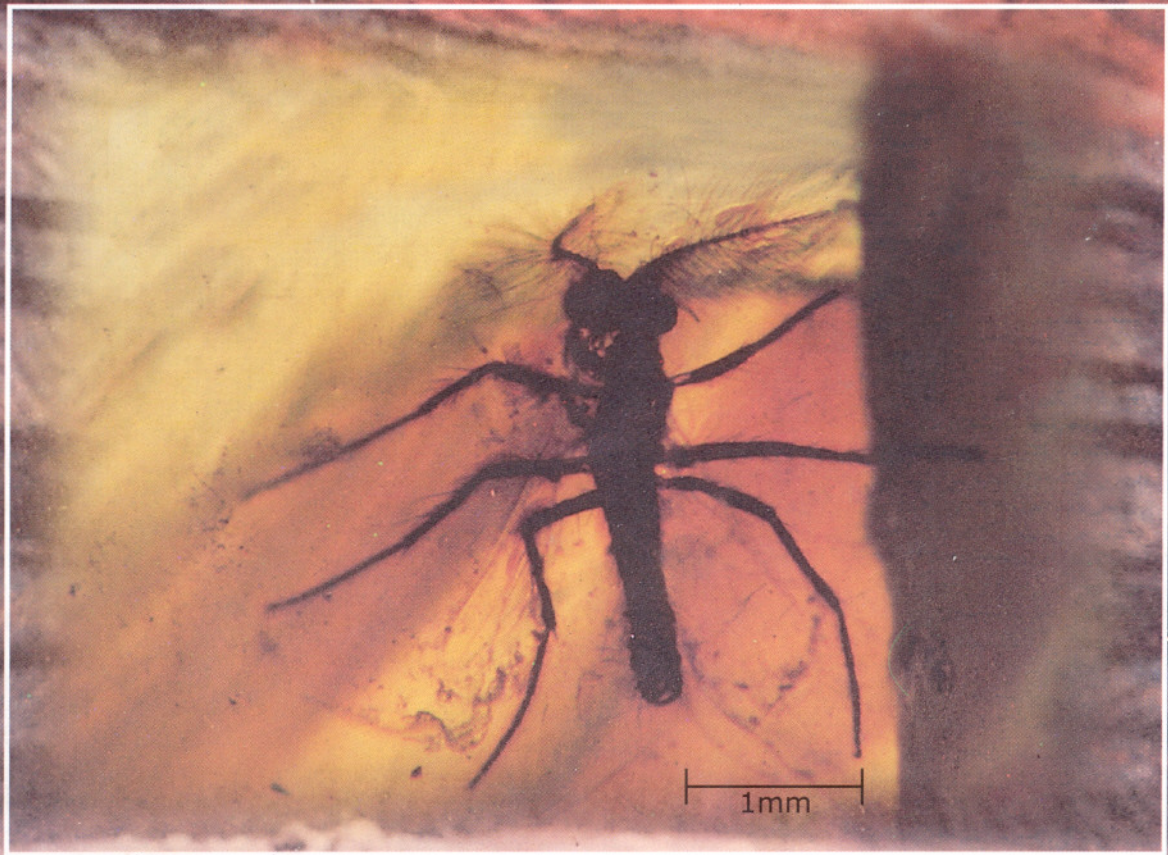


ANNUAL REPORT

1999-2000



1946

BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY, LUCKNOW

(An Autonomous Organisation under Department of Science and Technology, Government of India)

Annual Report

1999-2000

Compiled by
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INDIA



Front Cover: A view of Payangadi clay mines, Cannanore, Kerala (in background) showing Male *Culex* Mosquito embedded in the resin.

Back Cover: Mahuadanr Bed, Palamau, Bihar (in Background) showing insects *Psylla* of Hemiptera and *Ophion* of Hymenoptera.

Acknowledgement

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

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Preface

The Birbal Sahni Institute of Palaeobotany Lucknow has been a nodal centre of excellence in palaeobotanical and allied researches. Being a family institution of Department of Science and Technology, Government of India, the organisation plays a pivotal role to disseminate the palaeobotanical and earth science knowledge at a global level.

Changing facets of technological developments opened new vistas in reorienting scientific research. To keep pace with speedy progress in different disciplines of science an integrated approach of research has been adopted to meet the aims and objectives of the Institute. Palaeobotanical and allied earth science researches have been given a new impetus under identified Thrust Areas. The present Annual Report for 1999-2000 incorporates accumulated research findings during the year and various organisational activities. Systematised research information under various categories symbolises commitment by scientific staff working under fifteen projects. Individual, group and collaborative endeavours helped to generate new data on various aspects of palaeoclimate, stratigraphic correlation, palaeopalynology, evolution, coal petrology, isotope studies and related areas. In the process the expertise developed is utilised to extend services to outside agencies under consultancy, contract research and contract training services.

I am extremely happy to forward this document, an outcome of participatory involvement at various levels. The advice and guidance of the Governing Body and the Research Advisory Council has been a constant inspiration to accomplish target oriented tasks. The help extended by Dr G. Rajagopalan, project co-ordinators and senior scientists is appreciated. Untiring inputs by the members of Research Coordination and Planning Cell – Drs Suresh C. Srivastava, Ashwini K. Srivastava, Archana Tripathi and Bhagwan D. Singh; Publication Unit – Drs Annamraju Rajanikanth and Mukund Sharma, and other scientific, technical and administrative staff helped to bring out this report. I thankfully acknowledge their co-operation.



Anshu K. Sinha
Director

Executive Summary

The Birbal Sahni Institute of Palaeobotany has been carrying out researches during 1999-2000 on various aspects of Palaeobotany and allied subjects under following Thrust Areas: (1) Antiquity of Life; (2) Gondwana Supercontinent: Regional geology, floristics, terrane accretion, plate tectonics and configuration; (3) Biopetrology of Indian coals in relation to coal bed methane; (4) Floristics of petroliferous basins, and (5) Quaternary vegetation, climate and monsoon.

Significant contributions and discoveries

- First record of metazoan fossils like vertical burrows/ichnofossils and medusoid remains from Neoproterozoic Paniam Quartzite of Kurnool Basin indicates the appearance of animal life in Indian shield area.
- Discovery of Early Permian plant remains and Late Asselian palynomorphs from Karakoram Terrane provides crucial clue regarding the palaeogeographic reconstruction of the Karakoram-Himalayan block in the Permian. The Karakoram Terrane was close to the Salt Range. The micro-continents accreted with Indian Plate during Cimmerian orogenic cycle.
- Permian plant fossils from Arunachal Pradesh indicate presence of Glossopterid floral elements comparable with the flora of Barakar Formation of peninsular India. Among the Gondwana group of plants, dichotomous development pattern in Glossopterids has been analysed on the basis of morphological features of leaves and fructifications.
- Palynological study of intra-cratonic Gondwana sequences indicate palynofloral transition from Late Triassic to Early Jurassic sequences particularly in Rajmahal Basin. Neocomian palynofossil investigations demonstrate continuity of Upper Jurassic–Early Cretaceous sequences in Indian Craton.
- Petrological investigations of Permian Barakar coals from Kanhan area of Satpura Gondwana Basin indicate coals within the threshold of methane generation.
- Plant bearing Tertiary sediments of Warkala Formation, Kerala coast and Mahuadanr, Bihar have been found to contain insect remains in resin lumps. The productive resins are suitable for the study of fossil DNA. A collaborative study has been initiated with Centre for Cellular and Molecular Biology, Hyderabad.
- On the basis of fossil angiospermic remains from Tertiary sediments of Arunachal Pradesh existence of tropical evergreen to littoral and swampy forests conditions were deduced. The flora also shows the migration of some plants from Malaysia. Prevalence of evergreen semi-evergreen forest under warm humid climate is interpreted around Bilaspur in the Himalayan foot-hills on the basis of leaf impressions recovered from Siwalik sediments. Moist conditions with plenty of rainfall have been interpreted on the basis of fossil woods of Intertrappean sediments of Kutch.
- Further discovery of mango fossil leaf in Meghalaya confirms the earliest record of mango in North East Himalayan region of India during Palaeocene (55 Ma).
- Selective association and distribution of microfossils from Eocene rocks of Morni Hills (H.P.) indicate fluctuating environment of deposition due to sea level changes. Palynology of Siwalik sediments of Nadah area (Haryana) suggests presence of wet grassland with open and mixed flora during Pinjor sedimentation.
- *Botryococcus*, an oil forming green alga has been recovered from Eocene rocks of Jammu and Kashmir. The study is helpful in understanding the source rock evaluation which might help in the discovery of oil fields in the foot-hills of Himalaya.
- Pollen analysis of sedimentary profile from Punlota Lake, Nagaur District (Rajasthan) has revealed successive climatic phases 9200-8050 yrs B.P. arid, 8050-3810 yrs B.P. warm moist, around 3810–1325 yrs B.P. decrease in warm and moist conditions, and lastly comparatively drier or more or less similar conditions as in preceding phase.

- Silty clay sediments from the lake bed, Priyadarshini, Eastern Antarctica have been processed and a low hydrolysing periglacial depositional environment is deduced. Pollen analysis identifies three pollen zones based on the fluctuations in the retrieved palynomorphs which apparently manifest palaeoclimatic oscillations during Holocene.
- Evidence of carbonised botanical remains from archaeological site at Mesolithic Damdama in Pratapgarh District (U.P.) indicates shift from the hunter-gatherer economy of Stone age people to the sedentary life style of early Neolithic agriculturalists in the Ganga Valley.
- The tree ring chronology prepared from samples of *Abies pindrow* growing around Dokriani Bamak Glacier extending back to 1614 A.D. exhibits periods of low and high growth which might be linked with glacial fluctuation of this region.
- The chronology of palynologically analysed peat samples from Phulera, Kumaon (U.P.) works out to 15900±150 yrs B.P. (C-14 age). The sample from Priyadarshini Lake, Antarctica is dated as 7190±300 yrs B.P.
- During the year 61 research papers and 54 abstracts were published and 57 papers were accepted for publication. Thirty-five research papers were presented in International and National Conferences. In International Conferences 2 scientists were deputed while 28 scientists attended the Conferences organised in the country.

Related References

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phytogeographical interpretations. Review of *Palaeobotany and Palynology* 107 : 223-247.

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- Upadhyay R, Chandra R, Rai H, Jha N, Chandra S, Kar RK & Sinha AK 1999. First find of the Early Permian Lower Gondwana plant remains and palynomorphs from the Chhingtash Formation (Upper Shyok Valley), eastern Karakoram, India. *Palaeobotanist* 48 : 7-18.
- Upadhyay R, Sinha AK, Chandra R & Rai H 1999. Tectonic and magmatic evolution of the eastern Karakoram, India. *Geodinamica Acta* 12 : 341-358.
- Vijaya 1999. Palynological dating of the Neocomian-Aptian succession in the Indian Peninsula. *Cretaceous Research* 20 : 597-608.

International Conference

An International Conference on “*Multifaceted Aspects of Tree Ring Analysis*” was organised in BSIP during November 15-19, 1999 which provided a platform to discuss recent trends and developments in this discipline. The scientific deliberations were made by scientists from 8 countries. Institute is publishing the proceedings in the journal ‘*The Palaeobotanist*’.

Antarctica Expedition

One of the BSIP scientists participated in “19th Indian Scientific Expedition to Antarctica” from November 28, 1999 to March 09, 2000. A number of lake sites, valleys and Nunatak in and around Schirmachar Oasis, East Antarctica were surveyed. Collected a large number of samples including moss cushions, soil, dry algal mat, snow and ice and one lake sediment profile from Zub Lake near Maitri and adjoining areas. The expedition is being continued in the next year as well.

Forensic Palynology

In order to carry out researches on forensic palynology a core group of scientists of Quaternary palynology is formed to undertake the study in collaboration with the organisations dealing with forensic sciences in New Zealand and USA. This is an emerging new application of palaeobotanical researches in forensic science and useful for Police Department.

Integrated Long Term Programme between BSIP and Russian Academy of Sciences (RAS)

A project entitled “Floral and climatic evolution based on Geologic and Biotic events during Precambrian and Phanerozoic Time” has been initiated under ILTP of co-operation in Science and Technology between India and Russia. BSIP has been chosen as the nodal agency under the umbrella of Earth and Planetary Sciences on palaeoclimatic researches.

Monograph

A Monograph entitled “An introduction to Gymnosperms, Cycas and Cycadales” of Prof. D.D. Pant, Allahabad is being processed for publication.

Consultancy services

The Institute has rendered consultancy services to the personnel from various organisations in

radiocarbon dating, electron microscopy, palynology and identification of fossil remains.

Memorial Lectures

10th September 1999 was observed as Foundation Day. Dr Nitya Anand, FNA, Former Director, CDRI delivered 3rd Jubilee Lecture on “*Drug Research: Today and Tomorrow*”. On the Founder’s Day, the Institute’s staff and members from other organisations offered ‘*Pushpanjali*’ on Founder’s ‘*Samadhi*’. On this occasion 45th Sir Albert Charles Seward Memorial and 29th Birbal Sahni Memorial lectures were delivered by Dr D.J. Batten and Dr Hari Narain respectively.

Medal Awards

The first “T.M. Harris International Medal” was presented to Professor David J. Batten, Institute of Geography and Earth Sciences, University of Wales, U.K. The Medal was awarded on November 14, 1998 for his scientific contribution on “Palynofacies”.

Web Site and Internet access

The Institute web site (www.bsip-india.org) has been launched on November 14, 1999. The Institute has registered a domain “bsip.res.in” on the Internet. Internet access to scientists has been provided at 60 nodes throughout the institute.

Organisational Structure

GOVERNING BODY

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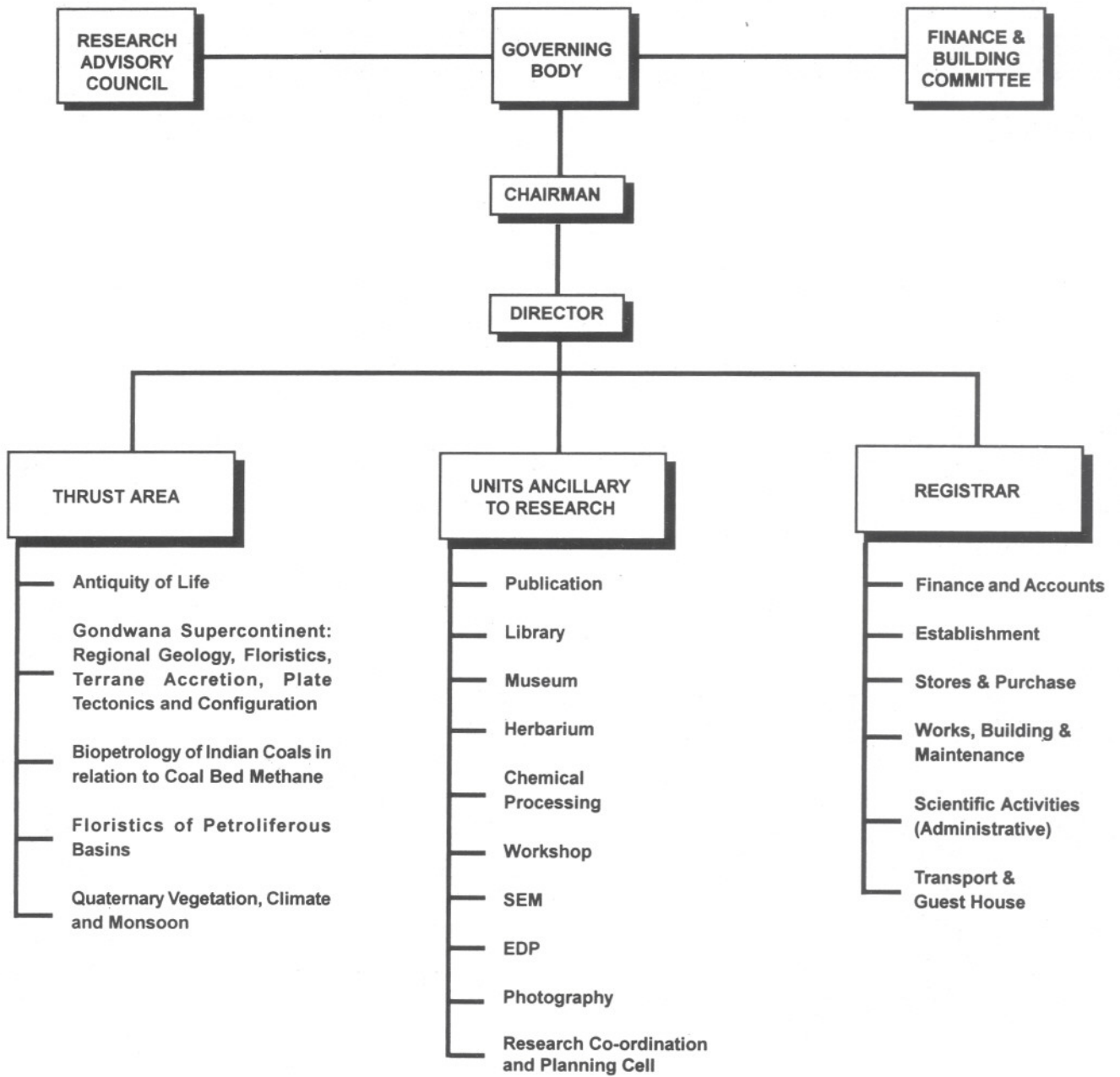
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ORGANISATIONAL SET-UP



Research

Thrust Area: Antiquity of Life

Project 1: Palaeobiology and biostratigraphy of Precambrian Basin

Component 1: Search for oldest biological remains in Archaean (till July 1999)

P.K. Maithy & Rupendra Babu

The sections of the interlinked stratiform to pseudocolumnar stromatolites collected from the 'F' member of carbonate sequence of Kasia Formation, Iron Ore Supergroup exposed near Barbil, Orissa were

prepared. The stromatolites resemble *Weedia* and *Irregularia* reported from Canada (2730 Ma). The small size of stromatolites may be either due to simple organisation of biota or ecological conditions.

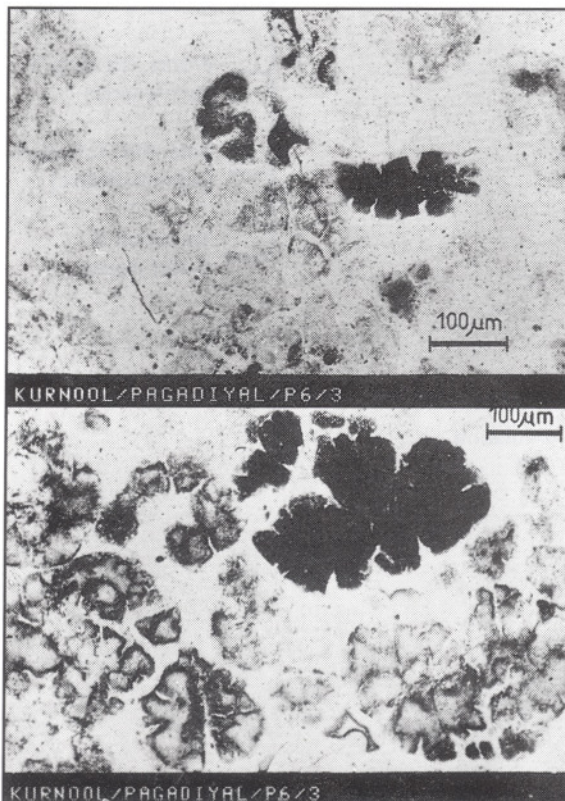
Component 2: Morphotaxonomical studies of biological remains of both micro- and megafossils from the Meso/Neoproterozoic sediments of the Kurnool and Chhattisgarh

Manoj Shukla, Mukund Sharma & Rupendra Babu

Shukla and Sharma studied microfossils comprising smooth walled acritarchs including

coiled algae belonging to *Obruchevella* non-carbonaceous mega remains, viz., *Longfengshania*, *Chuarina circularis*, *Tawuia* sp., *Beltina danai* and *Morania antiqua* from the Owk Shale Formation exposed near Ankireddipalle village, Kurnool District, Andhra Pradesh. Collected cherts from the Koilkuntla Limestone Formation and ichnofossils/dubiofossils from the Paniam Quartzite Formation in Kurnool District (A.P.). Also visited various localities in Kaladgi and Bhima basins during Field Workshop organised by Geological Society of India. Recorded vertical burrows and studied ichnofossils/dubiofossils from the Paniam Quartzite Formation. They are grouped under three broad categories. (i) medusoid-like forms, (ii) algal mats, and (iii) spindle-shaped forms from Koilkuntla Limestone Formation, Kurnool Group and thallophytic algae— *Thallophyca simplica* Zang, a form reported earlier from the Late Proterozoic sediments of South China and *Thallophyca* sp. showing affinity to modern genus *Ulva* from the chert bed.

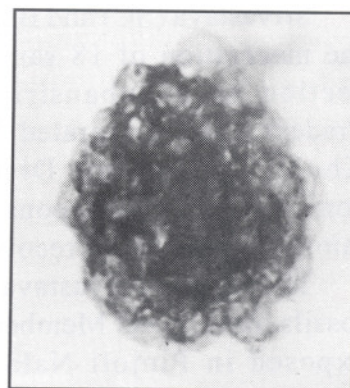
Babu studied organic-walled microfossils, viz., acritarchs, algae and Vase-Shaped Microfossils both in thin sections and macerated residue from



Thallophytic algae from Kurnool Super Group (1cm=100µm)

the chert bands intercalated in grey limestone belonging to Lakheri and Balban Limestone formations and Sirbu Shale Formation exposed in Bundi District, Rajasthan and its adjoining areas. The complexity of acritarch increases from older (Lakheri Limestone) to younger (Balban Limestone) formations of Bhander Group. Organic-walled microfossils are being reported for the first time from the Balban Limestone Formation. Also studied carbonaceous macrobiota belonging to Chuarid, Moranid, Beltanid and septate filamentous forms for the first time from the Sirbu Shale Formation of Bhander Group exposed around Nayagaon and Arauli villages of Bundi District. This assemblage indicates shallow water and quiet environmental conditions. The macrobiota resembles known Neoproterozoic assemblage of other countries. The organo-sedimentary structures-stromatolites are mostly branched forms belonging to genus *Baicalia* from the Balban Limestone Formation exposed near Kamleshwarji, Bundi District. Analysis of the studied macrobiota,

organic-walled microfossils and presence of stromatolites from older to younger formations of Bhander Group indicate Early-Neoproterozoic age. The presence of organic-walled microfossils and the type of sedimentation are both indicative of intermittent shallow environment during Bhander Group.



Myxococcoides from the chert band of Balban Limestone Formation x 1000.

Visited 14 localities for collection of palynological samples and mega remains from the Chandi Limestone, Gunderdehi Shale and Charmuria Limestone formations of Raipur Group exposed around Raipur District and its adjoining areas in Madhya Pradesh.

Thrust Area: Gondwana Supercontinent: Regional Geology, Floristics, Terrane Accretion, Plate Tectonics and Configuration

Project 2: Floristics and biostratigraphy of Palaeozoic and Mesozoic of Himalayas

Component 1: Floristics and stratigraphy of the Late Palaeozoic and Mesozoic sediments of the Tethyan Himalaya and their regional relationship

Vijaya

Rock samples (50) from Laptal Sancha Malla Track of Spiti Shale Formation have been worked out for palynological study. Yields of samples were poor and had no significant spore-pollen taxa, except

genus *Callialasporites*, to assess the palynological dating of this section. Further palynological investigation is needed for precise palynostratigraphy of the Spiti Shales.

Component 2: Permian plant fossils from North-Eastern Himalayas

Suresh C. Srivastava, A.K. Srivastava, Rajni Tewari & A.P. Bhattacharyya

Srivastava (SC) and Bhattacharyya completed the maceration of 18 samples from Lichy-Zero section from Subansiri District, Arunachal Pradesh. Also macerated 5 samples from Rakti Khola, Darjeeling District, West Bengal comprising carbonaceous shales and coal. No miospores have been recovered in these samples.

Tewari and Srivastava (AK) recorded plant fossils from Lower Member of Bhareli Formation exposed in Pinjoli Nala section situated on Bhalukpong-Bomdila Road section, West Kameng District, Arunachal Pradesh. The assemblage is represented by *Gangamopteris karharbariensis*, *Glossopteris communis*, *G.*

stenoneura, *G. longicaulis*, *G. indica*, *G. tenuifolia*, *G. spatulata*, *G. taeniensis*, *G. subtilis*, *G. sp. cf. G. decipiensis*, *Noeggerathiopsis hislopii*, *Samaropsis ganjrensis*, seed-bearing organ, *Vertebraria indica* and equisetalean leaves. The flora is comparable with that of Lower Barakar Formation of peninsular Gondwana of India. Taxonomic identification and comparative significance of Permian plant fossils from Tindharia, Kalijhor Nala section of Darjeeling Coalfield and Rohtak Khola section of Sikkim area are under progress. Systematic description and photodocumentation of the specimens were completed.

Project 4: Floristics, biostratigraphy and palaeoenvironment of Gondwana sediments

Component 1: Morphotaxonomy, floristics, evolution, biostratigraphy and palaeo-environmental studies of Son-Mahanadi, Damodar, Panagarh and Birbhum basins

Shaila Chandra, Suresh C. Srivastava, Anand-Prakash, Archana Tripathi, Vijaya, Ram Awatar, K.J. Singh, & K.L. Meena

Chandra and Singh completed identification of 300 impression and compression specimens collected from 5 localities, viz., Behra Nala section near Banapati Village (locations 1 & 2), Iria Nala section near Prem Nagar Village, near Basantpur Village and Ledho Nala Section near Karamdiha Village of Tatapani-Ramkola Coalfield area, Madhya Pradesh. The study indicates Late Permian to ?Triassic age affinity.

Singh and Chandra identified new branched fructification possibly belonging to Peltaspermales from Behra Nala section. Photography and draft of results are completed. Singh identified an equisetalean fertile genus showing compact cone from this section of Late Permian age. Singh also visited Mand-Raigarh



Umkomasia sp., female fructification of *Dicroidium* genus from the late Permian of Behra Nala

Coalfield; Madhya Pradesh and collected above 350 megafossil specimens from Talchir, Karharbari and Barakar formations exposed in different Nala sections and collieries.

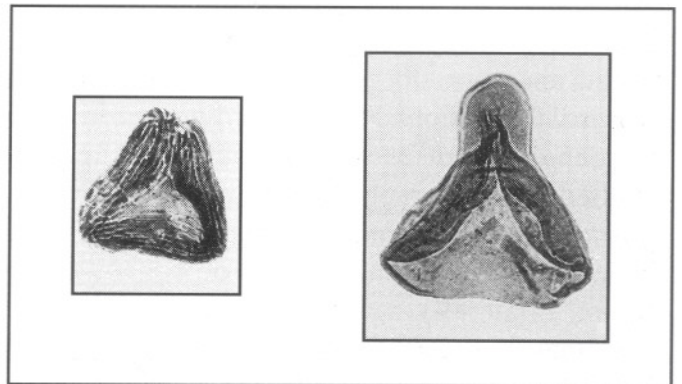
Srivastava and Anand Prakash carried out palynological studies on the Lower Permian sediments exposed along Suknaiya Nala in southern part of Tatapani-Ramkola Coalfield. The sequence includes alternation of medium- to coarse-grained sandstone, shale, carbonaceous shale and coal. The exposed thickness of coal bands is thin, often lenticular and not economical. The palyno-assembly shows dominance of striate disaccate pollen, chiefly *Faunipollenites* and *Striatopodocarpites*. *Distriatites*, *Verticypollenites* and *Striatites* occur consistently in low percentage. Nonstriate disaccate pollen forms are subdominant, represented by *Ibisporites*, *Scheuringipollenites*, *Vesicaspora*, *Primuspollenites* and *Rhizomaspora*. *Weylandites*, *Distriamonocolpites* and *Tiwariasporis* occur persistently in low amount. The trilete spores (*Brevitriletes*, *Acanthotriletes*), monolet spores (*Latosporites*) are inconsistent in occurrence. Among monosaccate pollen *Parasaccites* and *Barakarites* occur consistently in low percentages. The palyno-assembly recovered represents the Upper Barakar palynozone (*Faunipollenites varius* Assemblage-Zone).

Tripathi analysed the palynoflora recovered from Kamthi sediments of Talcher Coalfield, Orissa for the marker species. The samples from bore-hole TCP—39 have shown presence of taxa *Callumispora*, *Osmundacidites*, *Foveosporites* sp., *Rugulatisporites*, *Guttatisporites*, cf. *Cadargasporites*, *Camerosporites*, *Minutosaccus crenulatus*, *Satsangisaccites* and *Samaropollenites*. These indicate Late Triassic age. Report on palynodating of sequence from bore-hole TKE—2 was prepared and sent to GSI, Calcutta. Also visited GSI to discuss the palynological report on dating of the bore core materials.

Vijaya studied an outcrop section comprising Barakar and Dubrajpur formations in the Murgadangal area, Birbhum Coalfield, West Bengal for its palynodating. The basal 2 m strata of grey shales has yielded Late Permian and P/Tr palyno-assemblages. The subsequent 6 m strata of grey shales

and mudstone contains frequent evidences of Late Early Jurassic age affinity for the Dubrajpur strata. Also finalised palynological data on the Neocomian-Aptian succession from the Mesozoic sedimentary basins on Indian peninsula for the palyno-event stratigraphy.

Ram Awatar identified 3 palyno-assemblages in bore-hole SKM-12 of Sohagpur Coalfield, Madhya Pradesh. Assemblage-I (at 292.60-301.85 m depth) having dominance of *Parasaccites*, *Plicatipollenites* and *Potonieisporites* with rare occurrence of *Faunipollenites* is assigned to Early Permian age. Assemblage-II (at 262.50-292.60 m) has the prominence of *Callumispora* in association with monosaccate pollen grains showing Karharbari age affiliation. The youngest Assemblage-III is marked with *Scheuringipollenites* as dominant taxon at 86.25-259.50 m depth, showing Barakar age for the sediments. Quantitative analysis of bore-hole SJW-7 reveals 2 palyno-assemblages. The older assemblage (at 287.45-573.25 m) is dominated by monosaccate pollen grains—*Parasaccites*, *Plicatipollenites* and *Potonieisporites* with rare occurrence of striated-disaccate pollen indicating Early Permian age (=Talchir) for the sediments. The younger one (at 6.00-277.55 m) has yielded the striated-disaccate pollen—*Faunipollenites*, *Striatopodocarpites* and *Crescentipollenites* in prominence indicating Late Permian age. The sediments from Kamrai Nala section (Parsora Formation) have yielded *Callialasporites-Araucariacites* palynofossils. Besides, *Cicatricosisporites australiensis* and *Aquitriradites* sp. have also been recorded in the assemblage



Cicatricosisporites x 500

Dictyophyllidites x 500

Parsora Formation, South Rewa Basin, Madhya Pradesh

suggesting Late Jurassic-Early Cretaceous age of the sediments. Also visited Sohagpur and Mand-Raigarh coalfields for collection of bore-core and outcrop samples.

Meena processed 40 surface samples collected from the south bank of Chaturdhara Nala section, Ib-river Coalfield, Orissa. The location of these samples is one km away from the junction of Basundhara Nala section. Besides, processing of 20 samples from Lakhanpur Hill, District Jharsuguda was also

completed along with scanning and photography of important palynotaxa. The quantitative analysis is in progress. Also completed scanning, photography and counting of samples from bore-holes IBT-4, 5 & 6 which were collected from Tangadih Block, Jharsuguda. Recorded the Late Permian (Raniganj age) palyno-assemblage from the samples. Visited districts Jharsuguda, Sundargarh (Ib-river Coalfield) and also the Surguja District (Hasdo-Arand Coalfield, Madhya Pradesh) for collection of palynological samples.

Component 2: Morphotaxonomy, floristics, evolution, biostratigraphy and palaeoenvironmental studies of Satpura and Wardha-Godavari basins

A.K. Srivastava, Pramod Kumar, Neerja Jha, Rajni Tewari & A.P. Bhattacharyya

Srivastava and Tewari undertook study on plant fossil assemblages recovered from Pench East underground mine and open cast project of Shivpuri I, II and Kukurmunda collieries. Morphotaxonomy and cuticular investigations are under progress. Dominance of *Glossopteris* species and absence of Karharbari floral elements affiliate the flora with Upper Barakar seams locally numbered as I and II in Pench Valley Coalfield of Satpura Basin.

Kumar recorded palynofossils from Late Triassic beds of Denwa Formation of Anthoni region, Chhindwara District, Madhya Pradesh. Palyno-assemblages comprise *Brachysaccus*, *Falcisporites*, *Krempipollenites*, *Satsangisaccites*, *Staurosaccites*, *Minutosaccus*, *Aratrisporites*, *Ashmoripollis*, *Samaropollenites*, *Denwasporites*, etc., along with some Jurassic elements—*Haradisporites scabratus*, *Dictyophyllidites*, *Callialasporites* cf. *dampieri*, *Podocarpidites* sp., *Vitreisporites* sp., etc. This assemblage suggests mixture of cool temperate upland and warm dry climate in low land areas with seasonal fluctuations. Presence of dinocysts indicates the deposition of beds in lacustrine set up. Also studied morphographically a prepollen *Denwasporites* gen. nov. from Denwa exposed in subsurface in an artesian well cutting south of Anthoni village. Spore, bilaterally symmetrical, oval and bear a proximal monolete suture and smooth to weakly intrapunctate exine.

The palyno-assemblage comprising fungal and algal remains along with the palynomorphs of Upper

Denwa beds have been recorded from Bagra Formation (the youngest unit of Mahadeva Group). The palyno-assemblage shows the continuity of the Denwa palynomorphs and is palynologically assigned to Rhaetian age. Also recorded a fossilised microscopic, wingless ectoparasitic anopluran insect (from Bagra Formation) and a larval form of endoparasite (from Denwa Formation) from Upper Triassic sediments. Both specimens show parasitic habitat with the former on mammals and the latter in the intestinal region of fishes. Taxonomy of Phthiraptera has been discussed.

Jha analysed samples from Gattugudem bore-core SGG-1, Godavari Basin. Palynoflora at 53.75-55.40 m shows dominance of striated disaccates—*Striatopodocarpites* and *Faunipollenites* and subdominance of *Scheuringipollenites*. Study of samples from bore-core GKGD-27 of Rampur area has revealed presence of Late Permian palyno-assemblage- *Striatopodocarpites*+*Striasulcites* at 96.35 m depth. Study of samples in bore-core GC-17 from Krishnavaram block of Chintalpudi sub-basin has revealed the presence of Mesozoic palynoflora in lithologically designated Barren Measures and Lower Kamthi formations. Palyno-assemblage-1 (recognised at 109 m) is characterised by dominance of *Falcisporites* and *Lunatisporites*, whereas Palyno-assemblage-2 (between 75-76 m depth) is characterised by the dominance of *Classopollis*. These assemblages are characterised by the presence of certain significant taxa, viz.,

Callialasporites, *Classopollis*, *Araucariacites*, *Rajmahalispora*, *Dictyophyllidites*, *Cicatricosisporites*, *Striatopodocarpites auriculatus*, *Coptospora*; *Playfordiaspora*, *Osmundacidites*, *Lunatisporites*, *Chordasporites* and *Microcachryidites*. Also undertook a field trip in Kothagudem and Chintalpudi sub-basins to collect bore-core and surface samples for palynological studies.

Bhattacharyya completed maceration of bore-holes JK-1 (20 samples) and JK-2 (2 samples) from Jena Block, District Chandrapur (Maharashtra).

Densipollenites rich mioflora having *D. magnicarpus* along with *Corisaccites-Guttulapollenites* have been reported. Samples (18) from bore-hole KR-67 of Kondha Block have also been macerated. Barakar mioflora have been recovered. Another bore-hole (MJ-7) containing 20 samples have been processed. The bore-hole samples that passes through Deccan Traps and Motur in Mahadoli area did not yield miospores. Also visited GSI, Calcutta to consult recent GSI reports and literature.

Component 3: Ultrastructure of fossil cuticles and megaspores and comparative studies on selected modern taxa

Usha Bajpai

Ultrastructure of the leaf cuticle of a taxon—*Lepidopteris* sp. of peltaspermeous pteridosperm from Nidhpuri (Madhya Pradesh) has been investigated. The cuticle membrane (CM) exhibits three zones under TEM. The polylamellate zone consists of electron dense and electron lucent lamellae; the lamellae are loosely arranged and run parallel to each other. The middle zone is amorphous having homogenous matrix and it is followed by the innermost reticulate zone. Dispersed cuticles from the sediments were also studied under TEM.

The CM of the extant taxon *Cycas circinalis* was investigated under the electron microscope to understand the release of lipophilic compounds in monomeric form and the transportation of lipophilic compounds onto the surface of leaf epidermis and its polymerization. The species *C. revoluta* was also investigated and it was found that the structural configuration of two, the species of *Cycas* are quite distinct, though the basic polylamellate zone is

common in both the forms. Stages of CM development in extant taxa is likely to provide data for understanding the organization of fossil cuticles.

The SEM study of sporoderm in megaspore of 6 species of the genus *Selaginella* from NE Himalaya shows that the surface ornamentation of the megaspore sporoderm in all the species is tuberculate, the distribution of the tubercles varies with species. In between the tubercles the sporoderm is often covered with minute, sparsely or densely distributed spines. In some species the spines occur separately, while in others the spines are grouped in star-shaped entities and form a 'flower' pattern on the surface. Sporopollenin units as seen in the fracture sections of the sporoderm are rod-shaped bodies, which are variously curved and intertwined as a three-dimensional system. Two main types of sporopollenin units have been identified in *Selaginella*: (i) rod-shaped sporopollenin units, and (ii) branched ramifying units.

Project 5: Floristics, biostratigraphy and palaeoenvironment of Mesozoic sediments

Component 1: Morphotaxonomy, floristics, evolution, biostratigraphy and palaeoenvironmental studies of Triassic-Cretaceous flora of East-Coast Gondwana, Rajmahal and Gujarat basins

Jayasri Banerji, Archana Tripathi, B.N. Jana, A. Rajanikanth & Neeru Prakash

Banerji and Jana studied the anatomical features of petrified coniferous female cones belonging to the genus *Araucaria* of the family Araucariaceae from Sonajori locality of Rajmahal Basin. Anatomy of cone axis, bract scale, ovuliferous scale and seeds shows various significant features related to their developmental stages. Siliceous cherts from different sites of Nipania have also been cut and slides prepared for identification of various taxa. Presence of *Nipaniophyllum*-leaves, *Carnoconites*-cones and numerous coniferous shoots and woods indicate the dominance of Pentoxyleae and coniferales in the megafloreal assemblage.



Araucaria mirabilis (Spegazzini) Windhausen-Transverse section of cone - seed complex, Rajmahal Basin x 16.

Jana studied the plant megafloora of Gardeshwar Formation which is characterised by the dominance of conifer remains. Wide morphological variations were noticed in the forms referred to the genera *Elatocladus* and *Pagiophyllum*. The plant assemblage also contains *Lycopodium ghoshii*, *Gleichenia* sp., *Dictyophyllum* sp., *Taeniopteris* sp., etc. Fresh collection was made from that part of the Madhya Pradesh which is adjacent to the eastern border of Gujarat and also from Gardeshwar and Than regions. Petrified wood remains were found in abundance in western part of Madhya Pradesh.

Tripathi analysed Dubrajpur sediments from bore-holes RJU-5 (Pachwara Coalfield) and RJMC-4 (Mahuagarhi Coalfield) of Rajmahal Basin for marker species. A critical analysis of known palyno-assemblages from Rajmahal Formation is being done. Also analysed Dubrajpur sediments (325.07-380.75 m) of bore-hole RJNE-32 for palynodating. The dominance of *Arcuatipollenites* is recorded in Late Triassic palynofloral composition and *Arcuatipollenites tethyensis* zone is identified. This zone is correlatable with the *Polycingulatisporites crenulatus* zone of Australia which ranges from Early Norian to Late Hettangian. On the basis of change over of palynological characteristics and first appearance of taxa *Classopollis* and *Callialasporites* in the palynoflora for the first time, palynological transition from Late Triassic to Early Jurassic is identified in Rajmahal Basin.

Rajanikanth carried out xylotomical studies on the petrified woods of the Pranhita-Godavari Graben which demonstrates variable distribution of growth rings and lack of consistency in the seasonal accumulation pattern. Studies on the taxa *Araucarioxylon* and *Podocarpoxyylon* exemplify abundance of wood taxa consonance with the distribution of leaf taxa. Leaf fossils are invariably small in size and indicate long transport to the depositional site. Abundant leaves of conifers in the assemblage suggest their woody nature and more potential of preservation. The significant taxa include *Elatocladus*, *Pagiophyllum*, *Brachyphyllum*, *Satpuria*, *Araucaria*, *Stachyotaxus* and others. Compilation and analysis of Mesozoic Gondwana woods suggest climatic impact on the nature of growth rings.

Prakash carried out the morphotaxonomic studies of plant fossils from Uppugunduru of Vemavaram Formation. The recorded genera and species are *Ptilophyllum cutchense*, *P. acutifolium*, *Taeniopteris spatulata*, *Dictyozamites indicus*, *Pterophyllum footeanum*, *P. morrisianum*, *Brachyphyllum vemavarensis* sp. nov., *Pagiophyllum* sp., *Elatocladus plana* and *Taxites* sp. The fossil flora is dominated by cycadophytes and conifers. While comparing the floral assemblage with other contemporaneous assemblages it has been observed that Vemavaram floral assemblage is akin to Gollapalle and Sehora floral assemblages of Early Cretaceous age.

Component 2: Morphotaxonomy, floristics, evolution, biostratigraphy and palaeoenvironmental studies of Triassic-Cretaceous of South Rewa-Satpura basins

Shyam C. Srivastava & Neeru Prakash

A long standing controversial problem regarding the rachis of *Dicroidium* leaves reported from Nidpur bed (Triassic) has been resolved on the basis of forked-rachis found in *Dicroidium* frond. Out of the forked forms, 3 distinct species (*Dicroidium nidpurensis*, *D. papillosum* and *D. odontopteroides*) have been identified. *Dicroidium odontopteroides* common form is the first report

from India; which has been ascertained upon its cuticular features. It serves as tool for the correlation of Triassic beds of other Gondwana countries. Besides, microphotography and sketches have also been prepared.

In addition, Srivastava worked out fruiting bodies of seed attached organs; their taxonomic differentiation is in progress.

Project 14: Accretionary evolution and tectonics of Terranes in Ladakh-Karakoram Sector

A.K. Sinha

The Indus-Tsangpo Suture has come into existence due to subduction followed by continental collision (55-60 Ma) between Indian and Eurasian plates. While considering the recent palaeogeographic reconstruction of Pangea during Late Palaeozoic it appears that a southern belt of Asian microcontinents comprise several continental blocks and numerous fragments that have coalesced since the Mid-Palaeozoic along with the closure of Tethys. The origin, migration, assembly and timing of accretion of all these blocks to their present tectonics is not well known and there is no Permo-Triassic crust left in the present day Indian Ocean. The oldest ocean crust adjacent to the west African and Antarctic is of Early or Middle Cretaceous (approx. 120-130 Ma). The Karakoram-Hindukush microplate in the west and the Qiangtang-Lhasa Block in the central and eastern segment of South Asia margin are among those blocks already welded with Asian plates around 120-130 Ma ago, before the collision of India with the collage of plates forming Peri-Gondwanian microcontinents. But the reconstruction of palaeogeographic configuration remain incomplete due to paucity of authentic geologic information available from Karakoram, Pamir and western Tibet.

Discovery of Early Permian plant remains and

Late Asselian (~280-275 Ma) palynomorphs for the first time from Karakoram terrane provides crucial clue regarding the palaeogeographic reconstruction of the Karakoram-Himalayan block in the Permian time. This finding indicates that during Early Permian time the Karakoram microcontinent was located not far from the Salt range of Indian sub-continent—situated somewhere intermediate between the Indian Plate and the Qiangtang-Lhasa microcontinent, around 35° southern latitude from Equator. Since Karakoram microcontinent cannot be a part of Indian Plate as Indus-Tsangpo Suture mark the site of Indian and accreted fragments of Asian microcontinents, it is suggested that Karakoram terrane was welded to Asia sometimes during Late Jurassic or Early Cretaceous. Interestingly the present geotectonic position of Karakoram between 34°-36° northern latitude from Equator suggest an approximately 60° latitudinal movement since Early Permian (Late Asselian, 275 Ma) to present. On the basis of stages of batholith growth, it is also concluded that Shyok Suture is older than Indus Suture and closed sometimes between 75-100 Ma. The accretionary processes in the Karakoram region began prior to the final closure of Indus Suture.

Thrust Area : Biopetrology of Indian Coals in relation to Coal Bed Methane

Project 6: Coalification processes and depositional environment of coal and associated sediments

Component 1: Organic matter characterization from plant fossils and DOM in Cenozoic sediments

Anand Prakash, G.P. Srivastava, Manoj Shukla & Madhav Kumar

Studied the remains of a Mealybug and Centipede from the resin lumps associated with the sediments of Warkalli Formation of Kerala Coast. The insects belong to two new species—*Pseudococcus miocenia* and *Scolopendra miohardwikei*. Several egg cavities and galleries filled with organic matter have also been studied.

The study of dispersed organic matter (DOM) in lignitic clay samples (6) from Amberiwadi, Sindhudurg Formation (Maharashtra Coast) indicates the dominance of structural terrestrial, leaf, epidermal tissues, woody fragments, resins, black debris, spores and pollen grains. Well-preserved angiosperm leaves and cuticles belonging to families Lauraceae, Magnoliaceae, Myrtaceae, Moraceae, Caesalpiniaceae, Loranthaceae, Symplocaceae and Dioscoraceae are recorded from middle part. The detailed morphotaxonomic study shows that the cuticles of some plants of Lauraceae, Myrtaceae and Moraceae are apparently more resistant to degradation than other forms, possibly because of the richness of certain biopolymers in their cellular tissues. The

plants of Lauraceae and Myrtaceae contain aromatic oil glands, whereas milky juice is found in the plants of Moraceae. The preservation of original features in the cuticles of these plants indicates that the aromatic compounds and milky sap make epidermal tissues more resistant to decay.

SEM and EDAX analytical observation was also carried out to observe detailed cellular structure of dispersed leaf cuticles (jointly with Usha Bajpai). The study has been focused on the organisation of stomatal apparatus, accessory cells and effect of micro-organisms over it. It has been noticed that certain inorganic minerals are associated with the biodegraded epidermal tissues.

Macerated 8 lignitic clay samples from Kundra clay mine, Kerala to study DOM types. The slides of productive samples have been prepared and scanned. Also visited Mahuadanr Valley, Palamu (Bihar) and collected plant fossils including leaves, carbonised woods and samples for palynological study from the Tertiary sediments.

Component 2: Biopetrographic evaluation, genesis and depositional history of Indian coals

(I) Organic petrological evaluation of Karanpura coal deposit (Damodar Basin) in relation to carbonization properties, genesis and depositional history

B.K. Misra & B.D. Singh

Finalised petrological investigations on the Karharbari coals, represented by Bachra seams (Lower & Upper) from Ray-Bachra and Churi mines of the North Karanpura Coalfield. The sub-bituminous to high-volatile bituminous C rank (i.e. low rank- R_o max. 0.40%- 0.54%) coals dominantly contain mixed (vitrinite-rich as well as inertinite-rich) and fusic coal types and are of poor quality.

Visited Central Mine Planning and Design

Institute Limited and Central Coalfields Limited offices at Ranchi for discussions and consultations of reports related to coals of Bokaro Coalfield, especially about the potential areas for coal bed methane. Collected samples of Early Permian Barakar coal seams from Kathara, Jarangdih, Sawang and Govindpur collieries (open cast as well as from underground mines) of East Bokaro Coalfield. The coals are normally bright banded in nature.

(II) Biopetrology of Wardha-Godavari Valley coals

O.S. Sarate

The petrological study of coals from Durgapur Open Cast Mine, Wardha Valley Coalfield has revealed that they are mostly represented by vitrinite-rich and mixed coal types. The maximum reflectance on vitrinite in oil (R_o max. %) ranges between 0.50

to 0.62% suggesting that the coals have attained high-volatile bituminous C (sub-bituminous A) rank. These coals are comparable with the coals of Kondha and Nanduri Blocks of the Wardha Valley Coalfield in their overall petrographic composition.

(III) Biopetrographic evaluation of coals from Satpura Gondwana Basin with an emphasis on depositional pattern and utilization potential

Alpana Singh & B.D. Singh

Finalised petrological investigations both under normal incident and fluorescence modes on the coals from Mohan, Damua, Nandan and Tandsi mines of Kanhan area and the results were presented at the International Conference on "Coal bed methane", Calcutta. The composition of coal macerals (rich in vitrinite group and perhydrous vitrinite + liptinite) and rank (average R_o max. 0.61-0.97%) indicate that these Early Permian Barakar coals are within the threshold of methane generation (especially the coals from Nandan-Tandsi sector).

Studied microconstituents of Barakar coals from Eklehra and Mathani mines of PENCH area to assess

the nature and composition of coals. The coals have variable proportions of vitrinite and inertinite macerals and dominantly contain mixed coal types. The rank values, determined through reflectance measurements on vitrinite particles, indicate that the coals have attained sub-bituminous A to high-volatile bituminous C stages. Comparative study has revealed that the coals of PENCH area are of poor quality and low rank than the Kanhan area as they contain normally high amount of mineral matter. A westward increasing trend in coal quality and rank has been observed in the southern part of Satpura Basin.

(IV) Organic petrographic evaluation of coal seams from Talcher Coalfield

Rakesh Saxena & Jyotsana Rai

Petrological study of coals from Belanda and Kalinga areas shows the presence of low rank vitrinite group of macerals. Maceral trend suggests

that petrographic facies, viz., vitric, fusic, vitrofusic and fusovitric have played an important role in the genesis of Talcher coals. It further indicates the

prevalence of fluctuating conditions in the coal swamp. Low rank (R_o max. 0.60-0.70%) and composition make these coals unsuitable for coal bed

methane generation but make them useful for thermal power generation.

Component 3: Sedimentary organic matter characterization of Indian lignites

Rakesh Saxena & Jyotsana Rai

Lignite samples (20) from Panandhro and Rajpardih areas, Gujarat were processed for infra-red studies. The IR-spectra were recorded using KBr pellet and mull technique which suggest that the resinous matter associated with these lignites is of terpenoid nature. Some known resins of *Agathis* were also studied through IR-spectra. Further work is in progress. In addition, 12 samples have also been processed for DOM studies.

Processed 35 samples from a bore-well of Eocene age, Akri lignites, Rajasthan and observed DOM. It

indicates selective biodegradation of varied plant parts represented by amorphous, structured terrestrial, biodegraded terrestrial organic matter along with black and brownish black debris and fungal fruiting bodies. Selected samples from these lignites under fluorescence mode indicate the presence of well-preserved alginites, cuticles and fungal fruiting bodies along with foraminifers, fromboidal and octahedral pyrite crystals in abundance in some samples indicating reducing conditions followed by bacterial biodegradation.

Component 4: Biopetrography and geochemistry of coals, oil shales and organic matter in Late Palaeocene-Oligocene sediments from northeastern India

B.K. Misra

Completed quantitative assessment of macerals of coal samples (36) from Makum and Dilli-Jeypore coalfields, Assam. Fluorescence microscopic study

on 20 samples was also completed. The coals are vitrinite rich and have high proportion of fluorescing macerals (perhydrous vitrinite and liptinite).

Thrust Area : Floristics of Petroliferous Basins

Project 7: Morphotaxonomy, floristics, biostratigraphy and sedimentological studies of Tertiary sediments of Lesser Himalayas

Component 1: Floristics and biostratigraphy of Pre-Siwalik sediments

J.S. Guleria, Samir Sarkar, Rashmi Srivastava & Vandana Prasad

Guleria and Srivastava studied fossil leaf and fruit remains of *Mitragyna* and leaves of *Syzygium* and *Arthromeris* from Pre-Siwalik sediments of Kasauli, Himachal Pradesh. In addition, some more leaf remains of *Semecarpus* (Anacardiaceae), *Chukrasia*,

Heynea (Meliaceae), *Terminalia* (Combretaceae), *Tephrosia* (Fabaceae), *Lasianthus* (Rubiaceae), *Ficus* (Moraceae), *Donax* (Marantaceae), *Poacites* (Poaceae) have been identified. A field trip was also undertaken for systematic collection of plant

megafossils from Pre-Siwalik sediments of Himachal Pradesh and Tertiary sediments of Jammu region.

Sarkar and Prasad carried out morphological study of various species of the genus *Thalassiphora* Eisenack & Gocht from the Eocene rocks of Shimla Hills. The diagnosis of this genus has been emended in order to accommodate forms having endocyst with an antapical projection. One species- *T. subathuensis* is proposed as new. The stratigraphic distribution of this species has been found to be restricted to Late Ypresian–Early Lutetian transitional part of the Subathu Formation (Late Ypresian). A new fungal genus *Koshaliathyrites* (represented by only one species- *K. sahnii*) has also been instituted from the formation. A probable microthyraceous affinity is suggested for this fungal fruiting body. Also recorded for the first time Lamiaceous pollen grains referable to *Ocimumpollenites* (Kar) from the Subathu Formation exposed along the Koshalia Nala, near Chakki ka More, Sirmaur District, Himachal Pradesh. This record from the Lesser Himalaya indicates that the genus *Ocimum* was more wide spread during Early Eocene time than hitherto known.

Studied palynofloral assemblage recovered from a 366 m thick stratigraphic section of the Subathu Formation, exposed near the village Chamla, Morni Hills (Haryana). The recorded palynoflora consists of a variety of dinoflagellate cysts, spores, pollen grains, fungal and algal remains. Five assemblage zones along with one barren zone have been recognised. The selective association and distribution

of elements have been ascribed to the changing environment of deposition due to sea level changes. Two transgressive and one regressive phases of the Subathu Sea have been identified on the basis of dinocysts/spore-pollen assemblages ratios.

Recovered fossilized filaments of the Cyanophycean alga *Scytonema* (Nostocales) referable to the genus *Palaeoscytonema* from the basal horizons of the Subathu succession (Late Thanetian), exposed near the village Bidasini, Tal Valley, Garhwal Himalaya, Uttar Pradesh. This is the first record of this alga from Indian Tertiary rocks. Two species- *P. eoceanicus* and *P. talensis* are proposed as new. Palaeoenvironmental significance of these taxa have also been made in the light of the distribution of modern *Scytonema* in India. Also recorded Cyanophycean algal mats rich in genera *Palaeoscytonema* and *Gloeocapsomorpha prisca* (Zalessky) for the first time from the basal part of the Subathu succession.

Rich palynofloral assemblage is recovered from Subathu samples from the Kutharnala section (H.P.) and Nilkanth (U.P.). 408 samples were collected from 10 sections from the Lower Tertiary rocks of Shimla Hills, Morni Hills, Nilkanth, Dogadda and Tal Valley areas. Sarkar also visited Central National Herbarium, BSI, Howrah for comparing fossil lamiaceous pollen grains recovered from Late Ypresian sediments of Shimla Hills with the pollen grains of the extant taxa.

Component 2: Floristics, biostratigraphy and sedimentological studies of Siwalik sediments

M.R. Rao, S.K.M. Tripathi, Mahesh Prasad & G.K. Trivedi

Rao carried out chemical processing of the samples from the Middle Siwalik sediments of Bilaspur area, Himachal Pradesh and from the Pinjor Formation of Ghaggar River section and Nadah of Panchkula areas (Haryana). Scanning and photodocumentation of selected taxa have been completed. The assemblage recovered from the Bilaspur area is mainly represented by *Striatriletes*, *Lycopodiumsporites*, *Inaperturopollenites*, *Pinjoriapollis* and *Pinuspollenites*. Gymnosperm

pollen are dominant in the assemblage over angiospermous pollen followed by pteridophytic spores. The recovery of palynoassemblage from Ghaggar River section is poor and mainly represented by *Pinuspollenites* (*Pinus*). However, assemblage recovered from the sediments of Nadah area consists of algal and fungal remains and spores-pollen. The assemblage is dominated by gymnospermous and pteridophytic spores followed by angiospermous pollen. On the basis of affinities with the modern

plant families, a tropical-subtropical climate has been inferred during the time of sedimentation. The presence of *Zygnema* (alga), *Lycopodium*, *Ceratopteris*, fungal remains and angiosperm pollen collectively suggest existence of moist and swampy conditions. The presence of grass pollen (Poaceae) indicates existence of herbaceous flora. Based on the overall palynofloral assemblage, a wet grassland with open and mixed flora during the Pinjor sedimentation has been inferred. The temperate elements viz., *Abies*, *Picea*, *Pinus* and *Magnolia* appear to be derived from the nearby upland areas of the rising Himalaya.

Tripathi completed studies on palynofossils recovered from Middle Siwalik sediments exposed along Nandni-Nagrota Road, Jammu. The palynoflora is represented by pteridophytic spores of the families Cyatheaceae, Schizaeaceae, Parkeriaceae and Polypodiaceae. Gymnosperm pollen related to *Pinus*, *Podocarpus*, *Abies* and *Picea* are profusely recorded in the assemblage. Angiosperm families present in the assemblage are: Magnoliaceae, Compositae and Ctenolophonaceae. Interestingly one sample has shown abundant occurrence of *Ctenolophon* pollen which, so far, were never reported in such high frequency in the Siwalik sediments. Studies indicate that the flora is represented by cold loving gymnosperms and angiosperms occupying high elevations as well as those growing in fresh water swampy habitats of warm and humid climate.

Prasad carried out investigation on leaf impressions collected from Siwalik sediments of Bilaspur, Himachal Pradesh area for the first time. About 10 leaf impressions have been identified with the extant taxa, viz., *Fissistigma wallichii* (Anonaceae), *Hydnocarpus alpinus* (Flacourtiaceae), *Cratoxylum pruniflorum* (Clusiaceae), *Trichilea*

commoroides (Meliaceae), *Meliosma pinnata* (Sabiaceae), *Millettia pachycarpa* (Fabaceae), *Castanopsis tribuloides* (Cupuliforae) and *Ficus benjamina* (Urticaceae), besides a wing of fruit of Dipterocarpaceous taxa, *Anisoptera curtsii*. The present day distribution, habit and habitat of the above comparable taxa indicate that there was a prevalence of evergreen to semi-evergreen forests under warm humid climate around Bilaspur, Himachal Pradesh in the Himalayan foot hills as compared to the extant mixed deciduous forests. Studied plant fossils from Siwalik sediments of Tanakpur (Uttar Pradesh) reveal a variety of taxa belonging to 16 families of dicots and one monocot. Also visited Central National Herbarium, Howrah for the identification of plant fossils (leaf, fruit, and seed impressions) collected from the Siwalik sediments of Himachal Pradesh, Uttar Pradesh and Nepal.

Trivedi processed rock samples (34) for palynological study from Subansiri Formation exposed along Doimukh-Kheel-Sagali Road section, Papum Pass District, Arunachal Pradesh. The assemblage is dominated by reworked Palaeozoic palynomorphs, viz., *Rhizomaspora*, *Platysaccus*, etc. indicating that the Gondwana sediments were exposed nearby and were the source rocks for the younger Tertiary sediments. The assemblage also includes bisaccate gymnospermous pollen of *Pinus* (*Pinuspollenites*), *Abies* (*Abiespollenites*), *Polypodiaceaeosporites*, *Araucariacites*, besides fungal forms (chiefly *Frasnacritetrus* and fungal hyphae). Another 25 surface rock samples of Subansiri Formation exposed on Likabali-Along Road section, West Siang District were chemically processed. Recovery of palynofossils was poor.

Project 8: Tertiary floristics of peninsular India

Component 1: Tertiary floral diversity in North-East India

R.K. Saxena, Samir Sarkar, R.C Mehrotra, Madhav Kumar & B.D. Mandaokar

Saxena and Sarkar recorded a palynofloral assemblage, consisting of 37 genera and 53 species, from the Siju Formation (Middle Eocene) exposed

along Simsang River near Siju, South Garo Hills, Meghalaya. The assemblage is dominated by dinoflagellate cysts and acritarchs (73%) followed

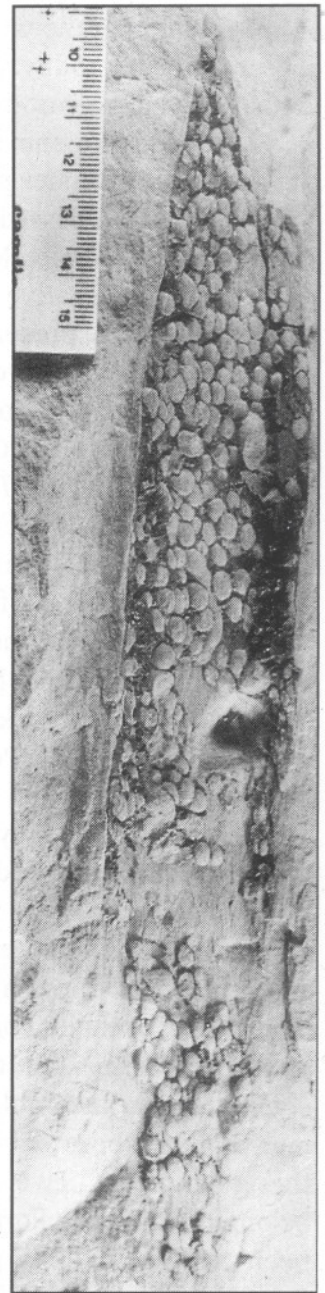
by fungal remains (26%), whereas spores-pollen (1%) are rare. Three new species, viz., *Cleistosphaeridium sijuensis*, *Collumosphaera garoensis* and *Thalassiphora indica* are proposed. On the basis of frequency and distribution of palynotaxa, two cenozones—*Homotryblium pallidum* Cenozozone and *Cleistosphaeridium sijuensis* Cenozozone have been proposed. These cenozones can be recognized by their characteristic and restricted palynotaxa. The palynoflora indicates prevalence of tropical (warm-humid) climate and presence of mangrove elements along the shore and also wet evergreen forest further inland. The environment of deposition has been interpreted as marginal marine. The palynoflora has been compared with the Eocene assemblages recorded from various sedimentary basins of India and has been assigned Middle Eocene age. Besides, morphotaxonomic study of the palynoflora recovered from the Siju Formation exposed in a stream section at Jenggitchakgre in West Garo Hills is being carried out. Chemical processing of the samples from the Rewak Formation has also been taken up.

Mehrotra studied *Nypa* fruits along with a few leaf impressions collected from Oligocene and Lower Miocene sediments of Assam and Mizoram. A rhizome-like structure collected from the Buruai Colliery near Jowai (Jaintia Hills, Meghalaya), was also studied in detail and finalised.

Kumar macerated about 60 samples collected from exposed sedimentary sequences of Surma-Tipam (Mio-Pliocene) at Jowai Badarpur Road and Barail Group (Late Oligocene) at Upper Assam. The slides of productive samples have been scanned and photodocumentation of selected palynotaxa and organic matters recovered from these sequences have been completed. The quantitative analyses of these

palynotaxa are in progress.

Mandaokar recorded a rich palynoflora assemblage consisting of dinoflagellate cysts, fungal remains, pteridophytic spores, gymnospermous and angiospermous pollen from Dulte area about 120 km east of Aizawl, Mizoram. The presence of fungal remains—*Dicellaesporites*, *Cucurbitariaceites*, *Phragmothyrites* indicates warm and humid climate. The assemblage indicate Early Miocene age for studied sequence. Palaeoecological interpretation based upon their known botanical affinities highlights the presence of mangrove, fresh water, swamp and water edge ecological groups. The composition of palynological assemblage suggest that Dulte Formation was deposited in a deltaic condition rich in terrigenous detritus where fungal elements thrived.



Teredolites clavatus Leymerie from the upper Bhuban Formation, Mizoram.

Component 2: Tertiary floristics of peninsular India

J.S. Guleria, K. Ambwani, J.P. Mandal, M.R. Rao, S.K.M. Tripathi, R.S Singh & Anil Agarwal

Guleria studied fossil dicotyledonous woods from the Deccan Intertrappean sediments of Kachchh, Gujarat. Among them 5 have been identified as woods of *Homalium*, *Hydnocarpus*, *Stemonurus* (= *Gomphandra*), *Bischofia* and

Mallotus belonging to families Flacourtiaceae, Icacinaceae, Bischofiaceae and Euphorbiaceae, respectively. The findings are palaeoclimatically very significant as the genera identified indicate moist condition with plenty of rainfall at the time

of preservation of the woods contrary to prevailing dry conditions today. Studied and tentatively identified a few woods and leaf remains from Neogene and Eocene sediments of Rajasthan. Detailed work is under progress.

Ambwani processed lignite samples collected from Neyveli Lignite Mine II for palynological studies. The qualitative and quantitative analyses of pollen-spores present were carried out. The angiospermous taxa were dominant in the total assemblage. Two cenozones were recognised within the lignite section—(i) *Ctenolophonidites costatus* Cenozone, and (ii) *Trilatiporites erdtmanii* Cenozone where the *Ctenolophonidites costatus* marks the upper limit of the lignite deposit. Photodocumentation of the palynotaxa has been completed. Finalised the study on the palynology of bore-hole SV—70 of Mine III. Also visited Tamil Nadu and collected rock samples for palynological studies from Neyveli, Pondicherry, Murutandi and nearby areas.

Mandal studied palynomorph assemblage from the type section of Harudi Formation (Early Middle Eocene) of Kutch Basin for stratigraphic correlation and palaeoenvironmental interpretation. The assemblage is dominated by *Botryococcus* and dinocysts. The major constituent of the angiosperm pollen are *Lakiapollis ovatus* and *Spinizonocolpites echinatus*. The assemblage suggests a very shallow marine near shore environment of deposition of these sediments. Two sections from Khari Nadi belonging to Chasra Formation (Miocene) have also been worked out for palynomorph. Only three samples have yielded pollen and spores. The assemblage is dominated by *Striatriletes*. Angiosperm pollen are rare and represented mainly by *Palaeomalvaceapollis*, *Hibisceapollenites* and *Compositoipollenites*. However, there are no gymnospermous pollen or dinocysts in the assemblage. Also visited various localities of SW Kutch and collected 200 palynological samples belonging to different formations.

Rao completed morphotaxonomy and identification of spore-pollen recovered from Amberiwadi and Kalwiwadi sections, Sindu Durg District, Maharashtra. The palynological

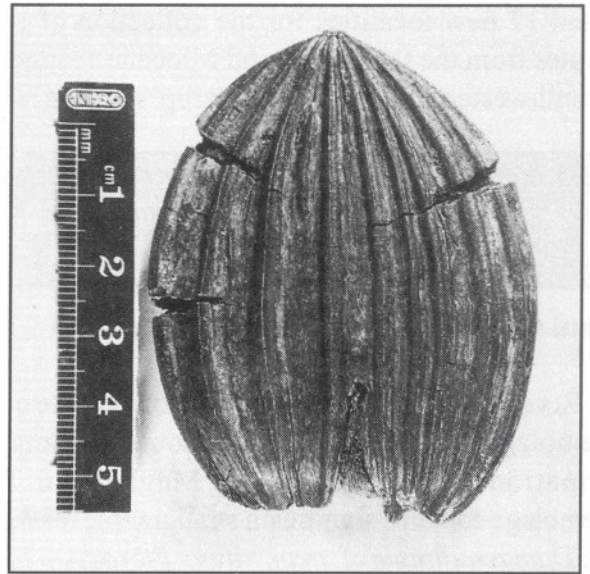
assemblages consist of fungal remains, pteridophytic spores and angiospermous pollen. Dinoflagellate cysts are also recorded. The fungal remains, represented by 15 genera and 20 species belonging to Microthyriaceae and Basidiomycetes, are dominant in the assemblage over pteridophytic spores (8 genera and 15 species) and angiospermous pollen (10 genera and 20 species). The palynoflora suggests a warm and humid climate (tropical-subtropical) with plenty of rainfall during the deposition of sediments. The environment of deposition has been interpreted as near shore with sufficient fresh water or fresh water swamps nearby. Dinoflagellate cysts have been reported for the first time from these sediments, thus indicating the marine influence at the time of deposition.

Tripathi continued palynological studies on sediments collected from Akli Formation, Giral Lignite Mine, Barmer District (Rajasthan). Rich palynofloral assemblages have been recorded from shale, lignite and lignitic shale samples of this formation. The assemblage is constituted by dinoflagellate cysts, fungal remains, pteridophytic spores and angiosperm pollen. The assemblage is distinctly dominated by monosulcate pollen which may be related to the family Arecaceae (Palmae). Different species of *Spinizonocolpites*, a fossil pollen having affinity with modern brackish water Palm *Nypa*, is recorded in high frequency. The assemblage shows the presence of many forms which are similar to *Spinizonocolpites* in aperture characters but differ in shape and size of processes. Variations in these pollen indicate that modern *Nypa* pollen are morphologically less variable than their fossil counterparts.

Singh processed rock samples (68) from the cliff section at Papanasam (Kerala). Some samples yielded rich and diverse palynofossils comprising of fungal remains, pteridophytic spores and angiospermic pollen. Fungal remains are represented by *Nothothyrites*, *Phragmothyrites*, *Parmathyrites*, *Dicellaesporites*, *Pluricellaesporites*; the spores are represented by *Cyathidites*, *Lycopodiumsporites*, *Crassoretitriletes*, *Polypodiisporites*. The angiospermic pollen are diverse mostly dominated by *Quilonipollenites*, *Margocolporites*, *Malvacea-*

rumpollis and *Meliapollis*. Some reworked pollen and spores of Palaeocene-Eocene are also recovered along with this typical Miocene assemblage.

Agarwal carried out sectioning and investigation of carbonised woods (14) from Kerala. Structural details could be observed in one wood and its study is in progress. Sectioning and investigations of the remaining carbonised woods are in process. Studied 5 petrified woods from Sattanur locality, Pondicherry. One wood seems to be new tentatively belonging to family Podocarpaceae and the rest of the woods have poor structural details. Morphological and SEM investigations of one fruit tentatively belonging to family Rubiaceae and study of cuticles from Ratnagiri are also in progress.



Fossil carbonised Rubiaceae fruit from Amberiwadi, Sindhudurg District, Maharashtra.

Component 3: Palaeofloristics of sedimentary sequences associated with Deccan Traps

R.S. Singh & Rashmi Srivastava

Singh visited Lalitpur District, Uttar Pradesh to study the volcano-sedimentaries exposed near Village Papro. It was observed that the lowermost rock exposed is Kaimur Sandstone which is overlain by about 3 m of conglomerate. Above it about 2 m of volcanic ash is deposited. The Deccan basalt is found resting on this ash bed which in turn harbours the chert containing gastropods and palynofossils. Previously it was contemplated that the chert is infratrappean in position but our study reveals that it

is supratrappean. The presence of *Dandotiaspora pseudoauriculata*, *Lakiapollis ovatus*, *Matanomadhiasulcites maximus* and *Proxapertites* sp. also confirms an Upper Palaeocene age. *Azolla cretacea* was recovered earlier from an ash bed.

Srivastava studied and photodocumented a number of fossil dicot woods from Ghansor, Seoni District, Madhya Pradesh. Also studied fossil dicotyledonous woods from the Deccan Intertrappean sediments of Kutch, Gujarat.

Project 9: Marine micropalaeontology of petroliferous basins

Component 1: Calcareous skeletal algae from the Tertiary sequences of Meghalaya and Kutch basins

A.K. Ghosh

Analysis and interpretations (specifically on palaeoenvironment and palaeobathymetry) have been made on the algal flora recovered from the Late Oligocene (Chattian) sediments of southwestern Kutch, Gujarat. The algal flora recorded from the Maniyara Fort Formation indicate moderate to slightly high-energy reef framework during the time of deposition of the sediments. Moreover,

preponderance of Coralline algae indicates open shelf environment. The algal genera prefer to grow at a bathyal level of 20-40 m. It is estimated that the algal forms thrived in a shallow, open shelf environment at approximately 20 m depth. In addition, recovered calcareous algae from the Early Miocene (Aquitaniian-Burdigalian) sediments (Khari Nadi and Chhasra formations) of southwestern Kutch. Also

visited 17 new localities for the collection of rock samples from the Oligocene and Miocene sediments of southwestern Kutch. The outcrop sections were

measured, lithocolumns prepared, photographs of the outcrops were taken and samples (124) were collected systematically.

Component 2: Integrated phytoplankton biozonation and palynofacies analysis of Cretaceous-Tertiary sequences of Meghalaya and Kutch with emphasis on bioevents, time boundaries and palaeoenvironment

Rahul Garg & Khowaja-Ateequzzaman

Recorded rich and diversified dinoflagellate cyst assemblages from almost throughout the Langpar Formation, Therriaghat area, Meghalaya. The assemblage contains significant stratigraphic markers, viz., *Damassadinium cf. manicatum*, *Fibrocysta licia*, *Senoniasphaera inornata*, *Spiniferites hyalospinosus* and *S. cryptovesicularis*. The assemblage is dated to be Danian in age. FAD of the genus *Apectodinium* (*A. hyperacanthum*) in the uppermost part of the formation suggests demarcation of Danian-Selandian boundary. Photodocumentation of the assemblage is partly carried out. Also recorded moderately to well-preserved nannofossil assemblages from several levels from Langpar Formation. Successive appearances of marker species in the section, viz., *Cruciplacolithus tenuis*, *Coccolithus pelagicus* and *Neochiastozygus* species help to assign the nannofossil assemblages to the Standard NP2 - NP3 Zones of the Danian. Identification and

documentation of nannofossils are partly done.

Analysis of dinoflagellate cyst associations, through ca 70 feet thick Type Naredi section (Thanetian-Ypresian), Kutch Basin has revealed significant variations in the assemblages indicative of changing palaeoenvironmental conditions. Predominance of *Muratodinium/Thallasiphora*, and abundance of well-preserved terrestrial plant debris (mostly cuticles) at several levels in the lower part of the section suggest low salinity, near shore environment with intermittent anoxic bottom conditions. Reduction in *Muratodinium/Thallasiphora* population and increase in chorate/skolochorate cysts (*Operculodinium/Polysphaeridium/Spiniferites*) in the middle and upper part, along with amorphous organic matter documents onset of normal marine conditions. This is also indicated by *Assilina*-rich marls and limestone at the top of the section.

Component 3: Neogene microfossils from Andaman and Nicobar Islands and their stratigraphical significance

Anil Chandra & R.K. Saxena

Completed studies on fossil diatoms and silicoflagellates from two sections (Inglis Formation) of Havelock Island. Neogene Tropical Diatom Zones are recognised from *Rossiella paleacea* Zone (NTD1) to *Nitzschia miocenica* Zone (NTD12) in the diatom assemblages from Lacam Point and Havelock Southwest sections which indicate Miocene age for the Inglis Formation. Also completed studies on fossil diatoms and silicoflagellates from two sections (Sawai Bay Formation) of the Neill Island. *Thalassiosira convexa* Zone (NTD13) to *Nitzschia*

reinholdii Zone (NTD16) are recognised in the diatom assemblages from Neill East Coast and Neill Nipple Hill sections which show Miocene-Pliocene age for the Sawai Bay Formation.

A bibliography covering all publications on the geology of Andaman and Nicobar Islands is under compilation. Also carried out field work in the Great Nicobar Island. Various sections belonging to the Archipelago Group were studied and samples were collected for the study of siliceous microfossils.

Thrust Area: Quaternary Vegetation, Climate and Monsoon

Project 10: Quaternary vegetation and palaeoenvironment

Component 1: Palaeovegetation and Palaeoclimate studies of Quaternary sediments from Himalayas

Chhaya Sharma, M.S. Chauhan & Asha Gupta

Sharma and Chauhan constructed pollen diagram and pollen spectra from Dewar Tal, Garhwal Himalaya.

Gupta completed pollen analysis of profile SRT-III (85 cm deep) from Saria Tal, Kumaun Himalaya and constructed pollen diagram which is divisible into 4 zones. The study indicates presence of mixed oak forest in the region with fluctuating warm and humid climate since Late Holocene. Also completed pollen analysis of surface samples from Saria Tal and prepared pollen diagram. Modern pollen deposition broadly reflects floristic composition in the area. Pollen analysed another profile SRT-I (2.0 m) from Saria Tal. Palyno-assemblage recovered shows dominance of non-arboreals over arboreals. Among arboreal *Quercus* and *Pinus* are chief elements. Non-arboreals show predominance of Poaceae followed by Cyperaceae. Aquatics are represented by *Typha*, *Potamogeton*, *Pediastrum*, *Nymphaea* and *Lemna*, etc. Fungal remains are encountered in all samples. The vegetational scenario reflects presence of mixed Oak-Chirpine forest in the region with warm and humid climate.



A view showing human interference (building construction and cutting of *Salix* trees) at Saria Tal, Nainital District, Kumaun Himalaya.

Also undertook field trip to Kumaun Himalaya in order to survey and collect material for study from potential sites in Nainital and Champawat districts; collected a dozen sedimentary profiles and a large number of moss cushions from different localities.

Component 2: Origin and history of tropical forests in peninsular India

S.K. Bera, M.S. Chauhan & Anjum Farooqui

Bera analysed 1.5 m thick sediment profile from Kaki Forest Division, Mikir Hills, Assam and recovered pollen. The profile is dated 12210 ± 110 yrs B.P. at 80 cm depth. The interpretation of palynological data and construction of pollen diagram are in progress.

Chauhan completed pollen analysis of 2.0 m deep sediment core from Kerha Swamp, Sidhi District, Madhya Pradesh. The study has revealed that between 1600 to 800 yrs B.P. this area had open tropical deciduous Sal (*Shorea robusta*) forests under dry climatic regime. Between 800

to 400 yrs B.P., the decline in Sal and a simultaneous expansion of *Bombax*, an important tree of savannah, together with better representation of dry elements such as *Diospyros*, *Aegle marmelos*, etc. suggest that the climate turned more dry than before. Since 400 yrs BP and onwards the expansion of Sal and its associates such as *Terminalia*, *Anogeissus*, *Madhuca indica*, etc. denotes onset of moist climatic conditions in the region.

Also carried out pollen analysis of surface samples (8) from the Sal forests distributed in Kusmi, Sidhi District. The overall pollen assemblage depicts that *Shorea robusta* and its close associates, viz., *Madhuca indica*, *Terminalia*, *Anogeissus*, *Lagerstroemia*, etc. are not represented appropriately in the pollen spectra as compared to their occurrence in the forest floristics. The under-representation of these taxa could be attributed to their entomophilous mode of pollination as well as poor preservation of pollen. Among the non-arboreals, Poaceae, Cyperaceae, Chen/Ams, Asteraceae and Ranunculaceae are the major constituents of ground flora. In general, the pollen spectra do not reflect the existing vegetation in the region. Pollen analytical investigation of a core (1.0 m) from Jarbokho (Kusmi) has shown the good representation of both arboreals and non-arboreals. The arboreals viz., *Shorea robusta* followed by *Madhuca indica*, *Terminalia*, *Emblica* and *Lagerstroemia* are the principal forest components. The herbaceous elements are recorded consistently in high values. The overall vegetational composition envisages the existence of rich tropical deciduous Sal forests in the region.

Undertook a field excursion to District Shahdol, Madhya Pradesh and adjoining areas and collected 6 sediment cores from swamps and 41 surface samples from different forest stands for pollen analytical investigation. A detailed survey of forest floristics was also conducted with an ecological perspective.

Farooqui studied 25 surface and subsurface (40-60 cm deep) samples from south-eastern flank

of the Pulicat lagoon with respect to vegetational succession in the area with sea level and subsequent configurational changes. Results show the depositional phase in this part of the navigable lagoon. The psammophytes are the dominant vegetation with the commercial plantation of *Casuarina* and *Eucalyptus* that renders the surface and subsurface soil moisture not conducive for the establishment of the pioneer species required for mangrove succession. This also promotes erosion both aeolian as well as fluvial. As a result the sand spit is fast prograding (NW) which may close the inlet of the lagoon in the future because the Sriharikota sand spit is also prograding (SE). Carried out palynological study of peat sediments (at 4.0-4.2 m) in a 9.0 m sedimentary profile from western flank of the dried part of Pulicat lagoon, collected at 3.0 m (a.s.l) in Kasdredinilam area (Sulurpet). Similarity in the mangrove palynological assemblage, both the core sediments indicates palaeostrandline during Early Holocene that formed the peat and this distance is presently 18 km inland from the present shoreline. The presence of the peat sediments at different depths with similar palynological assemblage points to the neo-tectonic activity in the region.

Completed stratigraphic study of heavy minerals as placer deposits in a 190 cm (19 samples) deep sedimentary soil dated to 3500 yrs B.P. from Pichavaram, Tamil Nadu that suggests either the change in the provenance or influence of energy regime or a variation in both that might have affected the littoral forest of the estuary through time. Studied a 170 cm (17 samples) sedimentary soil samples dated to 2140 yrs B.P. from Pichavaram with reference to organodebris and its relation to changing sea level/climatic changes. Also studied the modifications in leaf cuticle/epidermis of *Rhizophora apiculata* (collected from Pichavaram) through LM and SEM. Visited Kolleru Lake, Pulicat Lake and Pichavaram (Andhra Pradesh & Tamil Nadu) and collected 8 sedimentary profiles for palynological investigations.

Component 3: Studies of lake sediments in Rajasthan desert proxy climate signals

Chhaya Sharma & Chanchala Srivastava

Constructed pollen diagram of 2.0 m deep sedimentary profile from Punlota Lake (Degana), Nagaur District. Based on the fluctuations seen in the representation of prominent arboreals and non-arboreals, the pollen diagram is divided into four pollen assemblage zones, starting from bottom to top. Each pollen zone is prefixed by the abbreviations DG signifying the investigated site: (i) *Pollen zone DG-I (200-175 cm)*: Around 9200-8050 yrs B.P. the region had predominantly non-arboreal vegetation under arid climatic condition, (ii) *Pollen zone DG-II (175-85 cm)*: Around 8050 to 3810 yrs B.P. warm and moist conditions prevailed reflected by the establishment of savannah type vegetation together with increase in the fern as well as fungal spores, (iii) *Pollen zone DG-III (85-25 cm)*: Around 3810-1325 yrs B.P. decrease in warm and moist conditions is seen as savannah phase is replaced by reduction in arboreal taxa as well as fern spores and grasses with simultaneous increase in Cyperaceae and Chenop/Ams, etc. and (iv) *Pollen zone DG-IV (25-0 cm)*: Comparatively drier or more or less similar conditions are witnessed as in the preceding phase except for the increase in Poaceae and Caryophyllaceae.

The palynological investigations corroborate satisfactorily with geochemical studies which reveal major change in elemental abundance, i.e., increase in concentration of all major- Al, Fe, Ca and Mg and

trace- Mn, Ba, Pb, Cu, Ni and Zn elements around 4200 yrs B.P. (radiometric date) thereby indicating maximum precipitation (rainfall). Higher elemental abundance above 1.0 m boundary in the sediment is attributed to the factor of accelerated weathering in consequence to the greater amount of precipitation.

Carried out pollen analysis of surface samples (4) from Bagundi, Barmer District and constructed their recent pollen spectra. It revealed dominance of non-arboreal vegetation, viz., Poaceae, Cyperaceae, Chenop/Ams, *Capparis*, Convolvulaceae, etc. over arboreal vegetation, viz., *Acacia*, *Prosopis*, *Zizyphus*, etc. A more or less true composition of the surrounding vegetation is seen. Continued pollen analytical investigations of a sedimentary profile (4.0 m) from Bagundi, an extinct salt lake. It revealed mainly non-arboreal type of vegetation, viz., Poaceae, Cyperaceae, Chenop/Ams, Caryophyllaceae, Tubulifloreae, Urticaceae; fern spores—*Alternaria* and *Helminthosporium*, etc. Completed chemical processing of 2.40 m deep sedimentary profile from Pachpadra, an extinct salt lake in Barmer District. Preliminary investigations have revealed palynomorphs of Poaceae, Cyperaceae, Tubulifloreae, *Portulaca* sp. amongst non-arboreals and *Holoptelea*, *Ephedra* of arboreals.

Component 4 : Palaeomangroves and palaeoclimate in Andaman and Nicobar Islands during Quaternary Period

Asha Khandelwal

Completed pollen analytical studies of sediment profile collected from Netaji Nagar, Little Andaman. The pollen diagram has been phased into three pollen zones (NN-1, NN-2, NN-3) depicting transgression, regression and again transgression of the sea. Also pollen analysed 10 samples of a Quaternary section dated to: BS-1595; $36,550 \pm 870$ yrs B.P., collected from R.K. Puram, Little Andaman. The palynodebris

exhibited poor assemblage of pollen grains, fungal spores, fern spores, microforaminifera, etc. However, the stray occurrence of both core and peripheral mangroves are recorded. Compiled data on palaeoclimate and palaeovegetation in South Andaman since 20,000 yrs B.P. as reflected by palynostratigraphy.

Prepared a model of modern pollen deposition

based on the pollen analytical studies of 10 surface samples collected from Little Andaman and South Andaman. In general, the pollen assemblage obtained in surface samples reflect the floristic composition of the surrounding vegetation in a sufficiently consistent way. However, some of the vegetation details are not reflected in the pollen assemblage.

Pollen analysed 2 samples of mangrove honey collected from thickets of mangrove forests of South Bay and Jackson Creek, Little Andaman. Recorded the multifloral assemblage of pollen grains constituted of *Excoecaria*, *Salmalia*, *Symplocos*, *Morus*, *Potamogeton*, *Anagallis*, *Rhizophora*, Asteraceae, Poaceae, etc.

Component 5: Aerobiology in relation to pollen production, dispersal and preservation of pollen grains

Asha Khandelwal

Screened the damp-air-spore sample under SEM. It exhibited a large number of biodegraded pollen grains and spores. The microbes closely allied to bacteria or fungi are found responsible for the biological degradation of aerobioparticles. The localised destruction was found common in most of the cases forming holes of different sizes and the number varied from one to many. They apparently

associate with their host as saprophyte and deform the sporoderm to such an extent that taxonomic identity of pollen/spores is completely lost. It is envisaged that the infected pollen and spores might be acting as 'air-carrier' for the pathogens to help them in their dispersal. Thus, when these aerobiopollutants are inhaled, it may lead to complicated health problem as the chances of infection is doubled.

Project 11: Archaeobotany and dendrochronology

Component 1: Ancient plant economy of pre- and proto-historic sites in northern and western India

K.S. Saraswat & Chanchala Srivastava

Saraswat carried out study on the carbonised botanical remains recovered through the archaeological excavation of a wide range of deposits at Mesolithic site, Damdama in Pratapgarh District, Uttar Pradesh. About 1.50 m thick deposit of Mesolithic culture at the site, characterised by stone tool industry, has revealed 41 graves containing 48 skeletons of late Stone Age men, dated to about 8000 yrs B.P. during early Holocene times. The finds of seeds and fruits are the largest as yet recorded for such an early archaeological context in India and meaningfully furnish the evidence of the shift from the hunter-gatherer economy of Stone Age people to the sedentary life style of early Neolithic agriculturalists in the Ganga Valley.

A portion of morphologically well preserved seeds and fruits of wild grasses, sedges and some dicotyledonous plants, avoiding heat-distorted and mutilated specimens, permitted the safe identification

of foxtail-grass (*Setaria* cf. *glauca*), crowfoot-grass (*Dactyloctenium aegyptium*), job's tear (*Coix lachryma-jobi*), goose-grass (*Eleusine indica*), Barru-grass (*Sorghum halepense*), panic-grass (*Panicum* species), bull-grass (*Paspalum* species), flatsedge (*Cyperus* species), bulrush (*Scirpus* species), gular (*Ficus glomerata*), heliotrope (*Heliotropium indicum*), wild jujube/jharberi (*Zizyphus nummularia*), dock/jangli palak (*Rumex* cf. *dentatus*), vis-khakra (*Trianthema* cf. *portulacastrum*), bhui-anwala (*Phyllanthus asperulatus*), tulsi/basil (*Ocimum* cf. *sanctum*), dayflower (*Commelina* cf. *benghalensis*), wild rice (*Oryza* cf. *rufipogon*), goosefoot (*Chenopodium* species), kharanti (*Sida* species) and tickclover (*Desmodium* species). The seeds and fruits of foxtail-grass, job's tear, bull-grass, gular, goosefoot or bathua, jharberi and wild rice, and also the leaves and tender shoots of goosefoot, jangali palak and dayflower may have been gathered for food.

The carbonised tuber pieces comparable to those of *Cyperus rotundus*, are suggestive of the probable exploitation of starch rich rhizome also for consumption. It is tantalizing to observe that a few pieces of carbonised husk, comparable to those of some form of *Oryza sativa* (cultivated rice) have been encountered in the mixture of wild rice remains. Further, an impression of husk in a burnt mudclad also support the identification of cultivated rice. It is difficult to dismiss the possibility that the mixture of rice remains would have been the product of long-term introgression and the invasion of rice crop by sagetally adapted wild types, during the course of some incipient stage of cultivation. Only scanty assemblage of wild rice and early domestication is evident, but emergence of agriculture seems to have definitely taken place. Patterns of on-site deposition are too irregular and subsequent disturbances are too

common, which hamper the sequential reconstruction of events of rice cultivation from the wild populations. Pre-domestication cultivation is also archaeologically invisible - as a clinal process. But the evidence of some sort of agriculture at Mesolithic Damdama during early and mid-Holocene times is the earliest one in India and it is indeed to be reckoned with.

Srivastava undertook a field-trip to ancient site at Charda, Nanpara Tehsil, Bahraich District in Uttar Pradesh for the collection of archaeobotanical material in collaboration with the excavation team from the Department of Ancient Indian History and Archaeology, Lucknow University. The samples comprising of carbonised seeds, fruits, wood charcoals, etc. were collected in large number from the cultural phases of Kushan, Northern Black Polished Ware and pre-Northern Black Polished Ware.

Component 2: Tree ring analysis for reconstruction of Quaternary environment

R.R. Yadav & A. Bhattacharyya

Yadav studied the tree core samples of *Abies spectabilis* collected from four forest sites in Rargari, Bugdyar, Porting and Tola in Munsyari, Pithoragarh, Uttar Pradesh. Around 250 tree core samples from 120 trees were mounted and processed for cross dating of tree-ring sequences. Cross dating and measurement of ring-width sequences are in progress to prepare tree-ring chronology.

Bhattacharyya studied 6 discs of Teak collected from Dhekana under Tinmari Forest Circle,

Hoshangabad District, Madhya Pradesh. Rings have been counted along two radii each of sample which ranges from 102 to 158. Widths of each ring were measured. Further measurement and dating of other samples towards chronology preparation are in progress. Completed dating and measurement of all the 41 tree-ring samples of *Cedrus deodara* collected from Kashipur near Malari, Garhwal Himalayas. Verification of these dates using computer program is in progress.

Project 12: Cenozoic palaeofloristics of Andaman Islands

Component 1: Integrated nannofossil biostratigraphy and palaeoceanography of Neogene Mud-turbidites of Andaman Nicobar Basin

S.A. Jafar

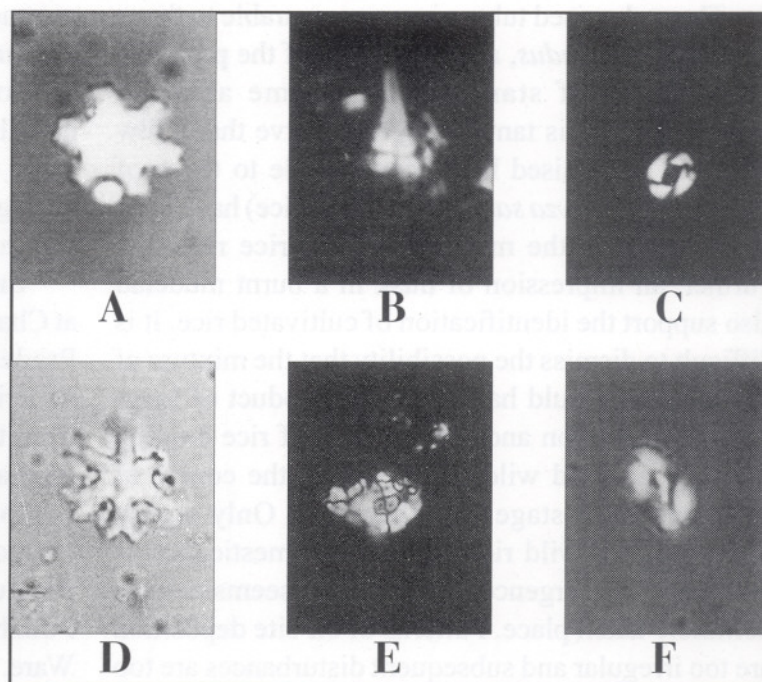
In view of the *Catinaster*-like nannofossils earlier recovered from the samples of Hut Bay Formation rather poorly exposed in Little Andaman Island, a detailed photodocumentation of calcareous nannofossils including rare but marker species of

discoasters was completed. *Catinaster*-like forms provide a basis for proposing a revised evolutionary lineage which has global application in further improving the resolution of Early Middle Miocene chronobiostratigraphy; this time slice is reputed to

contain source rock for giant oil fields of SE Asian region. The Hut Bay Formation with its type area in Little Andaman Island, was reassigned to *Sphenolithus heteromorphus* zone (see text-figure) = NN5/CN4 = Magnetic chron C5B = Langhian = absolute age ca. 15 Ma.

Field-work was conducted in the localities lying in the southern and southeastern regions of Port Blair, to study and collect samples from ophiolite suite of rocks associated with Andaman flysch containing bedded radiolarites. Saw Mill Road section of Little Andaman Island, poorly exposing Mud-turbidites of Hut Bay Formation was sampled again by digging older horizons, for nannofossil study. Massive algal limestones of Quaternary age, overlying Mud-turbidites of Hut Bay Formation, though contact was never seen, were sampled in two widely separated localities of Little Andaman Island.

Also visited NGRI, Hyderabad for discussions relating to the genesis and bathymetric significance of bedded radiolarites in the evolution of Andaman-Nicobar Basin; it was agreed upon by Drs Rao and Jafri that some key sections of flysch sequences already dated by palynological means (data provided



A. *Discoaster druggii* Bramlette & Wilcoxon 1967
 B. *Sphenolithus heteromorphus* Deflandre 1953.
 C. *Reticulofenestra* sp.
 D. *Discoaster variabilis* Martini & Bramlette 1963.
 E. *Thoracosphaera heimii* Kamptner 1941.
 F. *Helicosphaera intermedia* Martini 1965.
 (2.5 cm = 10 μm)

by me) be taken up for initiating palaeomagnetic studies to be followed by that of Neogene Mud-turbidites.

Project 13: Geochronometry and Isotope studies

Component 1: Radiocarbon dating of deposits relating to Quaternary Period and archaeobotanical investigations and chemical analysis of sediments for palaeoenvironmental interpretations

G. Rajagopalan

A total of 140 samples were processed in the Radiocarbon Lab during the year; of these 125 were dated. The routine dating of samples from different investigations has been continued using Quantulus Liquid Scintillation Counter. Windows based software EASY VIEW has been loaded and tested for analysis of Quantulus data. Using this program analysis of different spectra of ¹⁴C counting data, statistical test and age calculation are carried out.

The SQP (spectral quench parameter) measured using the internal standard of the Quantulus system is being used regularly to correct counting efficiency due to self quenching while calculating results. The Rack beta liquid scintillation counting unit is connected to the same computer which records Quantulus data. A new software was loaded for automatic recording of counting data. Dating of high counting samples are being carried out using Rack

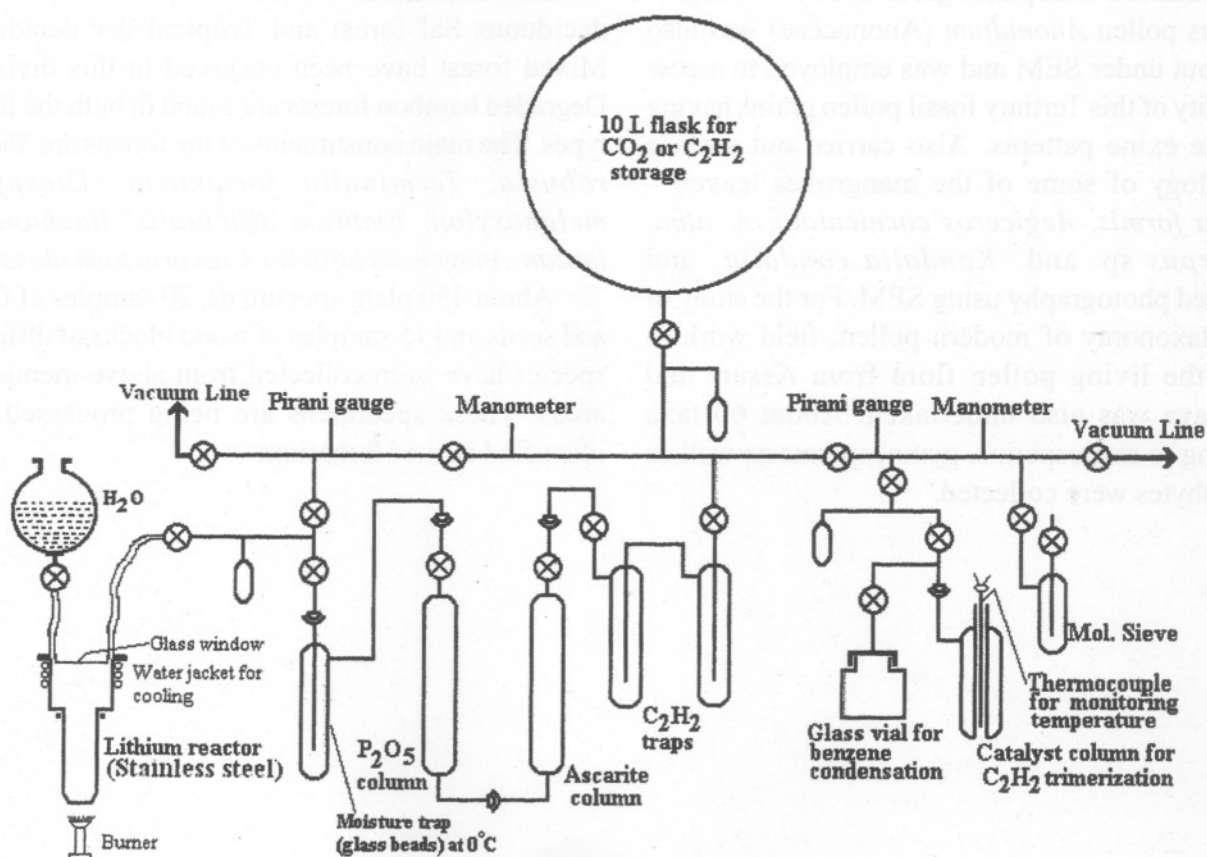
beta system. Correction for the counting efficiency on the basis of external standard ratio in the case of Rack beta is being routinely carried out.

Dating of some profile samples were carried out for determining the chronology of palaeofloristics and climate changes in the respective regions. The ^{14}C age of peat samples from Phulera, Kumaon, Uttar Pradesh at 3.65 m works out to 15900 ± 150 yrs B.P. Two calcareous Late Quaternary sediment samples (at 60.5 m) from Little Andaman, Andaman and Nicobar islands were dated as 36550 ± 870 yrs B.P. One peat sample (at 20, 50 cm) from Priyadarshini Lake, Antarctica was dated to 7190 ± 300 yrs B.P. One sediment sample (at 50 cm) from Samkharbasti, Kaki forest, Assam was also dated as 11020 ± 140 yrs B.P. Dating of carbonaceous sediment samples (at 31.20-31.24 m) from Surinsar Lake, Jammu & Kashmir was carried out and measured as 2900 ± 100 yrs B.P.

Dating of palaeolakes in Karnataka namely at

Vaddrakuppe, Chelukavadi and Muguru Mysore District were carried out in order to understand the origin of these lakes in relation to Late Quaternary tectonic activity. The results are: Vaddrakuppe (90 cm) 13870 ± 270 yrs B.P., Muguru (25 cm) 9760 ± 220 yrs B.P. and Chelukavadi (surface) 6480 ± 180 yrs B.P. Four charcoal samples were dated from Malhar, Chandoli District, Uttar Pradesh for determining ancient plant economy of pre- and protohistoric sites in northern and NW India through palaeobotanical studies.

A number of trial runs were carried out for direct conversion of charcoal, wood to lithium carbide for the synthesis of benzene for ^{14}C dating and parameters like temperature and pressure of absorption have been standardised. The above procedure will result in saving of one step of preparation in ^{14}C dating namely preparation of CO_2 , eliminate isotopic fraction error of that step, saving of processing time and liquid nitrogen. But it has



Modified and improved glass system for acetylene and benzene syntheses for Radiocarbon Dating

been found that the above procedure leads to lower spectral quench factor and lower efficiency. The microwave digestion system (MDS 2100) is being

used regularly for preparation of samples for chemical analysis.

Project 15: Special Activity

Component 1: Floristics and phytogeography of tropical and subtropical forests

K. Ambwani & D.C. Saini

Ambwani studied 60 pollen taxa belonging to Asteraceae, Solanaceae, Acanthaceae, Euphorbiaceae, Caesalpiniaceae, Apocynaceae, Solanaceae, Myrtaceae, Baringtoniaceae, Sapindaceae, Lamiaceae, Primulaceae, Elaeocarpaceae and Araceae. For detailed exine morphology of the taxa, SEM study of *Arenga pinnata*, *Licuala spinosa*, *Nypa fruticans* and *Caryota urens* belonging to Araceae was done. The photodocumentation was completed. Further study of other taxa of this group is under progress.

A detailed morphological study of angiospermous pollen *Anonidium* (Anonaceae) was also carried out under SEM and was employed to assess the affinity of this Tertiary fossil pollen grains having reticulate exine patterns. Also carried out surface morphology of some of the mangroves leaves—*Heritiera formis*, *Aegiceros corniculata*, *A. alba*, *Xylocarpus* sp. and *Kandalia candalia* and completed photography using SEM. For the study of morphotaxonomy of modern pollen, field work to collect the living pollen flora from Assam and Meghalaya was also undertaken. About 60 taxa belonging to angiosperms, gymnosperms as well as pteridophytes were collected.

Saini undertook a floristic survey of East Sidhi Forest Division, Madhya Pradesh to study the floristic diversity and phytogeography of the area and to collect extant plant materials for Herbarium. The studied area is bounded by Bagdora Game Sanctuary in the north, West Sidhi Division in west, Mirzapur District, Uttar Pradesh in east and Sarguja District in the south. The area, comprising Deosar, Chtrangi and Singrauli tehsils of Sidhi District is divided into six forest ranges—Chtrangi, Jiyawan, Bargawan, Sarai, Waidhan and Mada. Two forest types—Tropical dry deciduous Sal forest and Tropical dry deciduous Mixed forest have been observed in this division. Degraded bamboo forests are found in both the forest types. The main constituents of the forests are *Shorea robusta*, *Terminalia tomentosa*, *Diospyros melanoxylon*, *Emblica officinalis*, *Buchanania lanzan*, *Anogeissus latifolia*, *Casearia tomentosa*, etc.

About 450 plant specimens, 70 samples of fruits and seeds and 15 samples of wood blocks of different species have been collected from above mentioned areas. These specimens are being processed and identified in the Herbarium.

Contributions other than Project Work

Shaila Chandra prepared a chapter entitled "Glossopteridales—Foliage and Fruits from India" for book '*Gondwana Alive*' to be published from South Africa.

Shaila Chandra, K.J. Singh & Shreerup Goswami completed sorting of megaspores from three more locations from Tatapani-Ramkola area, Madhya Pradesh. In all, megaspores from eight locations from Early to Late Permian and Early Triassic sediments have been recovered and their study is in progress.

K.J. Singh finalised a chapter entitled "Horsetails from India" for book '*Gondwana Alive*' to be published from South Africa.

A.K. Srivastava described minute size acarid-like arthropod discovered in midrib region of *Glossopteris* leaf belonging to Barakar Formation of Raniganj Coalfield. The first evidence of association and interaction of mite in Gondwana flora of India was discussed.

A.K. Srivastava & Rajni Tewari examined the development of *Glossopteris* flora through *Gangamopteris* and *Glossopteris* stages from Early Permian to Late Permian. Appearance, disappearance, continuance and affiliation of different taxa in Lower Gondwana formations of India indicate that flora attained its maturity and diversity with specific association of genera and species during Early Permian (Karharbari-Barakar transition), Late Early Permian (Barakar Formation), Early Late Permian (Barakar Formation and Raniganj Formation), and Late Permian (Kamthi Formation). In other Gondwana countries, associated genera and species are different but they also demonstrate comparative developmental pattern of *Glossopteris* flora. The relevant data and observation have been compiled and finalised.

Rajni Tewari compiled and evaluated a morphological data on *Glossopteris* leaves of India for evolutionary significance. Factors influencing extinction of the genus have been analysed and a paper entitled "Evolutionary failure of *Glossopteris*—A view point" has been finalized. Taxonomic revision of *Glossopteris schopfii* (Maheshwari & Tewari) has

also been done. Studied the morphotaxonomy and distribution of Indian Gondwana megaspores and a report is being compiled.

A. Rajanikanth & Rajni Tewari compiled data on Gondwana woods from India and their growth ring patterns for interpretation of palaeoenvironment. Also studied fossil leaf impressions of Gondwana affinity from Pisdura locality, Nand-Dongargaon sub-basin of Wardha-Pranhita Valley.

A. Rajanikanth carried out xylotomical studies on the fossil woods of Tadwai Forest Block, Warangal, Andhra Pradesh provided by Forest Department.

Anil Chandra, R.K. Saxena & A.K. Ghosh completed the detailed study on the calcareous algal flora from the Car Nicobar Island and the Little Andaman Island.

R.K. Saxena prepared and finalised a manuscript entitled "Palynostratigraphy of the Tertiary sediments of Meghalaya, northeastern India— present status and gaps".

R.K. Saxena & S.K.M. Tripathi initiated to prepare a monograph including study of all the fungal remains known so far from the Indian sediments. The monograph will include morphotaxonomic restudy of fossil fungal taxa, their reallocation, wherever necessary, proposal of new genera and species, comments on their extant relationships, keys for identification of various genera of fungal spores and fruit bodies, etc. The detailed account of each taxon will be accompanied by suitable illustrations. Also finalised a manuscript dealing with the taxonomic and nomenclatural study of *Dyadosporites*, recorded from the Indian Tertiary sediments.

R.K. Saxena & G.K. Trivedi initiated to prepare a catalogue, including all records of spores and pollen from the Indian Tertiary sediments published during 1989 to 2000. This will update the earlier catalogue on Indian Tertiary spores and pollen (Saxena, 1991), which includes spore-pollen records published up to 1988.

S.K.M. Tripathi, R.K. Saxena & V. Prasad prepared and finalised a manuscript dealing with the palynostratigraphic study of the Tura Formation

(Early Eocene) exposed along the Tura-Dalu Road, West Garo Hills, Meghalaya, India.

J.P. Mandal & Samir Sarkar carried out critical morphotaxonomic evaluation of two pteridophytic spore genera – *Dandotiaspora* (Sah, Kar & Singh, 1971) and *Lygodiumsporites* (Potonié, 1956) for the preparation of a pteridophytic spore atlas. Collection of data from published literature is now being done.

J.P. Mandal & Madhav Kumar described 12 fossil taxa— *Polygonacidites frequens*, *Perfotri-colpites neyvelii*, *Lanagiopollis eocaenicus*, *Tiliaepollenites* cf. *rotundus*, *Tiliaepollenites* sp. *Favitricolpites assamensis*, *Strobilantheidites* cf. *africanus*, *Retitrescolpites africanus*, *Retitricolporites* cf. *guianensis*, *Corsinipollenites jussiaeensis*, *Discoidites bornensis* and *Tinalipollenites duttae* from Naogaon Formation to Dhekiajuli Formation of the Tinali well- 7, Upper Assam. The fossils are compared with similar pollen types from extant dicotyledonous species. The stratigraphic and palaeoecologic significance of the fossil forms is analysed in the light of geological distribution and habitat of the comparable modern taxa. It is observed that only four taxa are suitable as ecological indicators but none of them can be used as a stratigraphic marker for distant basins.

Rakesh Saxena finalised two papers entitled “Geological and biostratigraphical studies of coal-bearing sediments in West Bokaro Basin, Bihar, India” and “Permian spore and pollen grains from West Bokaro Basin, Bihar, India”.

Mahesh Prasad & E.G. Khare finalised a manuscript on the fossil woods from Deccan Intertrappean beds of Nawargaon, Maharashtra. Besides, some leaf impressions from same beds have been identified belonging to the families— Anonaceae, Meliaceae, Clusiaceae, Sterculiaceae, Anacardiaceae and Urticaceae.

Anjum Farooqui & Usha Bajpai studied under SEM the leaf cuticle/epidermal traits of *Rhizophora apiculata* Bl. growing in shallow estuarine coastal wet land, adapting to salt stress related to sea level and climate. The excess salt exuded through cork-wart-like structures that are found to be modifications of the stomatal complex. The salt exuded fills the stomatal cavity that appears small in the initial stages

but enlarges in the later stages, perhaps due to pressure exerted by excess salt filled in. Thus, during dry period when the water is physiologically not available in coastal wet-land ecosystem, the salt exuded on the leaf surface absorbs water from the atmosphere and supplements the water need of plants. During the rainy season it is washed off from the leaf surface revealing the plant from excess salt and leaving space for more salt exudation.

Chhaya Sharma, Chanchala Srivastava, M.S. Chauhan, Asha Gupta, Anjum Farooqui, Ratan Kar, Anjali Dixit, P.S. Ranhotra & Indra Goel under took a field excursion to Kukrail Forest (Lucknow) for the testing of newly fabricated manual corer and collected a 1.0 m deep sediment core for pollen analysis and 2 samples for radiocarbon dating.

Chhaya Sharma & S.K. Bera visited Indian Institute of Technology, Kanpur to procure Gravity Corer for collection of sedimentary cores from Antarctica and to discuss about Sambhar Lake profile collected by Dr Rajiv Sinha from Rajasthan. Six core samples were taken for pollen analysis.

S.K. Bera prepared a research proposal for the selection to 19th Indian Scientific Expedition to Antarctica for submission to DOD, New Delhi. Engaged in the arrangement of apparatus, Microscope, chemicals and other essential items for setting a laboratory at Antarctica during 19th Expedition and visited NCAOR, Goa to deposit the official luggage for loading in container vessel of the ship.

Chanchala Srivastava undertook a field trip to New Delhi as per the invitation from the Director of Museum, ASI regarding analysis of soil samples from the garden plots laid around the Humayun's Tomb. As there were no chances for preservation of carbonised content of macro-remains in the area, three soil profiles were collected for polleniferous material by cutting trenches of 2.70, 2.10 and 2.00 m depths along-with 8 ¹⁴C dating samples and 4 surface samples; to have the know-how of the gardening activities during Mughal Period at this historical site.

Completed chemical processing of two soil profiles (2.70 & 2.00 m depths). Their studies have revealed low pollen frequency, but the samples' productivity in organic content is very high. They

contain large number of wood charcoals and cuticle pieces, sections of gymnospermous woods showing cross-field pits (mainly Podocarpoid); Acritarchs, Concentricysts, fungal spores (mainly Ascospores, Negrospores), monolete and trilete fern spores; pollen of *Plantago* sp., *Cerealia* type, Cyperaceae, Brassicaceae, Tubulifloreae, Lamiaceae, Cheno/Ams and *Cedrus deodara*, a transported one. Photographed different taxa encountered and prepared their photoplates.

Asha Gupta finalised a manuscript dealing with fungal remains from Tertiary deposits exposed at Sirmaur District, Himachal Pradesh.

S.A. Jafar compiled data for a manuscript

entitled "Darwinism rescued against Catastrophism: Evidence of Fossil Phytoplankton at Cretaceous-Tertiary Boundary".

G. Rajagopalan & B. Sekar finalised the data on interpretations of climatic changes around Tsokar Lake, Ladakh during the last 33 kyrs years B.P. on the basis of chemical data and its comparison with other sites. Elemental analysis using atomic absorption spectrometer have been carried out for the analysis of samples from Paradise Lake, Selapass, Arunachal Pradesh and the interpretation of chemical data for inferring climatic changes on the basis of chemical analysis, ¹⁴C dating and palynological data (Dr A. Bhattacharyya) is in progress.

Collaborative Work

Indo-Russian Integrated Long Term Programme (ILTP) (INT/ILTP/B-2.22, w.e.f. February 01, 2000)

A project entitled "Floral and climatic evolution based on Geologic and Biotic events during Precambrian and Phanerozoic Time" has been initiated under ILTP of co-operation in Science and Technology between India and Russia under the Co-ordinatorships of Prof. A.K. Sinha (Director) and Prof. M.A. Akhmetiev (Russia). A preliminary report related to following themes along with future plans has been prepared:

Precambrian microbiota,

Permian Western Subangarida and Gondwana Flora,

Jurassic and Cretaceous floras: Comparative studies,

Palaeoclimatic studies of Cenozoic tropical and extratropical realm, and

Isotope and geochronological data generation and interpretation.

Shaila Chandra & K.J. Singh [& Drs Gene Mapes & G. Rothwell (USA)]

Completed colour and black and white photographs and observations of Conifer forms *Buriadia* and *Birsinghia*.

Suresh C. Srivastava & Madhav Kumar [& †Prof. S.K. Dutta, Dibrugarh]

Macerated 97 samples (depth interval 4446-1915 m, Palaeocene - Mio-Pliocene) from Bihpuria well no. 1, North Lakhimpur District, Assam. A rich organic matter, microforaminiferal linings, dinoflagellates and spores and pollen grains have been recovered from about 65 samples. The slides of productive samples have been scanned and frequency of various types of organic matter from Palaeogene sequence have been calculated.

Chhaya Sharma [& B.S. Kotlia (Nainital)]

Completed pollen analysis of 6.5 m thick Quaternary section from Phulera (Champawat), Kumaon Himalaya and constructed the pollen diagram. Also completed the pollen analysis of surface samples from the region and constructed the recent pollen spectra.

Chhaya Sharma & M.S. Chauhan [& Rajiv Sinha (IIT, Kanpur)]

Finalised a manuscript entitled "Sedimentological and pollen studies of cores from Lake Priyadarshini, Eastern Antarctica" inferring the palaeoclimatic oscillations in the region during last 8000 years.

M.S. Chauhan & G. Rajagopalan [& R.K. Mazari (Dehra Dun)]

Prepared and finalised a manuscript entitled "Vegetation and climate in upper Spiti region, Himachal Pradesh during late-Holocene" explaining

the movement of mountain glaciers owing to climatic shifts in the region since last 2300 years.

Asha Khandelwal [& Jyotsana Srivastava & Sunita Singh (Lucknow University)]

Carried out air-monitoring for 3 months under Environment-oriented Projects "Grass pollen: Production, aerial incidence and allergy" (with JS) and "Study on aerial prevalence of *Parthenium hysterophorus* pollen in relation to pollen allergy" (with SS) at five different places (BSIP- terrace, BSIP-ground, Lucknow University, Sarvodaya Nagar and Ganeshganj) of Lucknow. It provided useful information on post-rainy and early winter season periodicity of two important allergenic biopollutants.

Chhaya Sharma & S.K. Bera [& D.K. Upreti (NBRI, Lucknow)]

Pollen analysed 8 surface samples (5 moss cushions and 3 dry algal mat) from near Priyadarshini Lake, Antarctica collected by Dr Upreti, NBRI, Lucknow. The study reveals the occurrence of grasses, few herbs and some exotic arboreals including fungal and algal spores.

S.K.M. Tripathi & Madhav Kumar [& Dr M. Kedves (Hungary)]

Transmission Electron Microscopic studies on partially degraded pollen grains of *Phoenix sylvestris*

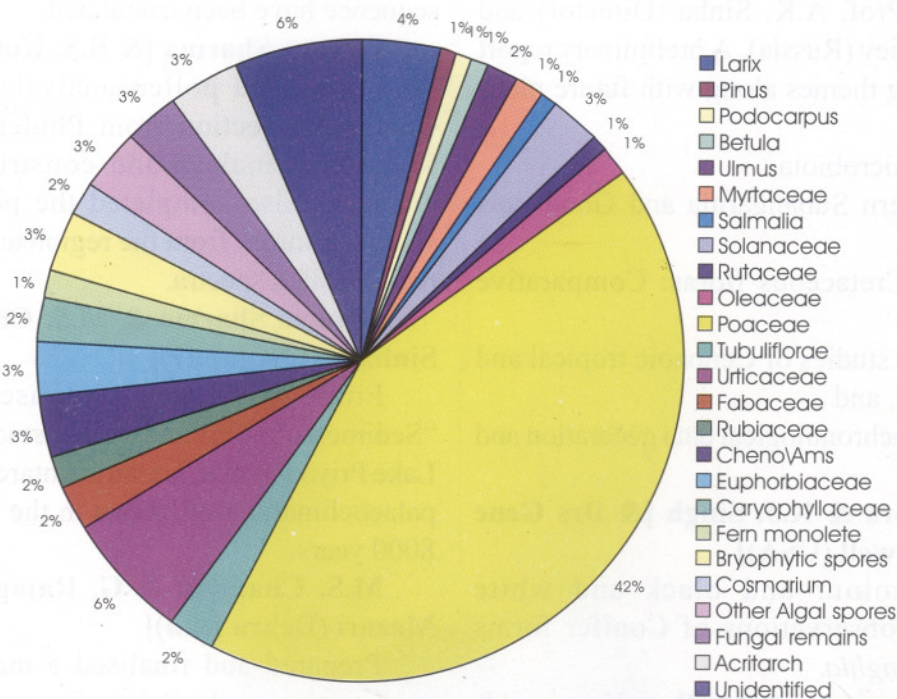
were made. More or less radially oriented and comparatively large regular pentagonal biopolymer units were observed on the tectal surface of the exine. These biopolymer units were examined by using the rotation method. In the peripheral region of one of the pentagonal biopolymer units peculiar penrose units were also noticed.

Jayasri Banerji [& Shashi Kumar (Bangalore)]

Identified various taxa of the fossil assemblages from different localities of Rajmahal and East Coast basins of India.

Rahul Garg [& Prof. S.K. Singh (Lucknow)]
Integrated biostratigraphy, Sea level changes and Environmental patterns of Indian Jurassic Shelves

Well-preserved dinoflagellate cyst assemblages are documented from basal part of Jhurio Hill section and lower part of Kanthkote Hill section. Low diversity dinocyst assemblage from Jhurio section includes *Ctenidodinium ornatum*, *C. tenellum*, *Meiurogonaulax* sp. *Rigaudella aemula*, corresponding to benthic foraminiferal *Garantella ornata* Zone of Late Bathonian. Dinocyst assemblages from basal shales of Kanthkot Member are rich and diverse. Occurrence of *Dingodinium jurassicum*, *D. tuberosum*, *Scrinodinium crista-*



Modern pollen-spore at Priyadarshini lake, Antarctica

llinum, *Aldorfia dictyota*, *Gonyaulacysta jurassica* is indicative of Kimmeridgian age.

Rahul Garg & Khawaja Ateequzzaman [& Dr Rajiv Nigam (NIO, Goa)]

Dinoflagellate cysts from marine sediments as indicators of past environmental changes along the western Indian Coast — 15 surface sediment samples from Arabian Sea near Marmagao (received from NIO) have been processed for studying dinoflagellate cyst distribution. Seven samples of shallow water depths (up to 50 m) are productive of well-preserved organic-walled dinoflagellates, which are otherwise rich in amorphous organic debris. The dinoflagellate assemblage shows high relative abundance of *Tuberculodinium vancampoae* followed by cysts of the *Protoperidinium* group (*Brigantedinium* spp., *Stelladinium* spp., *Multispinula quanta*). Other rare but ecologically significant species in the assemblage include *Polykrikos schwartzii*, *Algidasphaeridium* sp. cf. *A. spongium*, etc. The remaining 8 samples from deep water (~3000 m) region are processed for calcareous dinoflagellates and strewn slides prepared. The samples are productive of a rich calcareous dinoflagellate assemblage. Significant species include *Sphaerodinnella albatrosiana*, *Orthopithonella granifera* and *Thoracosphaera heimii*.

Jyotsana Rai & Rahul Garg [& Prof. S.K. Singh (Lucknow)]

Datable nannofossils assignable to earliest Callovian NJ12 *Ansulasmaera helvetica* Zone are recorded from the basal part of Kuldhar section, Jaisalmer. The marker species include *A. helvetica*, *Stephanolithion hexum*, *S. octum*, *S. bigoti*, *Cyclagelosphaera wiedmanii*. Photodocumentation of the assemblage is completed.

Jyotsana Rai & Rahul Garg [& Prof. S. Kumar (Lucknow)]

Nannofossil assemblage comprising over 50 species is recovered from sandstone unit (?Lameta Formation) overlying Coralline Limestone and Marls of Bagh Formation exposed in Chakrud I section, near Zeerabad, Bagh area. The assemblage includes cosmopolitan marker *Ceratolithoides aculeus* along with *Broinsonia parca*, *Lucianorhadus cayeuxi*, *Eifellithus eximus*, *Eprolithus floralis*, *Microrhabdulus undosus*, *Marthasterites furcatus* and is assigned to UC15/CC20 zone of late Early

Campanian age. Photodocumentation of the assemblage is completed.

K. Ambwani & A. Agarwal [& Dr S.K. Saha (Chandigarh)]

Finalised two manuscripts entitled "First occurrence of *Garugaoxylon bangladeshensis* gen. et sp. nov. from Lalmai Hills, Comilla District, Bangladesh" (jointly with Dr R.K. Kar) and "Fossil wood of *Barringtonia* (Lecythidaceae) from Ramgarh, Chittagong Hill Tract, Bangladesh".

Samir Sarkar [(& G. Corvinus (Kathmandu, Nepal)]

Finalization of palynological work carried out on the Siwalik rocks of Surai Khola and its adjoining areas of Nepal is continuing. Detailed morphological study of zygospores of various species of Zygnemataceae, viz., *Spirogyra*, *Zygnema*, *Mougeotia*, etc. recovered from Mio-Plio-Pleistocene sediments of Nepal were carried out.

R.C. Mehrotra & B.D. Mandaokar [(& R.P. Tiwari (Mizoram) & V. Rai (Lucknow)]

An ichnofossil *Teredolites clavatus* Leymerie is described for the first time from Ramrikawn stone quarry near Aizawl, Mizoram. It belongs to the Upper Bhuban Formation of Surma Group and is Lower-Middle Miocene in age. Its presence indicates deltaic environment of deposition. A manuscript incorporating results of these studies has been finalized and documented.

Mahesh Prasad [& P.P. Tripathi (Balrampur, UP)]

Investigated plant megafossils from Siwaliks of Koilabas area. Some more palaeobotanical data have been gathered from this area and utilised in the preparation of a manuscript entitled "Further contribution to the Siwalik flora from the Koilabas area, Western Nepal".

Mahesh Prasad [& S.K. Bhattacharyya (Ahmedabad)]

Work on Stable Carbon Isotopic composition of Siwalik Palaeosol and its relation to C₃/C₄ plants and climate has been started. About 50 carbonised samples collected from different sections of Siwalik sequence of Surai Khola, Western Nepal have been processed at Physical Research Laboratory (Ahmedabad) for their isotopic analysis. The work is under progress.

Sponsored Projects

Project : Search of palyno-event evidences for the status of Jurassic sequence on Indian Peninsula (Sponsored by DST, New Delhi, No. DST/ESS/CA-17/96)

Vijaya & Sanjay Singh

Chemical processing of 100 samples from Dubrajpur sediments in bore-hole DPD—3, Birbhum Coalfield (West Bengal) has been done. In 18.00 to 317.00 m thick strata, 50 samples have yielded palynomorphs. Search for marker spore-pollen species has been made in favour of Jurassic deposits in this Gondwana sequence comprising Rajmahal, Dubrajpur and Raniganj formations.

Vijaya carried out palynological study of 4 outcrop sections of the Kota Formation in the Pranhita-Godavari Valley to re-assess the age of this lithological unit (with Dr G.V.R. Prasad, Jammu). In all the sections genus *Callialasporites* is well-represented, along with other species of stratigraphic significance- *Murospora florida*, *Contignisporites cooksoniae*. It suggests the Upper Jurassic age affinity for the Kota type section exposed near Kota Village. Also compiled the palynological data from the Jurassic successions in various Mesozoic basins on Indian peninsula to prepare the palyno-event stratigraphy for Jurassic sequence.

Project : Deccan Intertrappean palynoflora and its implication for the demarcation of K/T Boundary (Sponsored by DST, New Delhi, No. DST/ESS/CA/A4—16/96)

K. Ambwani [R.K. Kar & Ashok Sahni]

Spermatites and *Costatheca* are recorded for the first time from the Deccan Intertrappean beds of Mohgaon-Kalan and Padwar, Madhya Pradesh, India. These two genera are found in association with Late Cretaceous marker palynological fossils like *Azolla cretacea*, *Ariadnaesporites* sp., *Gabonisporites vigourouxii* and *Aquilapollenites bengalensis*. To find out the living counter part of *Spermatites*, *Azolla pinnata* R. Brown was studied and it was observed

that the indusium of the megasporangium of this species resembles very much *Spermatites* in shape, size, ornamentation and in the presence of a cuitinized cap. The abortive megasporangium with indusium does not dissolve and hence could be regarded as *Spermatites* after fossilization. The indusium in *A. pinnata* grows out as a ring-wall below the sorus and covers it completely except for a micropyle – like opening at the top which could apparently resemble an integument round the ovule of a seed plant.

Project : Geochemical and palynological methods of Quaternary climate study using lake deposits (Sponsored by CSIR)

Chhaya Sharma & DN Yadav (up to 15-6-99)

Palynological as well as elemental analysis work on Bagundi profile from Rajasthan has been continued.

Project : The transition of lacustrine fauna and floral communities across Pleistocene-Holocene in Jammu and Ladakh (Sponsored by DST, New Delhi, No. DST/ESS/CA/A4—22/96)

Chhaya Sharma & Anjali Dixit (& M.A. Malik, Jammu)

Investigated sedimentary core (38.0 m deep) retrieved of Surinsar Lake in Jammu region. Pollen diagram constructed from 26 pollen analysed samples taken out at interval of about 1.00 m from the lithocolumn has been arbitrarily divided into four Pollen Assemblage Zones, based on the changes witnessed in vegetation pattern to interpret the climatic fluctuations:

Pollen Zone 1— *Quercus-Ulmus-Artemisia-Poaceae* Assemblage: Vegetation sequence during this early phase had mainly mixed broad leaved-oak forests with ground vegetation comprised mainly grasses, followed by *Artemisia*, Ranunculaceae and Urticaceae. The overall emerged vegetation composition reflects warm and moist climate in the

region.

Pollen Zone II— *Quercus-Ulmus-Pinus-Artemisia-Poaceae* Assemblage: This phase denotes a change in the composition of mixed broad leaved oak forests along with this, simultaneous increase in *Pinus*, thus, reflecting that the climate turned less moist compared to the preceding phase.

Pollen Zone III— *Pinus-Poaceae* Assemblage: Considerable reduction in *Quercus* as well as other broad leaved taxa with a marked increase in *Pinus* attaining its maximum by development. Replacement of mixed broad leaved oak by pine dominated forests determine this phase. This marked change in the vegetation pattern signify the onset of cold and dry climatic conditions in the region.

Pollen Zone IV— *Pinus-Quercus-Poaceae* Assemblage: Gradual decline in *Pinus* associated with simultaneous increase in *Quercus* and other broad-leaved taxa is witnessed. The change in the vegetation pattern reflects amelioration in the climate during the period.

Generating detailed pollen analytical data through sequential palynostratigraphical investigations of the Surinsar Lake profile. Study of Mansar Lake samples is also in progress. Undertook field work to Jammu and Kashmir and collected surface samples from the region.

Project : High altitude plant species response to global climate change (Sponsored by G.B. Pant Institute of Himalayan Environment and Development Kosi-Katarmal, Almora, Department of Environment, New Delhi, No. GBPI/IERP/98-99/02/567)

R.R. Yadav & Jayendra Singh

Collected tree-core samples of around 270 trees belonging to *Pinus wallichiana*, *Picea smithiana*, *Cedrus deodara*, *Abies spectabilis* from areas around Gangotri in Uttarkashi, Uttar Pradesh Himalaya. Tree core samples were mounted and processed for cross dating. Ring-width measurement of *Pinus wallichiana* has been completed. The statistical

analysis of ring-width measurements was done to evaluate the climatic signal in tree-rings.

Project : Analysis of climatic changes vis a vis glacial fluctuations using pollen and tree-ring data in Gangotri Glacier area, Garhwal Himalayas (Sponsored by DST, New Delhi, No. ES/91/018/97)

A. Bhattacharyya & P.S. Ranhotra

Relevant literature regarding distribution of plants in the Western Himalaya especially around Gangotri have been studied. A field trip to Gangotri Glacier was undertaken by one of us (PSR). Preliminary survey and observations were made regarding geomorphological features (morainic ridges, earth-pillars, striations on rock surfaces) and distribution of plants in relation to altitude. Eight surface samples including sediments and moss cushion, in which 1 moss sample from Chirbasa (9 km from Gangotri towards Goumukh); 3 surface sediments and 2 moss samples from Bhujbasa, (5 km from Chirbasa) and 2 surface sediments from flats near Goumukh Glacier) were collected to understand pollen/vegetation relationship of this region. All these samples were macerated for pollen analysis. Pollen count is in progress.

Project : Analysis of climate changes in Eastern Himalayan region using tree ring data (Sponsored by DST, New Delhi, No. DST/ (ESS/ 44/01/98)

A. Bhattacharyya & Vandana Chaudhary

Studied relevant literature regarding distribution of conifers in the eastern Himalayan region especially around Mishmi Hills, Lohit District, Arunachal Pradesh. A field trip was undertaken to Mishmi Hills and collected 176 tree cores from 90 trees of *Pinus merkusii* growing in Walong, Dichu, Dong valleys and other sites of this region growing at altitude around 2000 to 2500 m. Beside this, 4 cores from two trees of *Cephalotaxus* growing around Mayadia Pass (2655 m) in Dibang Valley were also collected.

Recognition

Chhaya Sharma

Chaired Technical Session- 6 at "*XVII Indian Colloquium on Micropaleontology and Stratigraphy*" held at Ujjain in January, 2000. Also Co-opted as an Organiser and Chairperson for the Symposium on "*Palynostratigraphy of Quaternary of Himalaya*" and to chair a session on 'Polar Palynology' for *10th International Palynological Congress* to be held in June, 2000 at Nanjing, China. Nominated outstanding woman of the 20th Century by American Biographical Institute, Inc., USA.

Chhaya Sharma, Chanchala Srivastava & D.N. Yadav

Awarded 'Commendation Certificate' for the best poster presentation entitled "Holocene history of vegetation and climate of fresh water Punlota Lake in Eastern Rajasthan, India" at the *XVI Convention of Indian Association of Sedimentologists* held at University of Jammu, Jammu in October, 1999.

A.K. Srivastava & Rajni Tewari

Nominated as Member, National Working Group of International Geological Correlation Programme (IGCP) Project- 411: *Geodynamics of Gondwanaland derived terranes in East and South Asia*.

Asha Khandelwal

Co-chairperson at *10th National Aerobiological Conference* held at Vishakhapatnam from December, 1999.

C.M. Nautiyal

Co-chaired a session in the NCSTC-MESTEC Workshop on Science Communication held at Imphal, Manipur during September, 1999.

Samir Sarkar

Awarded 'Dr D.N. Wadia Award' for the best poster presentation entitled "Sedimentary organic

matter as an indicator of depositional environment in the Surai Khola Siwalik succession (Miocene-Pliocene) of Western Nepal" at the *XVI Convention of Indian Association of Sedimentologists* held at University of Jammu, Jammu in October, 1999. Also co-chaired a Session in the Convention and another at the *XVII Indian Colloquium on Micropalaeontology and Stratigraphy* held at Ujjain in January, 2000.

Archana Tripathi

Awarded 'Dr P.N. Srivastava Medal-1999' (a medal and citation) for the best piece of research work done in BSIP (Scientist 'D' category) during 1997-99.

S.K.M. Tripathi

Awarded the 'Commemorative Medal' of the Cell Biological and Evolutionary Micropaleontological Laboratory, Botany Department, Szeged University, Szeged, Hungary for the year 1999.

Madhav Kumar

Awarded 'Diploma' of the Cell Biological and Evolutionary Micropaleontological Laboratory, Botany Department, Szeged University, Szeged, Hungary for the year 1999.

Mahesh Prasad

Awarded 'Chandra Dutt Pant Medal 1999' for the best piece of research work done in BSIP (Scientist 'C' category) during 1995-98. Also Awarded 'Commendation Certificate' for the poster presentation entitled "Plant fossils from Siwalik sediments of Tanakpur area in the Himalayan foot hills of Uttar Pradesh and its palaeoclimate implication" at the *XVI Convention of Indian Association of Sedimentologists* held at Jammu University, Jammu in October, 1999.

Representation in Committees/Boards

A.K. Sinha

- ◆ Co-ordinator, National Earth Science in Indo-Russian Projects under DST.
- ◆ Member, International Lithosphere Programme of INSA, New Delhi.
- ◆ Member, Antarctica Team Selection Board, Antarctica Research Centre, Goa, DOD, Govt. of India.
- ◆ Chief Editor, "*The Palaeobotanist*".
- ◆ Chairman, National Organising Committee, "*International Symposium on Multifaceted Aspects of Tree Ring Analysis*", BSIP, Lucknow.
- ◆ Convener, F-1 special Symposium on Global Tectonic Zones, "*31st International Geological Congress*", Brazil.
- ◆ Member, National Organising Committee, "*International Conference on CBM: Prospects and Potentialities*", Calcutta.
- ◆ Member, Local Advisory Committee, Regional Science Centre, Lucknow.
- ◆ Member, Scientific Advisory Committee, Research and Development Aspects of Conservation, Ministry of Human Resource Development, Govt. of India.
- ◆ Guest Editor, Special Issues of Himalaya, Indian Science News Association, Calcutta.

G. Rajagopalan

- ◆ Member, Research Advisory Council, Wadia Institute of Himalayan Geology, Dehradun.
- ◆ Member, National Organising Committee, Nuclear Track Society of India, Calcutta.
- ◆ Member, Academic Committee of School of Archaeological Dating, Jadavpur University, Calcutta.

Shaila Chandra

- ◆ President, The Palaeobotanical Society, Lucknow.
- ◆ Co-ordinator, International Project "Gondwana Alive".

Suresh C. Srivastava

- ◆ Chief Editor, "*Geophytology*".

Anand Prakash

- ◆ Councillor, Executive Council, The Palaeo-

botanical Society, Lucknow.

- ◆ Treasurer, Indian Association of Palynostratigraphers.
- ◆ Member, Bureau of Indian Standards, Solid Mineral Fuels Sectional Committee - PCD - 7.

S.A. Jafar

- ◆ Organizing Secretary, Lucknow Chapter, Zaheer Science Foundation, New Delhi.
- ◆ Member, International Professional Planning "Architekten ueber Grenzen-Initiativkreis".

K.S. Saraswat

- ◆ Member, Editorial Board, "*Ethnobotany*".

Chhaya Sharma

- ◆ Vice President, International Council of Biodeterioration of Cultural Property.
- ◆ Member, Advisory Committee, Journal of Bengal Natural History.
- ◆ Councillor, Executive Council, The Palaeobotanical Society.
- ◆ Member, Indian Society of Remote Sensing for Remote Sensing day Celebration Committee.

A.K. Srivastava

- ◆ Member, Advisory Board, Journal "*Neobotanica*".
- ◆ Member, Advisory Committee, Journal "*Vasundhara*".
- ◆ Member, Editorial Board and Treasurer, Indian Society of Geoscientists.

G.P. Srivastava

- ◆ Treasurer, The Palaeobotanical Society, Lucknow.

Usha Bajpai

- ◆ Member, Technical Advisory Committee of U.P. Environmental Concern.
- ◆ Member, Managing Council, Indian Association of Palynostratigraphers.

Rahul Garg

- ◆ Member, Editorial Board, "*Journal of the Palaeontological Society of India*".
- ◆ Member, Managing Council, Indian Association of Palynostratigraphers.

Neerja Jha

- ◆ Editor, "*Geophytology*".

B.K. Misra

- ◆ Member, Bureau of Indian Standards, Solid Mineral Fuels Sectional Committee - PCD – 7.
- ◆ Joint Secretary, Indian Society of Geoscientists.

C.M. Nautiyal

- ◆ General Secretary, National Children's Science Congress (U.P.).

R.K. Saxena

- ◆ Secretary and Member, Editorial Board, Indian Society of Geoscientists.

Archana Tripathi

- ◆ Member, Jurassic Microfossil Group, International Subcommission on Jurassic Stratigraphy.
- ◆ Member, Acritarch Subcommission.
- ◆ Editor, "*Quarterly Journal of Geological Association and Research Centre*".

Vijaya

- ◆ Corresponding Member, Committee for Quantitative Stratigraphy.
- ◆ Voting Member, International Commission on Triassic Stratigraphy.

A. Bhattacharyya

- ◆ Organising Secretary, "*International Symposium on Multifaceted Aspects of Tree Ring Analysis*" held at BSIP, Lucknow.

Asha Gupta

- ◆ Member, Executive Council, Scientist's Unique and Researcher's Yare Association.
- ◆ Member, Board of Editors, "*Flora & Fauna*".

Madhav Kumar

- ◆ Joint Secretary, The Palaeobotanical Society, Lucknow.

A. Rajanikanth

- ◆ Assistant Editor, "*The Palaeobotanist*".

O.S. Sarate

- ◆ Councillor, Executive Council, The Palaeobotanical Society, Lucknow.

Rakesh Saxena

- ◆ Member, Research Board of Advisors, ABI, U.S.A.
- ◆ Associate Member, International Committee for Coal and Organic Petrology.

Mukund Sharma

- ◆ Editor, "*Geophytology*".
- ◆ Assistant Editor, "*The Palaeobotanist*".
- ◆ Executive Editor, "*Vigyan Alok*".

Lectures Delivered

By Institute's scientists outside

A.K. Sinha

- ◆ *Geological evolution of Himalayas: Subduction of Indian Plate and accretion of Karakoram Plate in the light of new palaeobotanical data* at Geological Institute of Russian Academy of Sciences, Moscow (October, 1999).
- ◆ *Tectonic framework of Himalayan and Karakoram collision zones* at Moscow State University, Moscow (October, 1999).

G. Rajagopalan

- ◆ *Dating Methods for Geological samples* two lectures for M.Sc. Students, Lucknow University, Lucknow (April, 1999).

K.S. Saraswat

- ◆ *Emerging trends of Harappan plant economy in India* at the Department of Ancient Indian History, Culture and Archaeology, Banaras Hindu University, Varanasi (February 22, 2000).

Chhaya Sharma

- ◆ *Modern and Early-Holocene pollen data from Priyadarshini Lake, Antarctica* key-note address at XVII Indian Colloquium on Micropaleontology and stratigraphy, Ujjain (January 27, 2000).

C.M. Nautiyal

- ◆ *Communicating Science through Radio and Effective Science Communication through Audio-Visual Medium* at the Workshop on Science Writing/Journalism organised at Imphal by Manipur Council for Science Technology and Environment under a scheme of NCSTC, DST (September 4 & 6, 1999).

A. Bhattacharyya

- ◆ *Trees as an indicator of climatic changes* (in Hindi) at Akashvani, Lucknow (February 29, 2000).

A. Rajanikanth

- ◆ *What motivates a scientist?* at Science Motivation Camp, Institute for Integrated Society Development, Lucknow (December 21, 1999).

S.K. Bera

- ◆ *Palynology - a unique subject in Plant Sciences* during XIXth Indian Scientific Expedition to Antarctica, Maitri (January 26, 2000).

G.K. Trivedi

- ◆ *Tertiary fossil flora of Arunachal Pradesh* at G.B. Pant Institute of Himalayan Studies and Development, Itanagar Unit, Itanagar (May 5, 1999).

By outside scientists in the Institute

Dr Rajiv Sinha

Assistant Professor
Indian Institute of Technology, Kanpur

- ◆ *Lake sedimentology and palaeoclimatic analysis in the icy continent of Antarctica* (on April 15, 1999).

Dr K.K. Sharma

Scientist 'F'
Wadia Institute of Himalayan Geology, Dehradun

- ◆ *Cosmogenic nuclides: a new tool to measure precise erosion-uplift rates in Himalaya and Tibet* (on April 29, 1999).

Dr Krishnanand Sinha

Project Co-ordinator
Indira Gandhi Planetarium, Lucknow

- ◆ *Quantal leaps in Astronomy: courtesy small concepts*, National Technology Day Lecture (on May 11, 1999).

Deputation/Training/Study/Visit Abroad/in Country

Rahul Garg & Vandana Prasad

Attended contact programme on “*Sequence Stratigraphy*” organised by Society of Petroleum Geophysicists and sponsored by the DST under SERC Programme in Earth Sciences at Dehradun from August 23-27, 1999.

A.K. Sinha

Visited Moscow from October 13-26, 1999 under the Indo-Russian Integrated Long Term Programme (ILTP). During this period, finalised the collaborative project entitled “*Floral and climatic evolution based on geologic and biotic events during Precambrian and Phanerozoic time*”. The discussion was held with the Russian counter-part to extend scientific programme under the specified scientific areas of BSIP and the Institute of Russian Academy of Sciences. It was agreed upon that after the full implementation of the project, exchange of scientists will start. Later the project is approved by the Joint Indo-Russian Commission and implemented from February 1, 2000.

Also invited to attend the State Funeral of Late Academician A.L. Yanshin on October 14, 1999 at the main building of Russian Academy of Sciences in Moscow. Academician Yanshin was a great scientist and the architect of joint Indo-Russian programme. He was a strong supporter for the initiation of BSIP collaborative programme with various Institutions of Russian Academy of Sciences.

A.K. Sinha & A. Rajanikanth

Attended the “65th Annual Meeting of Indian Academy of Sciences, Bangalore” as invitee organised at Central Drug Research Institute, Lucknow from October 29-31, 1999.

S.K. Bera

Participated in “19th Indian Scientific Expedition to Antarctica” from November 28, 1999 to March 9, 2000. Journey was performed by air from Mumbai to Cape Town (South Africa) and subsequently by a German ship *Magdalena Oldendorff* to

Antarctica to increase the camping duration in the main land. Earlier, completed pre-Antarctic Training Programme at Auli and medical examination at AIIMS, New Delhi (August 31-September 18, 1999) as a part of selection for the Expedition. Also presented a palynological research proposal before Selection Committee at Department of Ocean Development, New Delhi on August 6, 1999.

A number of lake sites, valleys and Nunatak in and around Schirmacher Oasis, east Antarctica were surveyed. Collected a large number of samples including moss cushions, soil, moraines, dry algal mat, snow and ice and one lake sediment profile from Zub Lake near Maitri and adjoining areas. Daily air sampling was done by exposing glycerine smeared slides using Burkard Sampler on voyage starting from Cape Town to Antarctica and on return voyage from Antarctica to Cape Town for the first time for a period of two and half months in the history of Indian Expedition. Finalized and submitted the report of work done during Expedition.

C.M. Nautiyal, A. Rajanikanth, Mukund Sharma & Jyotsana Rai

Attended “VII National Children Science Congress” as its Secretary (CMN) and Members Jury (AR, MS & JR) held at Barabanki from December 4-5, 1999.

A. Rajanikanth

Attended the “*Science Motivation Camp*”



Part of Zub Lake showing pipe line supplying water to Maitri Station

organised by Institute for Integrated Society Development, Lucknow from December 20-24, 1999.

Samir Sarkar

Attended a short course on "Deep water Sedimentary systems: Key advances, latest techniques and current trends" given by Dr D.A.V. Stow, Southampton University, England, at Geology Department, Jammu University, Jammu.

R.R. Yadav

Presented the project entitled "Tree-line fluctuation along the high-land Himalaya in Himachal Pradesh" at the Project Evaluation Meeting under Plant Sciences of DST, New Delhi on

February 2, 2000.

Mahesh Prasad

Visited Physical Research Laboratory, Ahmedabad for finalization of a collaborative project on "Stable Carbon isotopic composition of Siwalik paleosols" with Dr S.K. Bhattacharyya, Earth Science Division.

B. Sekar

Attended "National Symposium on Management of Micronutrient deficiencies in Alluvial Plains" organised by Society for Sustainable use of Chemicals in Agriculture and ICAR, New Delhi from August 18-20, 1999.

Deputation to Conferences/Symposia/Seminars/Workshops

C.M. Nautiyal

- ◆ *Symposium Vision for Space Science and Technology* held at Physical Research Laboratory, Ahmedabad from August 12-13, 1999.

Manoj Shukla & Mukund Sharma

- ◆ *Field Workshop on Integrated Evaluation of the Kaladgi and Bhima basins* organised by Geological Society of India, Bangalore in October 1999.

Chhaya Sharma, J.S. Guleria, Vijaya, Samir Sarkar, Chanchala Srivastava, Ram Awatar, Mahesh Prasad, Rashmi Srivastava, G.K. Trivedi & Anjali Dixit

- ◆ *XVI Convention of Indian Association of Sedimentologists* held at University of Jammu, Jammu from October 24-30, 1999 [Also participated (except G.K. Trivedi) in the post-Convention geological field excursion on National Highway from Jammu to Srinagar with special reference to land slide hazards].

All the Scientists of BSIP and JRF of Sponsored Projects

- ◆ *International Symposium on Multifaceted Aspects of Tree Ring Analysis*, held at B.S.I.P., Lucknow from November 15-16, 1999.

A. Bhattacharyya

- ◆ *National Symposium on Frontiers of Research in Plant Sciences* held at Calcutta University, Calcutta from December 2-4, 1999.
- ◆ *Workshop on Application of Remote Sensing for Snow and Glacier investigations* held at Space Applications Centre, Ahmedabad on March 5, 2000.

B.K. Misra, Alpana Singh & B.D. Singh

- ◆ *International Conference on Coal Bed Methane: Prospects and potentialities* held at Calcutta on December 3, 1999.

G. Rajagopalan

- ◆ *Anacon'99* held at Nehru Centre, Bombay from December 11-19, 1999.

Asha Khandelwal & M.R. Rao

- ◆ *10th National Conference of Aerobiology and its application* held at Vishakhapatnam from December 21-23, 1999.

K.S. Saraswat & Chanchala Srivastava

- ◆ *Joint Annual Conference: Indian Archaeological Society (IAS) XXXIII, Indian Society for Pre-historic and Quaternary Studies (ISPQS) XXVII and Indian History and Culture Society (IHCS) XXIII* held at Deccan College, Pune from December 27-30, 1999.

A.K. Sinha & C.M. Nautiyal

- ◆ *87th Session of Indian Science Congress* held at Pune University, Pune from January 3-7, 2000.

Chhaya Sharma, Samir Sarkar & Neerja Jha

- ◆ *XVII Indian Colloquium on Micropalaeontology and Stratigraphy* held at Vikram University, Ujjain from January 27-29, 2000 (Also participated in the post-Colloquium field excursion to the Deccan Trap area at the outskirts of Indore on January 30, 2000).

Chhaya Sharma, R.R. Yadav, A. Bhattacharyya & Jayendra Singh

- ◆ *IGBP sponsored PAGES - Workshop on South Asian Palaeo-environment (PW-SAP)* held at IITM, Pune from February 4-5, 2000.

Asha Khandelwal

- ◆ *National Seminar on Eco-Environmental Concerns 2000 and Beyond* held at Lucknow University, Lucknow from February 25-26, 2000.

A.K. Ghosh

- ◆ *National Conference on Plants, Microbes and Environment* held at University of Burdwan, Burdwan from March 11-12, 2000.

Neerja Jha, A. Rajanikanth, Mukund Sharma, Alpana Singh & Puneet Bisaria

- ◆ *Bhuvigyan evam Khanan* Workshop sponsored by Council for Scientific and Technical Terminology, New Delhi and held at Directorate of Geology and Mining, Lucknow from April 20-22, 1999.

Papers presented at Conferences/Symposia/Meetings

- Arya R, Guleria JS & Srivastava R**—Fossil remains of *Syzygium* Gaertn. and *Arthromeris* J. Sm. from the Kasauli sediments of Himachal Pradesh, North-West India. *XVI Convention of Indian Association of Sedimentologists*, Jammu, October 1999.
- Bhattacharyya A**—Temporal growth variation of *Cedrus deodara* in relation to climatic changes in the western Himalaya. *National Symposium on Frontiers of Research in Plant Sciences*, Calcutta, December 1999.
- Bhattacharyya A**—Tree ring analysis from Eastern Himalayan region. *PAGES Workshop on South Asian Palaeoenvironment*, Pune, February 2000.
- Bhattacharyya A**—Application of remote sensing in palaeoclimatic studies. *Workshop on Remote Sensing for snow and ice studies*, Ahmedabad, March 2000.
- Bhattacharyya A, Chaudhary V & Gargen JT**—Analysis of tree ring data of *Abies pindrow* around Dokriani Bamak Glacier, Garhwal Himalayas, in relation to climate and glacial behaviour during recent past. *International Symposium on Multifaceted Aspects of Tree Ring Analysis*, Lucknow, November 1999.
- Chaudhary V & Bhattacharyya A**—Tree ring analysis of *Larix griffithiana* from northern Sikkim and western Arunachal Pradesh, Eastern Himalaya and its response to climate. *International Symposium on Multifaceted Aspects of Tree Ring Analysis*, Lucknow, November 1999.
- Ghosh AK**—Benthic calcareous algae from Petroliferous basins of India and their significance. *National Conference on Plants, Microbes and Environment*, Burdwan, March 2000.
- Guleria JS & Srivastava R**—Growth ring studies in Indian woods and their significance. *International Symposium on Multifaceted Aspects of Tree Ring Analysis*, Lucknow, November 1999.
- Guleria JS, Srivastava R & Arya R**—Occurrence of *Mitragyna* Korth. in Neogene sediments of Kasauli, Himachal Pradesh and its palaeoclimatic and palaeoecological significance. *XVI Convention of Indian Association of Sedimentologists*, Jammu, October 1999.
- Jha N**—Mesozoic palynoflora from Sattupalli Block, Chintalpudi Sub-basin, Andhra Pradesh. *XVII Indian Colloquium Micropalaeontology & Stratigraphy*, Ujjain, January 2000.
- Kar RK, Sahni A, Ambwani K & Dutta D**—Palynological assemblages from the Deccan Intertrappeans: implications for regional correlation and K/T boundary. *Deccan Trap Basalts and the K/T Boundary*, Ahmedabad.
- Khandelwal A**—Biodeterioration of aerobioparticles: Scanning Electron Microscopic study. *10th National Conference on Aerobiology and its applications*, Vishakhapatnam, December 1999.
- Khandelwal A**—Eco-friendly afforestation: Aspects and Prospects. *National Seminar on Eco-Environmental Concerns 2000 and Beyond*, Lucknow, February 2000.
- Kumar B, Das Sharma S, Dayal AM, Kale VS & Shukla M**—Carbon and strontium isotope geochemistry of Proterozoic carbonates of the Kaladgi and Bhima basins, South India. *Field Workshop Integrated Evaluation of the Kaladgi and Bhima basins*, Bangalore, October 1999.
- Malik MA, Sharma C, Sudan CS & Singh H**—Coring method employed for recovery of 40 m sediment core from the lakes of Jammu. *XVI Convention of Indian Association of Sedimentologists*, Jammu, October 1999.
- Mazari RK, Kumar R, Bagati TN, Chauhan MS & Rajagopalan G**—Holocene climate changes in part of Higher Trans Himalayan Transition Zone, Himachal Pradesh, India. *PAGES Workshop on South Asian Palaeoenvironments*, Pune, February 2000.
- Misra BK**—Application of biopetrology in the assessment of coal bed methane. *International Conference on Coal Bed Methane: prospects and*

- potentialities*, Calcutta, December 1999.
- Park W-K, Seo J-W, Lee J-H, Yadav RR & Ovtchinnikov D**—Development of tree-ring chronologies of *Pinus densiflora* and their applications in South Korea. *International Symposium on Multifaceted Aspects of Tree Ring Analysis*, Lucknow, November 1999.
- Prasad M**—Plant fossils from Siwalik sediments of Tanakpur area in the Himalayan foot hills of Uttar Pradesh and its palaeoclimatic implications. *XVI Convention of Indian Association of Sedimentologists*, Jammu, October 1999.
- Rajanikanth A & Tewari R**—Growth rings as climate indicators in the Indian Gondwana. *International Symposium on Multifaceted Aspects of Tree Ring Analysis*, Lucknow, November 1999.
- Ram-Awatar**—Palynostratigraphy of subsurface Pali sediments, Sohagpur Coalfield, M.P., India. *XVI Convention of Indian Association of Sedimentologists*, Jammu, October 1999.
- Rao MR & Rajanikanth A**—Spore-pollen: reliable ecological signatures. *10th National Conference on Aerobiology and its applications*, Vishakhapatnam, December 1999.
- Saraswat KS**—Plant economy of Early Harappans at Ancient Kunal, District Hisar, Haryana. *Annual Archaeological Conference*, Pune, December 1999.
- Sarkar S**—Sedimentary organic matter as an indicator of depositional environment in the Surai Khola Siwalik succession (Miocene-Pliocene) of western Nepal. *XVI Convention of Indian Association of Sedimentologists*, Jammu, October 1999.
- Sarkar S & Prasad V**—Morphological study of *Thalassiphora* Eisenack & Gocht from the Palaeogene rocks of Lesser Himalaya, India. *XVII Indian Colloquium Micropaleontology & Stratigraphy*, Ujjain, January 2000.
- Sharma C**—Synoptic evaluation of Late Quaternary vegetational and climatic data generated from Himalayan lake sediments with special reference to Sikkim and Darjeeling region. *PAGES Workshop on South Asian Palaeoenvironment*, Pune, February 2000.
- Sharma C, Dixit A & Malik MA**—Palaeoclimatic inferences from Lacustrine sediments from Surinsar Lake, Jammu. *XVII Indian Colloquium Micropaleontology & Stratigraphy*, Ujjain, January 2000.
- Sharma C, Srivastava C & Yadav DN**—Holocene History of vegetation and climate of fresh water Punlota Lake in Eastern Rajasthan, India. *XVI Convention of Indian Association of Sedimentologists*, Jammu, October 1999.
- Sharma M, Shukla M & Kale VS**—Stromatolites of the Kaladgi Basin: their systematics age implications and biostratigraphy. *Field Workshop Integrated Evaluation of the Kaladgi and Bhima Basins*, Bangalore, October 1999.
- Singh A & Singh BD**—Petrology of the Kanhan coals, Satpura Gondwana Basin (India) *vis-à-vis* coal bed methane. *International Conference on Coal Bed Methane: prospects and potentialities*, Calcutta, December 1999.
- Sinha AK**—Tectonics involving subduction and accretion of Himalayan and Karakoram terranes and their palaeo-geologic configuration. *87th Session on Indian Science Congress*, Pune, January 2000.
- Srivastava C**—Plant economy at Ancient Mahorana, Sangrur District, Punjab (ca. 2300 B.C. -200 A.D). *Annual Archaeological Conference*, Pune, December 1999.
- Trivedi GK**—Palynology of the Dafla Formation (Early-Middle Miocene) exposed along Bhalukpong-Bomdila Road, West Kameng District, Arunachal Pradesh. *XVI Convention of Indian Association of Sedimentologists*, Jammu, October 1999.
- Vijaya & Prasad GVR**—Re-appraisal on age of Kota Formation. *XVI Convention of Indian Association of Sedimentologists*, Jammu, October 1999.
- Yadav RR & Singh J**—Tree-ring chronologies from Western Himalaya, India. *PAGES Workshop on South Asian Palaeoenvironment*, Pune, February 2000.

Doctoral Degree awarded

Name	Supervisor	Title of the thesis	University
Shinjini Sarana	Suresh C. Srivastava	"Biopetrological study of Lower Gondwana coals from Tatapani-Ramkola Coalfield, Surguja District, M.P., India"	Lucknow University, Lucknow
Vandana Chaudhary	A. Bhattacharyya	"Dendroclimatological studies from the eastern Himalayan region"	Lucknow University, Lucknow

Consultancy/Technical Assistance rendered

Sixty-seven samples have been dated in the Radiocarbon Lab as a part of consultancy services offered by the Institute. Also technical assistance (Radiocarbon dating of samples) rendered to following agencies:

Geological Survey of India, Lucknow.

Wadia Institute of Himalayan Geology, Dehradun.

Kumaon University, Nainital.

National Institute of Oceanography, Goa.

National Geophysical Research Institute, Hyderabad.

Anna University, Chennai.

Deccan College, Pune.

Centre for Earth Science Studies, Trivandrum.

Agharkar Research Institute, Pune.

G.B. Pant Institute of Himalayan Environment Development, Sikkim.

National Bureau of Soil Survey & Land Use Planning, Nagpur.

Consultancy services were carried out in Scanning Electron Microscopy in different disciplines of Biological Sciences to the following agencies:

Department of Marine Geology and Geophysics, Cochin University of Science and

Technology, Cochin.

SGN Khalsa College, Sri Ganganagar, Rajasthan.

Zoology Department, Lucknow University, Lucknow.

Department of Geology, Banaras Hindu University, Varanasi.

Faculty of Dental Sciences, KGMC, Lucknow.

Chhaya Sharma & S.K. Bera investigated 5 soil samples of Kothiakhand and Rayka, Gujarat, Department of Geology, M.S. University Baroda, Vadodara and submitted the report.

Chhaya Sharma, S.K. Bera & M.S. Chauhan completed pollen analytical investigations and submitted the report of the 45 core samples received from Geological Survey of India.

J.S. Guleria provided technical assistance to Mr R.V. Patwardhan, Nasik in identification of woods sample.

B.D. Singh analysed coal samples (3), received from Dr D.K. Sharma, Indian Institute of Technology, New Delhi to determine the rank by reflectivity measurements on vitrinite maceral and to assess the maceral composition.

Units

Publication

Journal - *The Palaeobotanist*

Volume 47 and 48 of the Journal were published incorporating research papers on various topical aspects, maps and figures. A detailed "Instructions to Authors" was also published. A new getup and format has been adopted. Manuscripts for the Volume 49 have been processed. Contents of the Abstracts of Volume 48 are hosted on the Web-site of the Institute.

Monograph

Text of "*Monograph - An introduction to Gymnosperms, Cycas and Cycadales*" by Professor D.D. Pant (Ex-Head, Botany Department, Allahabad University) has been processed and necessary additions have been made. Relevant figures have been selected and processed for resketching and retouching.

Newsletter

Newsletter (June 1999) was published with information on important activities of the Institute including participation in exhibitions, conferences, *Hindi Pakhwara* (fortnight), new additions to library and related information along with pertinent photographs.

Annual Report

Bilingual (English/Hindi) Annual Report 1998-99 was published consisting of Research reports, conference participation, Awards, research papers

published, Foundation/Founder's Day function, Annual Accounts and related matters with relevant graphics and photographs.

Conference-Abstracts

An abstract Volume of the '*International Symposium on Multifaceted Aspects of Tree Ring Analysis*' including field trip information with map and elegant page cover was published.

Hand-outs

Biographical sketches of guest speakers Dr Nitya Anand, Ex-Director CDRI, Prof. David J. Batten, University of Wales, U.K. and Dr Hari Narain, Ex-Director, NGRI, Hyderabad and Lecture themes on Foundation Day and Founder's Day were published. Also invitation cards of the Foundation Day and Founder's Day celebrations and Tree-Ring Symposium were printed.

In addition to these a brochure containing concise information of Institute's history, aims, activities and achievements was published. A colourful Greeting 2000 depicting Antarctic Continent and an Asteraceous pollen was also printed.

Sale of Institute Publications: This year the publication of the Institute netted an income of Rs. 1,12,550.90.

Library

Majority of Library holdings have been computerised and strengthened different service counters for the benefit of its users. Improved infrastructural facilities and efficiency measures have been adopted.

The current holdings of Library are as under:

Particulars	Additions during 1999-2000	Total
Books	63	5,291
Journals	3	10,821
Reprints	130	36,046
Reference Books	60	317
Hindi Books	7	153
Ph.D. Thesis	—	89
Reports	—	46
Maps & Atlases	—	61
Microfilms/Fisches	—	294
CD	—	15

Currently the Library is receiving 153 journals, (82 are subscribed and 71 are in exchange). There are 161 registered card holders with the Library.

Exchange Unit

Journals received on exchange basis	71
Reprints of research papers purchased	37
Reprints sent out in exchange	2800
Institutions on exchange list	64
Individuals on exchange list	378

Computer Aided Library

Computerisation of library assets being done through LAN under UNIX O/S continues. Software employed is UNIFY RDBMS and the utilities are programmed in 'C' giving different levels of securities. Database of library's holdings of journals continued through dBase III+ package.

Current Awareness Service

Library launched its long awaited "Current Awareness Service" using CDS/ISIS package which provides concise abstract or short notes about the research publications often accompanied by some other details like serial number, title, author/s, subject area,

source of record, etc. An index (Era-wise) of articles is given at the end to facilitate easy retrieving of the articles.

Lucknow Networking (LUCKNET)

Prepared "Catalogue of Current Serials" of BSIP Library during 1999-2000 on dBase III+ and submitted to the Chairman "LUCKNET Working Group" (Lucknow Network) IM, Lucknow.

Lamination

Lamination of rare and fragile old books/ journals/ reprints, etc. is in progress.

Xeroxing Facilities

Library extended xeroxing facility to the institutes scientists on yearly quota basis. This facility is also available to the scientists of other organisations.

The following scientists from different organisations availed the Library facilities:

Mr S.K. Saha, Department of Geology, Panjab University, Chandigarh.

Dr P.K. Mishra, Department of Botany, Lucknow University, Lucknow.

Mr Anshu Singh, Department of Microbiology, Lucknow University, Lucknow.

Mr Vivek Kumar, Ph.D. Scholar (Pharmacognosy), Lucknow University, Lucknow.

Mr Kamlesor Rai, Research Scholar, Botany Department, Lucknow University, Lucknow.

Mr N.R. Satyanarayana, Department of Library & Information Science, Lucknow University, Lucknow.

Dr P.R. Nanjunda, Director, Bangalore University, Bangalore.

Prof S.K. Singh, Botany Department, Gorakhpur University, Gorakhpur.

Mr Shyamkishore & Mr Sarvesh Singh, Department of Botany, Lucknow University, Lucknow.

Mr Mohd. Hasis Azimkhan, Department of Geology, Aligarh Muslim University, Aligarh.

Mr Pankaj Srivastava, National Botanical Research Institute, Lucknow.

Museum

The Institute joined the Nation in celebrating National Technology Day on May 11, 1999 in a befitting manner. An exhibition about the Institute and its activities was erected. Students from university, colleges and schools visited and took keen interest.

A Science Motivation Camp was organized in collaboration with an NGO-Institute of Integrated Society Development under the umbrella of National Council of Science Technology and Communication, New Delhi. Talented students of local schools and colleges camped in the Institute's campus. Besides taking them to different Labs, Museum, Herbarium and Library of the Institute, arrangement was made for delivering lectures by experts. Visit to other National laboratories was also arranged.

Work on Inventory part III of Type and Figured specimens is under progress. A slide was loaned to Dr Paul Kenrick of Natural History Museum, London, UK for further study.

Type and Figured Specimens/Slides/Negatives

The scientists of the Institute deposited specimens/slides/negatives of their research publications as under:

Particulars	Addition during Total 1999-2000	
Type and Figured Specimens	109	5935
Type and Figured Slides	146	11,834
Negatives	288	15,757

New Collection

Specimens/samples were collected by the scientists from 201 localities of the country and deposited in Museum for investigations as under:

	Specimens	Samples
Project- 1	302	263
Project- 4	—	322
Project- 5	1,129	—
Project- 6	—	426

Project- 7	117	928
Project- 8	6	335
Project- 9	—	122
Project- 10	6	335
Project- 11	—	41
Project- 12	—	9

Presentation of fossil specimens

Sets of fossil specimens were gifted to the following Institute/Colleges with in the country under our educational programme- Palaeobotany for Education:

Department of Geology, Kumaon University, Nainital (U.P.)

Department of Botany, P.G. Centre Kolar Campus, Kolar (Karnataka).

Department of Botany, University of Calcutta, Calcutta.

Department of Geology, Panjab University, Chandigarh.

Institutional Visitors

Department of Botany, Vinoba Bhave University, Hazaribagh (Bihar).

Department of Botany, D.A.V. College, Azamgarh (U.P.).

A.M.D.M.M. College, Kanpur (U.P.).

Department of Botany, B.B. (P.G.) College, Jhansi (U.P.).

Department of Botany, Bundelkhand University.

Department of Museology, Calcutta University, Calcutta.

Department of Geology, Lucknow University, Lucknow.

Department of Botany, Lucknow University, Lucknow.

Teachers of Army Public School, Lucknow.

Teachers of Refereshor Course, Lucknow University, Lucknow.

Darrang College, Tezpur (Assam).

Herbarium

The main objective of Herbarium is to collect extant plant materials from field and their maintenance along with their preparations. About 596 plant specimens, 15 samples of wood blocks and 500 samples of fruits and seeds were collected from different localities in India. About 123 wood slides, 562 wood core samples and 23 pollen slides were added to the Herbarium. Data feeding work for *Inventory of Carpothek* has been completed. Preparation of cards and data feeding work in computer for preparation of *Inventory of Sporothek* and *Xylarium* are in progress.

Herbarium Holdings

Particulars	Additions during 1999-2000	Total
Herbarium		
Plant specimens	596	16,921
Leaf specimens	-	520
Laminated mounts of venation pattern	-	40
Xylarium		
Wood blocks	15	4,059
Wood discs	-	60
Wood cores	562	1,032
Wood slides	123	4,146
Palm slides (stem, leaf, petiole, root)	-	3,195
Sporothek		
Polleniferous materials	-	1,390
Pollen slides	23	11,714
Carpothek		
Fruits/seeds	500	3,326

Materials received

Fruits and seeds—Thirty samples of fruits and seeds were gifted by Dr Veena Chandra, Herbarium, Forest Research Institute, Dehra Dun.

Wood slides—One hundred twenty three wood slides were gifted by Dr Uttam Prakash, Retd. Deputy Director, BSIP, Lucknow.

Herbarium facilities provided to

- Dr Shubhlal Sah, King George Medical College, Lucknow, U.P.
- Dr P.G. Kale, Department of Bioscience, R.J. College, Mumbai, Maharashtra.
- Dr Kartikey Tripathi, Department of Botany, Shibli National College, Azamgarh, U.P.
- Mr Hoshiar S. Tak and Mr Amit Kumar, Department of Botany, S.G.N. College, Sri Ganganagar, Rajasthan.

Other Visitors

- Dr S.B. Chaudhary, Vinoba Bhave University, Hazaribagh, Bihar.
- Dr P.K. Nigam, Department of Botany, P.P.N. College, Kanpur, U.P.
- Dr Gagan Singh, Institute of Environment and Management, Lucknow, U.P.
- Dr (Mrs) Rajni Bajpai, Department of Zoology, Govt. P.G. College, Hamirpur, U.P.
- Dr A.R. Saxena, Department of Botany, D.A.V. College, Azamgarh, U.P.
- Dr Veena Chandra, Herbarium, Forest Research Institute, Dehra Dun, U.P.

Institutional Visitors

- Teachers attending Refresher Course, Academic Staff College, Lucknow University, Lucknow.
- Students of Botany Department, Vinoba Bhave University, Hazaribagh, Bihar.
- Students of Bal Vidya Mandir, Lucknow.
- Students of Botany Department, Shibli National College, Azamgarh, U.P.
- Students of Botany Department, D.A.V. College, Kanpur, U.P.
- Students of Botany Department, D.A.V. College, Azamgarh, U.P.
- Students of Botany Department, Govt. P.G. College, Hamirpur, U.P.

Electronic Data Processing

With the continuous efforts of the Electronic Data Processing Unit, the Institute's Web site was launched on November 14, 1999 with the address "www.bsip-india.org". Also the unit has successfully setup the 64 KBPS Leased line Internet connection in the Institute. The connectivity was commissioned on January 11, 2000 with the Domain Name "bsip.res.in".

The Hardwares- 4 servers (Pentium-II Compaq systems), Router (CISCO make) and Leased Line Modem (RAD ASM20) for Internet were procured. All are being configured on Windows NT platform. For Internet access in the Institute Local Area Network has been planned which will provide facility at 60 nodes which can be extended further. The hardwares for LAN-Switch (DLINK), UTP Cable Cat V, four Hubs (24 port) and other LAN accessories have been procured. The cabling work has been started. The procurement of MS-Exchange and MS-Proxy softwares and one External CD-Writer and one

Colour Scanner is being processed.

Windows based Application Software in Visual Basic has been developed for the fossil Catalogue for Project 9- Marine micropalaeontology of petroliferous basins, using Access RDBMS.

Already developed Softwares (Payroll Package, Pension Package, GPF Package and Income Tax Package, etc.) on different platforms have been made Y2K compliance specially for the Account Section. The Revised Estimates and Budget Estimates and other yearly reports of the section are also prepared for the year 2000-2001. The assistance to sections includes modification of menu driven payrolls and pension software packages. The data-base of daily Hindi words is also enhanced.

The Unit has also assisted Scientific, Technical and Administrative staff in preparing graphical presentation, charts and tables, layout for transparencies and OHP sheets, manuscripts of research papers, scanning and modifying pictures, graphs and other illustrations.

Section Cutting

Section Cutting Unit is an essential requirement for megafossil workers who primarily work on petrified/ silicified material and require details of anatomical features for identification. The unit prepares and provides slides of thin sections as well as polished slices of fossil materials as per the need of scientists.

During the year 425 samples of chert material, limestones and petrified woods were cut. A total of 600 slides of thin sections and 405 polished slices of fossil material were prepared. The sliced samples comprise mostly of bigger and hard material. A few samples were also cut and polished for presenting to various organisations and individual scientists as gift

samples on behalf of the Institute. In addition, sections and slides were prepared for collaborative and sponsored projects work under taken at the Institute. Logi-Tech polishing machine which was not functioning due to some mechanical problem was set right. About 100 lapped slides of uniform thickness was prepared. Besides, 25 slides were prepared as per scientists requirement.

A number of students and scientists visiting the Institute also observed the functioning of the Unit. The visitors were told about the various steps involved in preparations of thin sections of fossil material. Practical demonstrations were also given to some of the interested visitors.

Foundation Day and Founder's Day

On September 10, 1999 the Foundation Day of the Institute was celebrated. On this occasion Dr Nitya Anand, FNA, Former Director, Central Drug Research Institute, Lucknow and Scientist Emeritus delivered 'Third Golden Jubilee Commemoration Lecture' on the topic "*Drug Research: Today and Tomorrow*". Professor C.V. Subramanian, FNA, Chairman, Governing Body of the Institute presided over the function. Many guests and scientists from and outside Institute attended the function.

On 14th November, 1999 - the Founder's Day, the Institute's staff and distinguished guests from other organisations offered *Pushpanjali* on the *Samadhi* of the Founder Professor Birbal Sahni in the campus. Same day in the evening two memorial lectures were organised as usual:

Padmashri Dr Hari Narain, FNA, Member Advisory Council, Directorate General of Hydrocarbons, Govt. of India and Former Director, National Geophysical Research Institute, Hyderabad delivered the '29th Birbal Sahni Memorial Lecture' on the topic "*The role of Earth Science in the next Century*".



Professor C.V. Subramanian, FNA, Chairman, Governing Body of the Institute presiding over the Foundation Day Function.

Professor David J. Batten, Institute of Geography and Earth Sciences, University of Wales, United Kingdom delivered the '45th Sir Albert Charles Seward Memorial Lecture' entitled "*Palaeobotanical and palynological perspectives on the Early Cretaceous environment of Southern England.*" Professor J.S. Singh, FNA, Banaras Hindu University, Varanasi and Member Research Advisory Council of the Institute presided over the function and awarded TM Harris International Medal to Prof DJ Batten



Padmashri Dr Hari Narain, FNA, paying tributes to the founder



Professor JS Singh awarded TM Harris International Medal to Professor DJ Batten

National Science Day

To popularise the science of Palaeobotany amongst the students and other people of the country, National Science Day was celebrated from February 21-28, 2000 on the theme "*Recreating interest and excitement in Basic Science*". In this connection, a mobile exhibition on *Indian Fossil Plants* was taken out to the Colleges and Schools of rural areas and of Lucknow, viz., Ram Bharose Maiku Lal Inter College, Telibagh; Shyam Manohar Mishra Inter College, Bakshi Ka Talab; Babu Triloki Singh Inter College, Kakori; J.P. Convent, Dhawan, Chinhat; and Desh Bharati Public School, Rajajipuram. The students, teachers and public of adjoining areas took keen interest in the exhibits.

An art competition was held for students on 27th February in which about 400 children participated. An open house quiz was jointly organised by BSIP and Regional Science Centre, Lucknow on 28th February in the Insti-

tute, about 300 students participated in it. Besides, educational film and slide show on scientific themes was also arranged. An exhibition on plant fossils was thrown open to the visitors. Prizes were distributed to winners at Regional Science Centre by the Director, BSIP.



Children participating in Art Competition on National Science Day

Distinguished Visitors

Dr Hari Narain

Former Director,
National Geophysical Research Institute,
Hyderabad

Shri Amitabh Pande

Joint Secretary
Department of Science & Technology,
New Delhi

Dr Hario Tonazells

University of Sao Paulo,
Brazil

Dr Brendan Buckley

Lamont-Doherty Earth Observatory, Palisades,
USA

Shri Dinesh Rai

Secretary, Science & Technology
Government of U.P.,
Lucknow

Ms Nina Sahay

1417 W. Tonny Unit
Chicago II. 60626,
USA

Dr Nitya Anand

Former Director
Central Drug Research Institute,
Lucknow

Professor David J. Batten

Institute of Geography and Earth Sciences
University of Wales,
UK

Professor M. Kedves

J.A. University, Szeged,
Hungary

Delegates of the International Symposium—
"Multifaceted Aspects of Tree Ring Analysis".

Status of Official Language

To promote the usage of Hindi in official work, many concrete steps were taken. Institute continued to be an active member of *Nagar Rajbhasha Karyanvayan Samiti* (NARAKAS), UNIT- 6. The meetings of the Institute's *Rajbhasha Karyanvayan Samiti* were held as per schedule during the year under the Chairmanship of Professor A.K. Sinha, Director.

It has been suggested unanimously to enhance the usage of Official Language in various departments/sections of the Institute and to interact with other scientific organisations in this regard.

Hindi abstracts for the volume 47 and 48 of the Institute's journal "*The Palaeobotanists*" were processed for publication. Annual Report for the year 1998-1999 was also prepared in Hindi. Hindi section of the *Newsletter* (June – 1999) was processed.

For doing maximum work in Hindi in the Institute, prizes (cash) were distributed on the occasion of Founder's Day (November 14th). The 'first prize' winners were Drs Anil Chandra and R.K. Saxena, 'second prize' winners were Drs G.P. Srivastava, Manoj Shukla and Puneet Bisaria, and 'third prize' winners were Mr P.K. Bajpai, Mr Prem Prakash, Mr Pradeep Mohan, Mr Madhukar Arvind and Mr Y.P. Singh.

Hindi Terminology

One Hindi terminological word has been on display daily. For this purpose with the help of multilingual software simple database was prepared on computer.

Hindi Pakhwara

The year 1999-2000 was the Golden Jubilee year of the Official Language. To mark the occasion, *Hindi Pakhwara* was organised in the Institute in a special way. Many functions were held in the Institute from September 14-28, 1999, in which staff of the Institute participated in a befitting manner. The inaugural ceremony was held on September 16th and the function was presided over by

Prof. A.K. Sinha, Director of the Institute, Prof. S.P. Dixit, Former Head, Hindi Department, Lucknow University and Dr R.L. Singh, Chief Conservator, Forests, U.P. Government graced the occasion. Prof. Dixit delivered a lecture on "*Hindi mein vaigyanik shodh lekhan*", whereas Dr Singh shared some interesting memories of forest life. On this occasion, a debate on the topic '*Kya parmanu astra vishwa shanti hetu awashyak hain*' was also held. The First, Second and Third winners were Mr Sanjay Singh, Dr Mukund Sharma and Dr A. Rajanikanth respectively.

On September 20th, a "Hindi Typing Contest" was held in which Mr Hari Lal, Km Chitra Chatterji and Mr Ajai K. Srivastava were the prize winners respectively. A "Short Essay Contest" on the topic '*Bharat ki vigat 50 varshon ki vaigyanik uplabdhian*' was held on 22nd September. The top three contestants were Dr Rajni Tewari, Dr Chanchala Srivastava and Dr Neerja Jha respectively. On September 24th a "*Prashna Manch Contest*" was organised between five teams, namely, *Himalaya*, *Vindhya*, *Aravali*, *Sahyadri* and *Nilgiri*. The configuration of a team contained three persons each. The winner team was '*Nilgiri*' and the members of the team were Dr Mukund Sharma, Mr Sundeep Bisaria and Mr K.C. Chandola. The runner up team was '*Aravali*'. Dr A.



'Kavi Sammelan' during Hindi Pakhwara

Rajanikanth, Dr K.J. Singh and Dr Vandana Chaudhary were the members of that team. "A Hindi Elocution Contest" was held on September 27th, in which only 'Ahindibhashi' contestants of the institute participated. The winners were Mrs V. Nirmala, Mrs Rita Banerji and Dr A. Rajanikanth respectively.

The concluding function was held on 28th September. On this occasion a colourful 'Kavi Sammelan' was organised. The function was presided over by Dr (Smt) Shakuntala Kalra, Reader, Hindi Department, Maitri College, New Delhi. A galaxy of local Hindi poets, namely Prof. Ram Swaroop 'Sindoor', Shri Vali 'Asi', Shri Surya Kumar Pandey,

Shri Rajendra Verma, Shri Vahid Ali 'Vahid', Shri Kunwar 'Kusumesh', Km Ranjana Sharma, Shri Sarvesh Asthana, Shri Bhola Nath 'Adheer' and Shri Ashok Mishra 'Pravasi' enthralled the audience.

Miscellaneous

Various administrative forms of establishment unit were made bilingual and museum write ups, labels, hoardings, folders, hand outs, etc. were translated in Hindi. Four Quarterly reports, consisting the information of Hindi activities of the Institute, were made in Hindi and sent to DST, New Delhi.

Reservations and Concessions

To provide adequate representations to Scheduled Castes and Scheduled Tribes and Other Backward Classes for posts meant for direct recruitment, the General Reservation Orders of the Government of India as applicable to Autonomous Bodies and as amended from time to time are sincerely being followed by the Institute. The Roster for reservation of Scheduled Castes and Scheduled Tribes and Other

Backward Classes is maintained by post-based Roster as directives of the Government of India, Department of Personal and exempted from the purview of the General Reservation Orders.

The Government of India orders issued from time to time for reservation in respect of blind, deaf and orthopaedically handicapped candidates are applicable in Group "C" and Group "D" posts of the Institute.

The Staff

Director

Professor Anshu K. Sinha

Scientists

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

Scientist 'G'

Dr Govindraja Rajagopalan

Scientist 'F'

Dr Anil Chandra

Dr (Mrs) Shaila Chandra

Dr Syed A. Jafar

Dr Anand Prakash

Dr (Mrs) Chhaya Sharma

Dr Suresh C. Srivastava

Scientist 'E'

Dr Krishna Ambwani

Dr (Ms) Jayasri Banerji

Dr Rahul Garg

Dr Kripa S. Saraswat

Dr Ramesh K. Saxena

Dr Manoj Shukla

Dr Ashwini K. Srivastava

Dr Gajendra P. Srivastava

Dr (Mrs) Archana Tripathi

Scientist 'D'

Dr Anil Agarwal

Dr (Mrs) Usha Bajpai

Dr Jaswant S. Guleria

Dr (Mrs) Neerja Jha

Dr (Mrs) Asha Khandelwal

Dr Pramod Kumar

Dr Jagannath P. Mandal

Dr Basant K. Misra

Dr Mulagalapalli R. Rao

Dr Chandra M. Nautiyal

Dr Samir Sarkar

Dr Rama S. Singh

Dr Shyam C. Srivastava

Dr S.K.M. Tripathi

Dr (Ms) Vijaya

Dr Ram R. Yadav

Scientist 'C'

Dr Annamraju Rajanikanth

Dr Rupendra Babu

Dr Samir K. Bera

Dr Amalava Bhattacharyya

Dr Anant P. Bhattacharyya

Dr Mohan S. Chauhan

Dr (Ms) Asha Gupta

Dr Brijendra N. Jana

Dr Khowaja Ateequzzaman

Dr Madhav Kumar

Dr Bhagwan D. Mandaokar

Dr Kindu L. Meena

Dr Rakesh C. Mehrotra

Dr (Mrs) Neeru Prakash

Dr Mahesh Prasad

Dr (Mrs) Jyotsana Rai

Dr Ram Awatar

Dr Dinesh C. Saini

Dr Omprakash S. Sarate

Dr Rakesh Saxena

Dr Mukund Sharma

Dr (Mrs) Alpna Singh

Dr Bhagwan D. Singh

Dr Kamal J. Singh

Dr (Mrs) Chanchala Srivastava

Dr (Mrs) Rashmi Srivastava

Dr (Mrs) Rajni Tewari

Dr Gyanendra K. Trivedi

Scientist 'A'

Dr (Mrs) Anjum Farooqui

Dr Amit K. Ghosh

Dr (Mrs) Vandana Prasad

Sponsored Project

Mr Sanjay Singh,

Junior Research Fellow (till 13.02.2000)

Miss Debi Dutta,

Junior Research Fellow

Mr Jagdish Prasad

(Field/Lab Attendant)

Technical Personnel

Publication

Mr R.L. Mehra (Technical Assistant 'E')
Mr Syed Rashid Ali (Technical Assistant 'D')

Library

Mrs Kavita Kumar (Technical Officer 'A')
Mr V.K. Nigam (Technical Assistant 'E')
Mr Sumit K. Manna (Technical Assistant 'D')
Mr Dharendra Sharma (Technical Assistant 'D')
Mr S.R. Yadav (Technical Assistant 'C')
Mr Avanish Kumar (Technical Assistant 'A')

Museum

Mr P.K. Bajpai (Technical Officer 'B')
Mrs Sunita Khanna (Technical Officer 'A')
Mr Prem Prakash (Technical Officer 'A')
Mr Sanjai Kumar Singh (Technical Assistant 'D')
Mr Raj Kumar Tantua (Technical Assistant 'D')
Mr Pawan Kumar (Technical Assistant 'A')

Herbarium

Mr Diwakar Pradhan (Technical Officer 'A')
Mr S.M. Vethanayagam (Technical Assistant 'D')

Photography

Mr Pradeep Mohan (Technical Assistant 'E')
Mr D.S. Bisht (Technical Assistant 'D')

Laboratory Services

Dr B. Sekar (Technical Officer 'C')
Dr (Mrs) Madhabi Chakraborty (Technical Officer 'B')
Mrs Indra Goel (Technical Officer 'B')
Mrs Asha Guleria (Technical Officer 'B')
Dr E.G. Khare (Technical Officer 'B')
Mr T.K. Mandal (Technical Officer 'B')
Mr V.K. Singh (Technical Officer 'B')
Mrs Reeta Banerjee (Technical Officer 'A')
Mr Chandra Pal (Technical Officer 'A')
Mr V.P. Singh (Technical Officer 'A')
Mr A.K. Srivastava (Technical Officer 'A')
Mr R.C. Mishra (Technical Assistant 'E')
Mr Keshav Ram (Technical Assistant 'E')
Mr Shreerup Goswami (Technical Assistant 'D')
Mr S. Suresh K. Pillai (Technical Assistant 'D')

Technical Services

Mr P.S. Katiyar (Technical Officer 'B')
Mr K. Nagapooshanam (Technical Officer 'B')
Mr Madhukar Arvind (Technical Assistant 'E')
Mr A.K. Ghosh (Technical Assistant 'E')
Mr V.S. Panwar (Technical Assistant 'E')
Mr Y.P. Singh (Technical Assistant 'E')
Mr Dharendra Kumar Pal (Technical Assistant 'D')
Mr Madhavendra Singh (Technical Assistant 'D')
Mr Chandra Bali (Technical Assistant 'C')
Mr C.L. Verma (Technical Assistant 'C')
Mr M.S. Rana (Technical Assistant 'A')
Mr S.C. Singh (Technical Assistant 'A')
Mr A.K. Srivastava (Technical Assistant 'A')
Mr Om Prakash Yadav (Technical Assistant 'A')

Administrative Personnel

Registrar

Mr S.C. Bajpai

Accounts Officer

Mr J.C. Singh

PS to Director

Mr S.P. Chadha

Section Officers

Mr Ramesh Chandra
Mr N.N. Joshi
Mr I.J. Mehra
Mr H.S. Srivastava
Mr R.K. Takru

Maintenance Officer

Mr R.B. Kukreti

Accountant

Mr I.J.S. Bedi

Assistants

Mrs Ruchita Bose
Mrs Usha Chandra
Mr R.K. Kapoor
Mrs V. Nirmala
Mr Dhoom Singh
Mrs P. Thomas

Stenographer

Mrs M. Jagath Janani

Hindi Translator

Dr Puneet Bisaria

Upper Division Clerks

Mr Hari Lal

Mrs Swapna Mazumdar

Mr M. Pillai

Mr Gopal Singh

Mr K.P. Singh

Mr Koshy Thomas

Mr N. Unnikannan

Lower Division Clerks

Mr Akhil Antal

Ms Chitra Chatterjee

Mr Mishri Lal

Mr S.S. Panwar

Mr Rameshwar Prasad

Mrs Shail S. Rathore

Mr A.K. Srivastava

Mrs Renu Srivastava

Driver

Mr Nafees Ahmed ('II')

Mr D.K. Misra ('I')

Mr M.M. Mishra ('I')

Mr Pushpendra K. Misra ('I')

Mr V.P. Singh ('I')

Attendants 'III' (SG)

Mr Raja Ram

Attendants 'III'

Mr K.C. Chandola

Mr Prem Chandra

Mr Ram Deen

Mr Ram Kishan

Mr Sunder Lal

Mr Haradhan Mohanti

Mr Kesho Ram

Mr Satruhan

Mr Ram Singh

Attendants 'II'

Mrs Maya Devi

Mrs Munni

Mr Kailash Nath

Mr Mani Lal Pal

Mr Sri Ram

Mr Mohammad Shakil

Mr Bam Singh

Mr Kedar N. Yadav

Attendants 'I'

Mr R.K. Awasthi

Mr K.K. Bajpai

Mr Ram Dheeraj

Mr V.S. Gaikwad

Mrs Ram Kali

Mr Hari Kishan

Mr Deepak Kumar

Mr Inder Kumar

Mr Ramesh Kumar

Mr Dhan Bahadur Kunwar

Mr S.C. Mishra

Mr Ram Ujagar

Mali

Mr Rameshwar Prasad Pal (Skilled 'III')

Mr Ram Chander (Unskilled 'I')

Mr Ram Kewal (Unskilled 'I')

Mr Mathura Prasad (Unskilled 'I')

Appointments

Mr Sanjai Kumar Singh, Technical Assistant 'D',
w.e.f. 08.12.1999.

Mr Dharendra Sharma, Technical Assistant 'D', w.e.f.
10.12.1999.

Mr S.M. Vethanayagam, Technical Assistant 'D',
w.e.f. 10.12.1999.

Mr Madhavendra Singh, Technical Assistant 'D',
w.e.f. 15.12.1999.

Mr Dharendra Kumar Pal, Technical Assistant 'D',
w.e.f. 16.12.1999.

Mr Shreerup Goswami, Technical Assistant 'D',
w.e.f. 20.12.1999.

Mr Digamber Singh Bisht, Technical Assistant 'D',
w.e.f. 22.12.1999.

Mr Raj Kumar Tantua, Technical Assistant 'D', w.e.f. 23.12.1999.
Mr S. Suresh Kumar Pillai, Technical Assistant 'D', w.e.f. 27.12.1999.
Mr Sumit Kumar Manna, Technical Assistant 'D', w.e.f. 03.01.2000.
Mr Syed Rashid Ali, Technical Assistant 'D', w.e.f. 06.03.2000.
Mr Akhil Antal, Lower Division Clerk, w.e.f. 28.04.1999.
Mr Pushpendra Kumar Misra, Driver 'I', w.e.f. 13.01.2000.
Mrs Ram Kali, Attendant 'I', w.e.f. 04.05.1999.
Dr Vandana Chowdhuri, Research Associate (DST Sponsored Project) w.e.f. 27.05.1999.
Mr Parminder Singh Ranhotra, Junior Research Fellow (DST Sponsored Project) w.e.f. 27.05.1999.
Miss Anjali Dixit, Junior Research Fellow (DST Sponsored Project) w.e.f. 27.05.1999.
Mr Sandeep Bisaria, Lab Assistant (DST Sponsored Project) w.e.f. 27.05.1999.
Mr Jayendra Singh, Project Assistant (Dept. of Environment Sponsored Project) w.e.f. 31.12.1999.
Dr Ratan Kar, Research Associate (DST Sponsored Project) w.e.f. 21.02.2000.
Miss Kiran Verma, Junior Research Fellow (DST Sponsored Project) w.e.f. 28.02.2000.

Promotions

Dr G. Rajagopalan, Scientist 'G', w.e.f. 01.04.1999.
Dr Syed A. Jafar, Scientist 'F', w.e.f. 01.04.1999.
Dr (Mrs) Chhaya Sharma, Scientist 'F', w.e.f. 01.04.1999.
Dr Krishna Ambwani, Scientist 'E', w.e.f. 01.04.1999.
Dr Rahul Garg, Scientist 'E', w.e.f. 01.04.1999.
Dr Ramesh K. Saxena, Scientist 'E', w.e.f. 01.04.1999.

Dr Manoj Shukla, Scientist 'E', w.e.f. 01.04.1999.
Dr (Mrs) Archana Tripathi, Scientist 'E', w.e.f. 01.04.1999.
Dr Anil Agarwal, Scientist 'D', w.e.f. 01.04.1999.
Dr G.K. Trivedi, Scientist 'C', w.e.f. 01.04.1999.
Dr E.G. Khare, Technical Officer 'B', w.e.f. 01.04.1999.
Mrs Reeta Banerjee, Technical Officer 'A', w.e.f. 01.04.1999.
Mrs Kavita Kumar, Technical Officer 'A', w.e.f. 01.04.1999.
Mr Chandra Pal, Technical Officer 'A', w.e.f. 01.04.1999.
Mr V.P. Singh, Technical Officer 'A', w.e.f. 01.04.1999.
Mr A.K. Srivastava, Technical Officer 'A', w.e.f. 01.04.1999.
Mr Y.P. Singh, Technical Assistant 'E', w.e.f. 01.04.1999.

Resumption of duty

Mr S.C. Bajpai resumed his duties as Registrar w.e.f. 17.12.1999 (AN) after his deputation to Baba Saheb Bhim Rao Ambedkar University, Lucknow, as Registrar.

Retirements

Dr Prabhat K. Maithy, Scientist 'F' retired on 31.07.1999.
Mr Saryu Prasad, Attendant 'III' (Special Grade) retired on 29.02.2000.

Obituary

Mr Sia Ram, Attendant 'III' (Special Grade) expired on 29.07.1999.

Papers published

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- †**Antal JS, Prasad M & Khare EG 1999.** *In situ* fossil wood of *Dipterocarpus* Gaertn. in the Himalayan foot hills of Darjeeling District, West Bengal, India. *Biol. Mem.* 25: 25-28
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- Chandra R, Upadhyay R & Sinha AK 1999.** Subduction and collision related magmatism in the Shyok Suture and eastern Karakoram. *Palaeobotanist* 48: 183-209.
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- Farooqui A 1999.** Biostratigraphic studies of Pichavaram mangrove swamps and environmental changes during Holocene. *J. Gondwana Geol. Soc. Spl. Vol. 4:* 293-300.
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- Ghosh AK & Maithy PK 1999.** Fossil algae from the Maastrichtian of Kallankurichchi Formation, Ariyalur Group. *Geosci. J.* 20: 35-40.
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- Guleria JS & Mehrotra RC 1999.** On some plant remains from Deccan Intertrappean localities of Seoni and Mandla districts of Madhya Pradesh, India. *Palaeobotanist* 47: 68-87.
- Gupta A 1998.** Spore types in Bryophytes. *Chenia, Int. Symp. 2000's Bryology* 5: 39-48.
- Jafar SA & Singh OP 1999.** Late Miocene Cocoliths from Neill Island, Andaman Sea, India. *J. Palaeontol. Soc. India* 44: 119-134.
- Kedves M, Borbola A, Tripathi SKM & Kumar M 2000.** Thermal effect on some extant palm pollen. *Plant Cell Biol. Devel., Hungary* 11: 166-183.
- Kumar B, Das Sharma S, Shukla M & Sharma M 1999.** Chronostratigraphic implications of the carbon and Oxygen isotopic composition of the Proterozoic Bhima Carbonates, southern India. *J. Geol. Soc. India* 53: 593-600.
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- Mandal J 1999.** Fossil Rivulariaceae from the Early Eocene of Kutch, India. *J. Palaeont. Soc. India* 44: 135-139.
- Mandaokar BD 1999.** Occurrence of palynofossils from the Tirap River section (Disang Group), Tinsukia District, Assam. *Palaeobotanist* 48: 239-243.
- Meena KL 1998.** Palynodating of Sub-surface Kamthi sediments in Ib-river Coalfield, Orissa. *Geophytology* 27: 107-110.
- Meena KL 1999.** Late Barakar flora from the Chaturdhara Nala section, Ib-river Coalfield, Sundargarh, Orissa, India. *Palaeobotanist* 48: 141-145.
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- Park W-K, Yadav RR & Seo J-W 1999.** 265-year long May drought records from tree-rings of Korean red pine. *Proc. Korean Meteorol. Soc.* 1999 Spring Meeting: 267-270.
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- Shukla M, Kumar P, Srivastava GP, Anand-Prakash & Kumar M 2000.** Record of resin embedded insects and related organic remains from Mahuadanr Valley, Palamu, Bihar, India. *Curr. Sci.* 78: 385-386.
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- Singh RS 1999.** Diversity of *Nypa* in the Indian subcontinent- Late Cretaceous to Recent. *Palaeobotanist* 48: 147-154.
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- Tripathi A 1999.** *Talcheridium indicum* a new acritarch with dinoflagellate like features from Permian Barakar Formation of India. *Balleino della Societa Paleontol. Italiana* 38: 313-316.
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- Upadhyay R, Sinha AK, Chandra R & Rai H 1999.** Tectonic and magmatic evolution of the eastern Karakoram, India. *Geodinamica Acta* 12: 341-358.
- Valdiya KS, Rajagopalan G, Nanda AC, Suresh GC & Upendra T 2000.** Neotectonic lake and vertebrate fossils in Hemavati Catchment, Hassan District, Karnataka. *J. Geol. Soc. India* 55: 229-237.
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Papers accepted for publication

- Agarwal A & Ambwani K**—*Canariocarpon ratnagiriensis* gen. et sp. nov. from Sindhudurg District, Maharashtra, India. Palaeobotanist.
- Anderson JM, Anderson HM, Archangelsky S, Bamford M, Chandra S, Dettman M, Hill R, Mcloughlin S & Rosler O**—Patterns of plant colonisation and diversification on Gondwana and its dispersed continental fragments. *Alex Dutoit Symp. Xth Gondwana*, Cape Town, South Africa.
- Arya R, Guleria JS & Srivastava R**—New records of plant fossil from the Kasauli sediments of Himachal Pradesh, North -West India. *Curr. Sci.*
- Bajpai U**—Ultrastructure of the sporoderm in megaspores of some Indian *Selaginellas*. Palaeobotanist.
- Banerji J**—Megafloral diversity of the Upper Gondwana Sequence of the Rajmahal Basin, India. *J. African Earth Sci.*
- Banerji J & Jana BN**—Early Cretaceous megaflora of Bartala Hill, Rajmahal Basin, India. Palaeobotanist.
- Bera SK**—Modern pollen deposition in Mikir Hills, Assam. Palaeobotanist.
- Bera SK & Farooqui A**—Mid-Holocene vegetation and climate of South Indian montane. *J. Palaeont. Soc. India.*
- Chandra S**—Colonisation and subsequent speciation/ diversification on Indian Gondwana subcontinent - Gondwana Biodiversity. *Proc. Xth Gondw. Conf.*, Cape Town, South Africa.
- Chauhan MS**—Pollen evidence of Late Quaternary vegetation and climate changes in north-eastern Madhya Pradesh. Palaeobotanist.
- Chauhan MS, Mazari RK & Rajagopalan G**—Vegetation and climate in upper Spiti region, Himachal Pradesh during Late Holocene. *Curr. Sci.*
- Chauhan MS & Sharma C**—Late Holocene Vegetation climate in Garhwal Himalaya. Palaeobotanist.
- Guleria JS, Srivastava R & Arya R**—Occurrence of fossil *Mitragyna* in the Early Miocene of Himachal Pradesh, India. Palaeobotanist.
- Guleria JS, Srivastava R & Prasad M**—Some fossil leaves from Kasauli Formation of Himachal Pradesh, North-West India. *Himalayan Geol.*
- Kedves M, Horvath A, Tripathi SKM & Kumar M**—Symmetry operations on the quasi-crystalloid biopolymer system of the sporopollenin of *Phoenix sylvestris* Linn. from India. *Plant Cell Biol. Devel.*, Hungary.
- Khandelwal A**—Survey of aerospora by Rotorod Sampler : Qualitative and Quantitative assessment. *Aerobiologia.*
- Khandelwal A & Gupta HP**—Mangrove history since 1,500 yrs B.P. at Dangmal, Baitarni-Brahmani Delta, Orissa, India. Palaeobotanist.
- Khandelwal A & Misra L**—Survey of airspora of vegetable market of Lucknow, India. Palaeobotanist.
- Khare EG, Prasad M & Awasthi N**—Contribution to the Deccan Intertrappean flora of Nawargaon, Wardha District, Maharashtra, India. Palaeobotanist.
- Maithy PK & Babu R**—Organic-walled microfossils from the Bhagwar Shale Formation (Semri Group) Rohtasgarh District. Bihar and their implication for the age. *J. Geosci.*
- Maithy PK, Kumar S & Babu R**—Biological remains and organo-sedimentary structures from Iron Ore (Archaean) of Barbil, Singhbhum Craton. *Geol. Sur. India Special. Vol.*
- Mandal J & Kumar M**—Stratigraphic significance of some angiosperm pollen from the Tinali Oil field, Upper Assam, India. Palaeobotanist.
- Mandaokar BD**—Palynology and palaeoenvironment of the Bhuban Formation (Early Miocene) of Ramrikawn near Aizawl, Mizoram. Palaeobotanist.
- Mandaokar BD**—Palynofloral investigation of Tikak Parbat Formation (Late Oligocene) of Borjan area, Nagaland, India. *Geobios.*
- Meena KL**—Palynological correlation of bore holes studies in Ib-river Coalfield, Son-Mahanadi Graben, Orissa. Palaeobotanist.
- Meena KL**—Palynology of surface sediments

- exposed in Basundhara Nala, Ib-river Coalfield, Sundargarh District, Orissa, India. Palaeobotanist.
- Mehrotra RC**—Study of plant megafossils from the Tura Formation of Nangalbibra, Garo Hills, Meghalaya. Palaeobotanist.
- Mehrotra RC, Mandaokar BD, Tiwari RP & Rai V**—*Teredolites clavatus* from the Upper Bhuban Formation of Aizawl District, Mizoram, India. Ichnos.
- Misra BK**—Petrography, genesis and deposition of Tertiary coals of northeastern India. Palaeobotanist.
- Pokharia AK & Saraswat KS**—Wood charcoals remains from ancient Sanghol, Punjab (ca. 100-300 A.D.). Prāgdhārā : J. State Archaeol. Dept.
- Prakash N**—Floral diversity of two fossil sites (Dudhkol & Sitalpur) of Rajmahal Formation, Bihar, India. Palaeobotanist.
- Prasad M, †Antal JS, Tripathi PP & Pandey VK**—Further contribution to the Siwalik flora from the Koilabas area, Western Nepal. Palaeobotanist.
- Rajanikanth A, Venkatachala BS & Ashok Kumar**—Geological age of the *Ptilophyllum* flora - A critical assesment. J. Geol. Soc. India.
- Rao MR**—Palynostratigraphic zonation of the Tertiary sediments of the Kerala Basin, India. Proc. IX IPC, AASP. Palynology.
- Rao MR**—Palynological investigation of the Kherapara Formation (Oligocene) exposed along Tura Dalu Road near Kherapara, West Garo Hills District, Meghalaya. Palaeobotanist.
- Saini DC**—New phytogeographic record of some plants from Lucknow District, Uttar Pradesh – II. J. Econ. Taxon. Bot.
- Saini DC**—New phytogeographic record of some plants from Lucknow District, Uttar Pradesh – III. J. Econ. Taxon. Bot.
- Saini DC**—Flora of Bahraich District, Uttar Pradesh – II. J. Econ. Taxon. Bot.
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AUDIT REPORT
to the Governing Body of the
Birbal Sahni Institute of Palaeobotany, Lucknow

We have audited the attached Balance Sheet of Birbal Sahni Institute of Palaeobotany, Lucknow, as at 31st March, 2000, Income and Expenditure Account and Receipt & Payment Account for the year ended on that date and subject to our comments and observations as given in Annexure 'A', we report that :-

In our opinion and to the best of our information and according to the explanations given to us the said accounts give a true and fair view :-

- (i) In the case of Balance Sheet, of the State of affairs of the Institute as at 31st March, 2000.
- (ii) In the case of Income and Expenditure Account, of the excess/deficit of income over expenditure for the year then ended, and
- (iii) In the case of Receipt and Payment Account, of the receipts and payments of Institute for the year then ended.

For Singh Agarwal & Associates
Chartered Accountants

Sd/-

Mukesh K. Agarwal

(Partner)

Date : 27.07.2000

Place : Lucknow

ANNEXURE - 'A'

**(Annexed to and forming part of the Audit Report for the year ended 31st March, 2000)
Comments/Audit Observations on Accounts of Birbal Sahni Institute of Palaeobotany, Lucknow
for the year ended 31st March, 2000**

ACCOUNTS

1. The Accounts of the Institute are being maintained on cash basis, except a portion amounting to Rs.10.00 lacs of the DST Grant from Govt. of India which was received during the financial year 2000-2001, have been accounted-for during the year under audit, on the basis of sanction.

2. An unsettled advance amounting to Rs. 1317.00 is pending for recovery since 1983-84 against books purchased. Efforts be made for the recovery/settlement of the same.

PUBLICATIONS

3. On scrutiny of records of the priced publications of the Institute, it has been observed that during the last several years, the Institute had brought-out publications on different subject with an objective to sell-out the same, in the market. The stock position of these priced publications as on 31.03.2000 was Rs.27.07 lacs apart from the reserved stock of Rs. 4.26 lacs. Thus the total stock of the publications stood at Rs. 31.33 lacs at the close of the year.

LIBRARY

4. No physical verification of the library books was carried out by the management during the year under audit. It was explained to us, that as per Central Government Rules, the library stocks are physically verified after a time-gap of 5 years. Last physical verification was done in April,1997 and the next is due in April, 2002.

STORES

5. The Fixed Assets register is being maintained on proper lines since 1988, which was produced before us for our examination. According to the information & explanations furnished to us, no physical verification of fixed assets has been carried-out. More-over identification marks on the fixed assets have also not been made for quick and proper verification of the same.

6. The Institute, being a non-profit earning organisation, no depreciation on fixed assets has been provided.

RESERVES

7. Reserve Fund & Pension Fund

During the year no appropriation against the Reserve Fund and Pension Fund were made out of Institute Funds. As explained to us, separate investment could not be made against the balances of these funds to the tune of Rs. 126.51 lacs and Rs. 49.43 lacs appearing in the books under the respective heads, reason being the shortage of resources.

8. Employees Provident Fund

As against the total reserves of Rs. 260.97 lacs against the Employees Provident Fund as on 31.03.2000, a sum of Rs. 215.87 lacs was invested with Nationalised Banks and other organisations as prescribed under the provisions of the Bye-Laws of the Institute.

*For Singh Agarwal & Associates
Chartered Accountants*

Sd/-
Mukesh K. Agarwal
(Partner)

Date : 27.07.2000

Place : Lucknow

Serialim Replies to the comments offered by the Chartered Accountants on the final accounts of the Institutes for the Year 1999-2000

ACCOUNTS

1. Statement of facts. No comments.
2. The amount of Rs.439.00 has since been settled leaving an unsettled advance of Rs. 878.00 for the year 1983-84. Publisher is being regularly reminded for supply of the issues.

PUBLICATIONS

3. The stock position of the priced publications stands to Rs. 26.545 lacs as on 31.8.2000. Further efforts are being made to sell out the unsold stock.

LIBRARY

4. Statement of facts. Hence no comments.

STORES

5. Efforts are being made to verify the physical stock of the fixed assets and put an identification mark thereon wherever considered necessary.
6. Statement of facts, Hence no comments.

RESERVES

7. It is an statement of facts. Reason being shortage of funds.

EMPLOYEES PROVIDENT FUND

8. Statement of facts. No comments.

Sd/-
J.C. Singh
(Accounts Officer)

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
Anshu K. Sinha
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow

Balance Sheet as at March 31, 2000

Fig. in Rupees

Previous Year 1998-99	(Liabilities) Sources of Funds	Current Year 1999-2000
95615315	1. Capital Fund	94885471
13340328	2. Current Liability	17636058
12650889	3. Reserve Fund	12650889
4942816	4. Pension Fund	4942816
882587	5. Donated Fund	877757
48784	6. Deposit Accounts	123185
21950013	7. General Provident Fund	26096917
149430732	Total	157213093
Previous Year 1998-99	(Assets) Application of Fund	Current Year 1999-2000
	1. Fixed Assets	
78984556	I) Owned Assets	84438618
671075	II) Donated Assets	671075
192000	2. Investments	192000
18086644	3. Excess of expend. over income	13387481
11952739	4. Loans and advances/deposits	14833297
12650889	5. Reserve Fund	12650889
4942816	6. Pension Fund	4942816
21950013	7. General Provident Fund	26096917
149430732	Total	157213093

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 Singh Agarwal & Associates
Chartered Accountants

Sd/-

Mukesh K. Agarwal
(Partner)

Sd/-

J.C. Singh
(Accounts Officer)

Sd/-

S.C. Bajpai
(Registrar)

Sd/-

Anshu K. Sinha
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow

Income and Expenditure Account for the year ending March 31, 2000

Fig. in Rupees

Previous Year			Schedule			Current Year			
Plan	Non Plan	Total		Plan	Non Plan	Total			
			Income :						
15890000	17800000	33690000	1. Grants	26729844	17300000	44029844			
0	523947	523947	2. R and D Receipts	0	361051	361051			
0	129970	129970	3. Misc. Income & Recoveries	0	50670	50670			
0	382000	382000	4. Interest	0	166753	166753			
15890000	18835917	34725917	Total	26729844	17878474	44608318			
			Expenditure :						
1576711	33418402	34995113	1. Pay & Allowances	18477663	14043787	32521450			
1229272	109000	1338272	2. Academic Expenses	638494	69641	708135			
733568	9045	742613	3. Expenses on Units/Services Ancillary to research	569260	32035	601295			
565934	0	565934	4. Travelling Expenses	559325	0	559325			
147508	139859	287367	5. Publication Expenses	58540	301497	360037			
3240436	457722	3698158	6. Contingencies	3189478	437358	3626836			
1780962	0	1780962	7. Maintenance & Repairs	1532077	0	1532077			
6615609	-15298111	-8682502	Balance Carried Down	1705007	2994156	4699163			
15890000	18835917	34725917	Total	26729844	17878474	44608318			
6615609	-15298111	-8682502	Balance of Income & Expenditure	1705007	2994156	4699163			
			Less Appropriation during the year						
-5000000	0	-5000000	Reserve Fund	0	0	0			
-1000000	0	-1000000	Pension Fund	0	0	0			
			Balance transferred to Capital Fund						
615609	-15298111	-14682502	Net Excess of Income over Expend.	1705007	2994156	4699163			

For Singh Agarwal & Associates
Chartered Accountants
Sd/-
Mukesh K. Agarwal
(Partner)

Sd/-
J.C. Singh
(Accounts Officer)

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
Anshu K. Sinha
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow
Receipts and Payments Account for the year ending March 31, 2000

Fig. in Rupees

Receipts		Plan	Non-Plan	Total	Payments		Plan	Non-Plan	Total
To	Opening Balance				By Fixed Assets		7127829	0	7127829
	Bank Current Account								
	Revenue & Capital	7918840	-21327708	-13408868					
	G.P.F.	0	6000	6000	By Pay and Allowances		18477663	8066558	26544221
	Deposit A/C				By Retiring Expenses		0	5977229	5977229
	Capital Revenue	26034	0	26034	By Academic Expenses		638494	69641	708135
		22750	0	22750	By Expn Services/Units		569260	32035	601295
	Cash In Hand	0	245	245	Ancillary to research				
					By Travelling Expenses		559325	0	559325
					By Publication Expenses		58540	301497	360037
					By Maintenance & Repairs		1532077	0	1532077
	Donation Account	0	19511	19511	By Contingencies		3189478	437358	3626836
To	Project Accounts				By Advances		1854000	98100	1952100
	Opening Balance	1991352	0	1991352	By General Provident Fund		246496	7130947	7377443
	Grants	793246	0	793246	By Miscellaneous Payment		102279	3682308	3784587
To	Grants :	26000000	17300000	43300000	By Investment/Appropriation Fund		0	0	0
To	Refund of CNR Advance	88556	0	88556	By Deposit Account		0	0	0
To	Donation and Endowment				By Project Account		1424398	0	1424398
	Maturity	0	0	0	By Donation Account		0	6665	6665
	Interest	0	1835	1835	By Closing Cash & Bank Balances				
To	R & D Receipts	0	361051	361051	Deposit Account (C.N.R.)		100435	0	100435
To	Admn. Receipts	348775	11632224	11980999	Current Account (Capital)		0	0	0
To	Deposit Account	74401	0	74401	Deposit Account (Revenue)		22750	0	22750
To	Interest	0	0	0	G.P.F		0	0	0
To	Misc. Income & Recovery	0	49207	49207	Current Account (Revenue)		730	-17775145	-17774415
To	Pension Fund				Cash in Hand		0	491	491
	Opening Balance	0	4942816	4942816	Donation Account		0	14681	14681
	Addition	0	0	0	Project Accounts		1360200	0	1360200
To	Reserve Fund				Pension Fund		0	4942816	4942816
	Opening Balance	12650889	0	12650889	Reserve Fund		12650889	0	12650889
	Addition	0	0	0					
To	Other Receipt	0	0	0					
Total :-		49914843	12985181	62900024	Total :-		49914843	12985181	62900024

For Singh Agarwal & Associates
Chartered Accountants
Sd/-
Mukesh K. Agarwal
(Partner)

Sd/-
J.C. Singh
(Accounts Officer)

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
Anshu K. Sinha
(Director)

