jagdish Prasad, Field/Lab Assistant
Mr Saheb Lal Yadav, Lab Assistant

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

Appointments

Mr J. Baskaran, Technical Assistant 'A' w.e.f. 17.04.2007 (AN)
Mr Ashok Kumar Sharma, Technical Assistant 'A' w.e.f. 07.03.2008 (FN)

Mr Om Prakash, Birbal Sahni Research Associate w.e.f. 03.04.2007 (FN)

Mrs Abha Singh, Birbal Sahni Research Scholar w.e.f. 02.04.2007 (FN)
Mr Mohamad Firoze Quamar, Birbal Sahni Research Scholar w.e.f. 23.04.2007 (FN)
Ms Shilpa Singh, Birbal Sahni Research Scholar w.e.f. 25.04.2007 (FN)
Ms Deepa Agnihotri, Birbal Sahni Research Scholar w.e.f. 30.04.2007 (FN)
Ms Neha Goel, Birbal Sahni Research Scholar w.e.f. 04.06.2007 (FN)
Ms Ruchi Srivastava, Junior Research Fellow w.e.f. 31.12.2007 (FN)
Mr Harinam Joshi, Junior Research Fellow w.e.f. 08.01.2008 (FN)

Ms Swati Dixit, Project Assistant w.e.f. 22.06.2007 (AN)
Mr Gaurav Srivastava, Project Assistant w.e.f. 23.07.2007 (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 2008 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, 2008;
 - 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 15, 2008
Place : Lucknow

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

Sd/-
(R.N. Khanna)
Partner

ANNEXURE - 'A'

(Annexed to and forming part of the Audit Report for the year ended 31st March, 2008)
**Comments/Audit observations on accounts of Birbal Sahni Institute of Palaeobotany- Lucknow
for the year ended 31st March, 2008**

Comments/Observations by the Chartered Accountants	Actions taken by the Institute																
<p>1. The Institute received grants for Plan and Non-Plan expenses, based on budgets approved by the DST. During the year, total grant of Rs.630 Lacs (Rs. 500 Lacs for Plan expenses and Rs. 130 Lacs for Non-Plan expenses) received which is shown as Income of the Institute for current year.</p>	—																
<p>2. The Income and Expenditure Account shows Rs. 243.50 Lacs as Excess of Expenditure over Income of the year after provision of depreciation of Rs. 163.22 Lacs and Rs. 60 Lacs have been transferred to General Reserve and Rs. 94 Lacs to Pension Fund, the accumulated deficit for the year is Rs. 397.50 Lacs.</p>	—																
<p>3. The Institute has held Rs. 357.37 Lacs in the current account of Bank, it is suggested that the funds are to be invested in short and long term Bank Deposits to meet the budgeted requirement of the Institute, it will generate additional funds by way of interest to the Institute.</p>	<p>Rs. 357.37 included the amount of Rs. 200.00 Lacs invested as Fixed Deposit which matured on March 28, 2008. Rs. 180.00 Lacs was again reinvested w.e.f. May 21, 2008.</p>																
<p>4 a) The old unsettled advances need attention of the Institute for the recovery and adjustments, further observed that official advances are not timely settled, be properly adhered.</p>																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Particulars</th> <th style="text-align: left;">Year</th> <th style="text-align: left;">Amount</th> </tr> </thead> <tbody> <tr> <td rowspan="3">1. Books & Journals</td> <td>1983-84</td> <td>878.00</td> </tr> <tr> <td>2003-04</td> <td>519.31</td> </tr> <tr> <td>2005-06</td> <td>3547.80</td> </tr> <tr> <td></td> <td>2006-07</td> <td>75511.00</td> </tr> <tr> <td>2. CNR shifting transformer</td> <td>2003-04</td> <td>562789.00</td> </tr> </tbody> </table>	Particulars	Year	Amount	1. Books & Journals	1983-84	878.00	2003-04	519.31	2005-06	3547.80		2006-07	75511.00	2. CNR shifting transformer	2003-04	562789.00	<p>Inspite of the best efforts for supply of the books, the books could not be supplied and the amounts have been written off by the Competent Authority.</p> <p>The journals have been supplied and the advance has been settled.</p> <p>Rs. 45385.00 have been settled and Rs. 30126.00 is being settled.</p> <p>The settlement of the outstanding advance of M/s Electricity Urban Distribution Division, UP Power Corporation Limited is under process.</p>
Particulars	Year	Amount															
1. Books & Journals	1983-84	878.00															
	2003-04	519.31															
	2005-06	3547.80															
	2006-07	75511.00															
2. CNR shifting transformer	2003-04	562789.00															

Comments/Observations by the Chartered Accountants	Action taken by the Institute
<p>3. Upgradation of C-14 Lab :</p> <p>a) Rs. 25,74,000.00 stands as unsettled advance to Kelvin International Co. against LC pending to be executed, to be reviewed and settled.</p> <p>b) Rs.1,55,319.00 Draft sent to Chart Industries Inc, USA, not presented by the party to be reviewed for recall.</p>	<p>The matter is pending with the Department of Science & Technology, New Delhi for further processing of the purchase.</p> <p>A letter has been issued to the Bankers for “Stop Payment” and to take further necessary action for crediting of the money to the Institute’s account.</p>
<p>b) The recovery of following staff loans are irregular and over due to be recovered to regularize the over due recovery :</p> <p>Dr Shyam C Srivastava Ex-Scientist ‘D’ Conveyance Advance Rs.60000/- LTC Advance Rs.26190/-</p>	<p>Dr Shyam C Srivastava, Scientist 'D' was dismissed from the Institute and the matter is pending in the Hon'ble High High Court of Judicature at Lucknow Bench, Lucknow.</p>
<p>c) Shri R K Tantua, Technical Assistant 'D' has been on deputation with State Government. His lien had been expired on 31.03.2007, the contribution for retirement and terminal benefits have not been received.</p>	<p>The matter has been taken up with the Directorate of Geology & Mining, Government of UP to settle the issue.</p>
<p>5. The Institute Fixed assets do not bear the identification mark and year of purchase and the discrepancies reported on physical verification for shortage, damaged and unserviceable assets including Vehicles identified have not been disposed off and accounted. The Office Memorandum for the physical verification of annual stocks of assets as on 31.03.2008 have been issued, all the reports are yet to be received and examined, to be looked and appropriate action be taken for write off, disposal and recovery of discrepancies reported.</p>	<p>Some of the verification reports have been received and further action as per rules is being taken. The process for identification marks on Fixed Assets is progressing. The process for auction of unserviceable vehicles has also started.</p>
<p>6. The Institute has charged Depreciation on fixed assets w.e.f. 01.04.2005 at the rates prescribed under Income Tax Act. During the year full depreciation have been provided on WDV 01.04.2007 and 50% depreciation on the additions of fixed assets during the year.</p>	<p>—</p>



7. The Institute has not followed Double Entry System of accounting for meaningful and effective maintenance of accounting record in compliance to the standards applicable in India. The Institute has in compliance on the observation reported, awarded the assignment who has taken up job.

The work for execution of Double Entry System has started.

8. The Institute have furnished stock position of priced publications valued at Rs.62.33 Lacs including Reserved stock of publication Rs. 9.30 Lacs, which are valued at printed price. The Institute have to take effective measures to reduce the inventory to avoid blockade of funds.

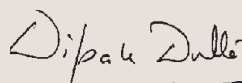
The stock of priced publications of the Institute is gradually being reduced.

9. During the year 2006-07 Investment of GPF Funds in RBI Bonds Rs. 12.00 Lacs have been redeemed at par and the premium of Rs. 124800.00 paid on Securities is appearing as Investment in Securities. The Institute should review the matter for settlement.

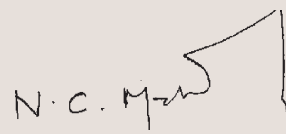
The matter has been discussed in the F&B Committee and Governing Body meetings and is being reviewed for settlement.

10. The excess expenditure of the projects handled be avoided and in the case of a project handled by Dr A Bhattacharya, excess expenditure of Rs. 2183.00 be called :

The Utilization Certificate has been submitted to the Funding Agency for releasing of further amount.


Dipak K. Dütta
(Accounts Officer)


S.C. Bajpai
(Registrar)


Naresh C. Mehrotra
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow

Balance Sheet as on March 31, 2008

Fig. in Rupees

CORPUS/CAPITAL FUND AND LIABILITIES	Schedule	Current Year	Previous Year
CORPUS/CAPITAL FUND	1	195407118	235157470
RESERVES AND SURPLUS	2	20960903	14960903
EARMARKED/ENDOWMENT FUNDS	3	85707875	73338561
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	126066	108584
TOTAL		302202962	323566518
ASSETS			
FIXED ASSETS	8	110362075	97087565
INVESTMENTS-FROM EARMARKED/ENDOWMENT FUNDS	9	85062653	72693339
INVESTMENTS-OTHERS	10	22891245	15944403
CURRENT ASSETS, LOANS, ADVANCES ETC.	11	83886989	137841211
MISCELLANEOUS EXPENDITURE (to the extent not written off or adjusted)			
TOTAL		302202962	323566518
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

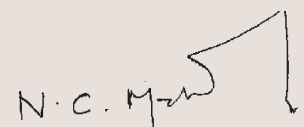
CERTIFICATE

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
Sd/-
R.N. Khanna
(Partner)


Dipak K. Dutta
(Accounts Officer)


S.C. Bajpai
(Registrar)

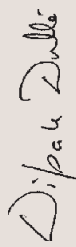

Naresh C. Mehrotra
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow
Income and Expenditure Account for the year ending March 31, 2008


Fig. in Rupees

INCOME	Schedule	Current Year	Previous Year
Income from Sales/Services	12	963324	1003976
Grants/subsidies (OB, Deposit A/C and Transfer from Cap. Fund)	13	63000000	63300000
fees/Subscriptions	14	0	0
Income from Investments (Income on Invest. From earmarked/endow. Funds transferred to Funds)	15	946842	420166
Income from Royalty,Publication etc.	16	114903	139347
Interest Earned	17	2963513	7307838
Other Income	18	670211	1031657
Increase/(decrease)in stock of Finished goods and works-in-progress	19	0	0
TOTAL(A)		68658793	73202984
EXPENDITURE			
Establishment Expenses	20	56336259	49985512
Other Administrative Expenses etc.	21	20350875	17687497
Expenditure on Grants,Subsidies etc.	22	0	0
Interest	23	0	0
Depreciation (Net Total at the year-end-corresponding to Schedule 8)		16322011	15475014
TOTAL (B)		93009145	83148023
Balance being excess of Expenditure over Income B-A		-24350352	-9945039
Transfer to Special Reserve (Sepecify each)		6000000	4800000
Transfer to/from General Reserve to Pension Fund		9400000	7150000
BALANCE BEING SURPLUS/DEFICIT CARRIED TO CORPUS/CAPITAL FUND		-39750352	-21895039
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

For **R.N. Khanna & Company**
Chartered Accountants
Sd/-
R.N. Khanna, (Partner)


Dipak K. Dutta
(Accounts Officer)


S.C. Bajpai
(Registrar)


Naresh C. Mehrotra
(Director)



R R