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BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY, LUCKNOW

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

Annual Report

1998-99

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Front Cover : Chhongtash Formation, Karakoram Tethyan zone, Micro-Mega plant fossils
Back Cover : Branched palm *(Hyphene dichotoma),* Harauni, Unnao District, U.P.

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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 & guidance.

Contents

Preface

The Birbal Sahni Institute was founded to develop scientific knowledge and expertise in all branches of Palaeobotany and related disciplines. An integrated and multi-disciplinary approach is followed to fulfill the following aims and objectives:

- To develop palaeobotany, including palaeopalynology, in all its botanical and geological aspects;
- To constantly update the data for interaction with allied disciplines;
- To co-ordinate with other knowledge centres in areas of mutual interest, such as early life, exploration of fossil fuels, vegetation dynamics, climatic modelling, conservation of forests, etc.; and
- Dissemination of palaeobotanical knowledge

In order to achieve the objectives the research activities during 1998-99 have been carried out under fifteen Projects under the five identified Thrust Areas. The targets defined under various projects/components have been by and large achieved which are detailed in the following pages of this Report.

I am grateful to the members of Governing Body and the Research Advisory Council of the Institute for the valuable suggestions and advice. The members of the Research Co-ordination and Planning Cell of the Institute: Drs Suresh C. Srivastava, Archana Tripathi and B.D. Singh; Drs A. Rajanikanth and Mukund Sharma of the Publication Unit; Dr. G. Rajagopalan and Administrative Unit of BSIP have greatly helped in compiling and processing this document. Besides the support provided by all colleagues in various Sections/Units is thankfully acknowledged.

Anshu K. Sinha
Director

Executive Summary

Birbal Sahni Institute of Palaeobotany - a premier research organisation of India is carrying out palaeobotanical researches to promote research on various aspects of palaeobotany, botany and geology. The research activities during 1998-99 have been carried out under the following five Thrust Areas, identified for IX Five Year Plan:

- **Antiquity of life,**
- **Gondwana Supercontinent: Regional geology, floristics, terrane accretion, plate tectonics and configuration,**
- **Biopetrology of Indian coals in relation to coal bed methane,**
- **Floristics of petroliferous basins, and**
- **Quaternary vegetation, climate and monsoon.**

Some of the significant achievements carried out at the Institute for each Project and its components are given below:

Antiquity of life

Conophyton-type small cones in association with columnar stromatolite *Colonella*-type are recovered from Archaean Kasia Formation, Iron Ore Supergroup near Barbil, Orissa. The upper part of carbonate sequence shows good biogenic activity owing to profuse development of algal mat. The biological assemblage consisting of *Myxococcoides, Ameliaphycus*, *Nucellosphaeridium, Micrhystridium, Colonella* and *Baicalia* suggest Neoproterozoic age for upper part of Raipur Limestone Formation of Chhattisgarh Supergroup exposed around Kodwa and Ghattapara in Durg District (M.P.). The presence of *Chuaria-Tawuia* microfossil assemblage in Owk Shale Formation (Kurnool Group) provides strong evidence (Neoproterozoic age) of correlation between the assemblage of Rewa and Bhander groups of Vindhyan and to some extent with the Halkal Formation of the Bhima Group.

Gondwana Supercontinent: Regional geology, floristics, terrane accretion, plate tectonics and configuration.

The occurrence of palynomorphs with microbial association and pyrite deposition in Lower Permian of Siang District, Arunachal Pradesh indicates the role of fungi in degradation of flora during early diagenetic stage. Palynological study along the contact zone of Permian and Tertiary sediments reveals that Eocene sediments have come up along the contact and are wedge deep into the Permian outcrops in Arunachal Himalaya.

Plant megafossils have been studied from Tatapani-Ramkola and Mand-Raigarh coalfields, Satpura, South Rewa and Pranhita-Godavari basins and also from Andhra Pradesh. Cherts from Sonajori, Rajmahal Basin have shown presence of female araucarian cones. The genus *Reinitsia* is recorded for the first time in India from Gumapahar locality of Rajmahal Basin. Fragmentary angiosperm fossil leaves have been recovered from Lameta Formation at Pisdura. The records of fossils plant from major Gondwana basins have been synthesized to build successive megafloras from the Early Carboniferous to the Early Cretaceous in India.

The ultrastructure- significant thickness of homogeneous matrix of Holloway's CM Type-6 of cuticular membrane of *Komlopteris (Thinnfeldia indica)* suggests ecological adaptation for plant protection in the extreme dry climate.

The palynodating and correlation of coal-bearing sediments have been done in Tatapani-Ramkola, Sohagpur, Talcher, Ib-river, Mand-Raigarh coalfields and Satpura Basin and Wardha Godavari Graben. A new acritarch genus *Talcheridium* is instituted from Early Permian sediments of Talcher Coalfield. The Mesozoic succession pertaining to Panchet, Dubrajpur and Rajmahal formations are palynologically analysed. The Tithonian-Berriasian age is indicated for Rajmahal Formation in Panagarh Basin. *Mallophagan* type of parasitic (external) insects have been recorded for the first time from matrix of Bagra conglomerate and Upper Triassic Denwa clays of Satpura Basin.

Accumulated the first palaeobotanical and geochemical data from eastern Karakoram to support the concept of accretion or mosaic tectonics to the Karakoram Block. This provides evidence to advocate that the Karakoram terrane belongs to Gondwanian blocks, rifted away from Gondwana during the Late Palaeozoic and accreted along the southern Eurasian margin before final collision with the Indian Plate.

Biopetrology of Indian coals in relation to coal bed methane

Coals from North Karanpura and Talcher coalfields, Wardha and Satpura Gondwana basins and Makum Coalfield (Tertiary) have been analysed for their composition and rank in relation to their economic potential. On the basis of nature and composition of coal macerals and rank, the coals from Kanhan area have been found to be within the threshold zone of methane generation.

The resins from Upper Tertiary sediments in Mahuadanr Valley, Palamau, Bihar and Upper Tertiary lignite beds of Kerala Coast have shown presence of insects and other related organic remains. The insects include *Psylla, Ophion,* male culex mosquito and beetle.

Floristics of petroliferous basins

Floristics of Tertiary sediments have been worked out for assessing biostratigraphic and palaeoenvironmental significance. The abundance of fabaceous taxa suggests the prevalence of evergreen forests under humid climate around Koilabas in the Himalayan foot hills. The moist evergreen genus *Dipterocarpus* is recorded in the Upper Tertiary sediments in Jammu & Kashmir which is confined to Assam in the northern region at present. Some gymnospermous woods from Infra-trappean beds of north-west Kutch are being reported for the first time. The palynoassemblages from Morni Hills, Haryana indicate late Early Eocene-early Middle Eocene age for the Subathu succession which is in agreement with faunal age determination. A very shallow marine nearshore environment with occasional influence of the open sea is evidenced in the older horizon, whereas highly reducing environment in the younger horizon is interpreted. The presence of *Striatriletes* in good number along with fungal elements indicates tropical to subtropical, moist warm humid climate during deposition of sediments of Dafla Formation in Arunachal Pradesh.

The palynofloral assemblage dominated by dinoflagellate cysts has shown Middle Eocene age for the Siju Formation in South Garo Hills, Meghalaya. It was laid down in unstable shelf in shallow sea. The sea floor oscillations are also indicated by variation in facies and thickness of the formation. The palynoflora of Surma sediments suggest Early Miocene age for Ramrikawn quarry, Mizoram. The pteridophytic spores *Striatriletes, Todisporites, Pteridacidites* and abundance of fungal remains — *Multicellaesporites, Trichothyrites, Cucurbitariacites* indicate tropical-subtropical warm humid climate. The composition of palynoflora indicates existence of brackish water swamp and prograding delta complex with fresh water influx.

The Calcareous algae from Tertiary sediments of south western Kutch have been studied. Coralline red algae — *Lithophyllum* and *Mesophyllum* are the main constituents from the Oligocene sediments. Completed documentation of dinoflagellate cysts from Cherrapunji area of Meghalaya and Naredi Formation of Kutch Basin for ascertaining the biostratigraphic potential.

The nannofossil assemblage from Hut Bay Formation in Little Andaman Island is assigned to CN 7b correlated with upper part of NN9 and matches with upper part of magnetic chron C5 (=9.5 Ma) assignable to Late Miocene age. The diatom *Actinocyclus, Azpeitia, Biddulphia, Cocconeis, Thalassiothrix, Hemidiscus,* etc. indicate Miocene age for the Inglis Formation in Havelock Island. The diatom assemblage from Neill Island shows a Miocene-Pliocene age for Sawai Bay Formation. Coralline algae have been reported for the first time from the Kakana Formation (Middle Pliocene) of Car Nicobar Island and Hut-Bay Formation of Little Andaman Island.

Quaternary vegetation, climate and monsoon

The Quaternary sediments have been pollen analysed to understand the past vegetation, history of forest and palaeoenvironment. The vegetational scenario from Saria Tal, Kumaun Himalaya reflects mixed Oak forest with warm humid conditions. The pollen analysis of sediments from Jagamotha Swamp, Sidhi (M.P.) have shown the forest history. Around 16,000 YBP mixed open grassland vegetation existed under dry condition and changed to mixed deciduous forest around 8000 YBP with invasion of more tree taxa such as *Adina cordifolia, Holoptelea lagerstroemia, Diospyros.* Around 6000 YBP the *Shorea robusta* appeared becoming a dominant deciduous element of forest around 2500 YBP. The palynological studies in Pichavaram, Tamil Nadu show rythmic dry and wet climate during Holocene. Also the dominance of upland vegetation during 3000-2000 YBP indicates dense forest cover beyond coastal mangrove vegetation in Pichavaram.

The ancient plant economy of archaeological site at Imlidih-Khurd in Gorakhpur District is worked out. The plant remains indicate rich plant economy of Chalcolithic community during 1600-800 B.C. Fruit and seed remains of anwala (*Emblica officinalis*), haritaki/chebulic myrabolan (*Terminalia chebula),* bahera/ beleric myrabolan (*Terminalia belerica),* basil/tulsi *(Ocimum* cf. *tenuiflorum),* nux-vomica/kuchla (*Strycnos nux-vomica)* and rhizome of ginger *(Zingiber officinale)* indicate use of rational herbal medicines.

The tree-ring analysis of *Cedrus deodara* from Tolma, Joshimath, with reference to ring width chronology extending back to AD 1606, indicate the presence of strong climatic signal in the chronology. On the basis of ring width chronology the reconstructed data on mean temperature for previous year October to concurrent year August back to AD 1717 show significant correlation ($r=0.50$, $p<0.01$) with the instrumental records.

Radiocarbon dating of Quaternary sediments has been carried out for chronological demarcation of vegetational changes, chronology and climatic reconstructions. The age of Jagmotha and Kerha profiles in Sidhi District is worked out to 6250 ± 90 YBP and 1440±160 YBP respectively. The 14_C age at 90 cm in Dokriani Bamak Glacier at Uttarkashi is estimated to 7060±380 YBP.

Other Activities

During the year 52 research papers, 5 popular articles and 55 abstracts were published and 92 papers and 16 abstracts were submitted for publication. 40 research papers were presented in the International and National conferences. 25 staff members including scientists and technical personnel were deputed to various conferences organised in the country and 12 scientists and 1 technical personnel were deputed to the International Conferences abroad. 8 scientists delivered lectures in other organisations. 10 scientists from other organisations delivered talk in the Institute.

The Institute scientists undertook field excursions to 198 localities. About 1546 fossil specimens and 3178 rock samples were collected for analysis in the coming year. These were deposited in the Museum. The modern plant material including plant specimens, wood blocks, polleniferous material, fruit and seeds, etc., were also collected by herbarium and other staff members of the Institute. During the year three Doctoral

Degrees were awarded by the University of Lucknow on the problems related to palaeopalynology, palaeobotany and palaeoethnobotany.

The Institute has rendered technical assistance and consultancy services, in palynology, electron microscopy, identification of fossil remains and radiocarbon dating, to the personnel from various organisations. The Institute generated revenue of Rs.1,91,750.00 during 1998-99. The Institute has gifted fossil specimens and sent relevant information to 9 educational institutions in the country. The Herbarium facilities were also extended to scientists from various colleges and universities. The new literature received in the Library enriched the holdings. The Library facilities were extended to scientists, teachers and students from various organisations and universities in India and abroad. Scientists and visitors from various organisations from the country and abroad visited the Institute and Museum.

The Publication Unit of the Institute processed the publication of Vol. 47 of the journal *The Palaeobotanist.* The BSIP Newsletter Number 1 was also published. The Electronic Data Processing Unit has assisted scientific, technical and administrative staff in various ways. The unit has procured Dr Solomon Anti virus Software. The unit made continuous effort for the Internet connection at the Institute for better and faster communication world over.

The Institute participated in Science and Technology Exhibitions organised at Indian Science Congress, Chennai; State level "Golden Jubilee Science and Technology Exhibition and Fair", Allahabad and *"Agrasar"* Achievement of Science and Technology since Independence and vision for future, New Delhi. The National Science Day was celebrated on the theme "Harnessing Information Technology". It included lecture, film and slide show, exhibition, art competition and open house.

Efforts were made to promote usage of Hindi in official work. The Institute continued to be an active member of City's Implementation Committee of official language, Unit 6. The "Hindi Pakhwara" was organised from 14 Sept - 28 Sept. 1998. On this occasion debate, essay and type writing contests and *Kavya Gosthi* were organised.

The Institute celebrated the National festivals: The Independence Day and Republic Day. The Institute staff paid homage by offering floral tributes on the "*Samadhi*". of Professor Birbal Sahni on 10th April, 98, the death anniversary.

The Foundation Day was observed on 10th September 1998. On this occasion Second Golden Jubilee Lecture was delivered by Professor D. Balasubramanian on "New Biology with help of old Botany". The Institute staff and members from other organisations offered '*Pushpanjali*' on the *Samadhi* of Professor Birbal Sahni on 14th November, 1998- The Founder's Day. Two memorial lectures- The 28th Birbal Sahni and 44th Sir Albert Charles Seward Memorial Lectures were delivered on this occasion. Same day two Medals were awarded: "Dr Chunnilal Khatiyal Medal -1998" for best piece of research work done in BSIP by Scientist "A" category to Dr A.K. Ghosh. First "Professor T.M. Harris International Medal" was awarded to Professor D.J. Batten, Institute of Geography and Earth Science, University of Wales, United Kingdom on his research contribution on "Palynofacies" which was adjudged as the best article on palaeobotany or allied disciplines during the preceding two years.

Organisational Structure

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Lucknow

Institute's Organisational Set-up

RESEARCH ADVISORY COUNCIL — **GOVERNING BODY** — **FINANCE & BUILDING COMMITTEE**

CHAIRMAN

DIRECTOR

RESEARCH PROJECTS IN THE AREAS OF:	*UNITS ANCILLARY TO RESEARCH*	*REGISTRAR*
1. Non-Vascular Plants	1. Publication	1. Finance and Accounts
2. Palaeophytic Evolutionary Botany	2. Library 3. Museum	2. Establishment 3. Stores & Purchase
3. Mesophytic Evolutionary Botany		
4. Cenophytic Evolutionary Botany	4. Herbarium	4. Works, Building & Maintenance
5. Quaternary Biogeography and Archaeobotany	5. Maceration Laboratory	5. Scientific Activities (Administrative)
6. Pre-Gondwana Palynostratigraphy of Peninsular India	6. Workshop	6. Transport & Guest House
7. Post-Gondwana Palynostratigraphy of Extra-Peninsular India	7. SEM	
8. Planktonology	8. EDP	
9. Biodiagenesis	9. Photography	
10. Radiometric Dating		

Research Projects at the Institute

Thrust Area : Antiquity of life.

Project 1 - Palaeobiology and biostratigraphy of Precambrian Basin.

Thrust Area : Gondwana supercontinent : Regional geology, floristics, terrane accretion, plate tectonics and configuration.

Project 2 - Floristics and biostratigraphy of Palaeozoic and Mesozoic of Himalaya.

Project 3 - Ultrastructural studies of fossil cuticles and megaspores, data processing of Gondwana fossils.

Project 4 - Floristics, biostratigraphy and palaeoenvironment of Gondwana sediments.

Project 5 - Floristics, biostratigraphy and palaeoenvironment of Mesozoic sediments.

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

Thrust Area : Biopetrology of Indian coals in relation to coal bed methane.

Project 6 - Coalification processes and depositional environment of coal and associated sediments.

Thrust Area : Floristics of petroliferous basins.

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

Project 8 - Tertiary floristics of peninsular India.

Project 9 - Marine micropalaeontology of petroliferous basins.

Thrust Area : Quaternary vegetation, climate and monsoon.

Project 10 - Quaternary vegetation and palaeoenvironment.

Project 11 - Archaeobotany and dendrochronology.

Project 12 - Cenozoic palaeofloristics of Andaman Islands.

Project 13 - Geochronometry and Isotope studies.

Project 15 - Special Activities.

Research

Projects and Components

Project 1 : Palaeobiology and biostratigraphy of Precambrian Basin

Component 1 : Search for oldest biological remains in Archaean

P.K. Maithy & Rupendra Babu

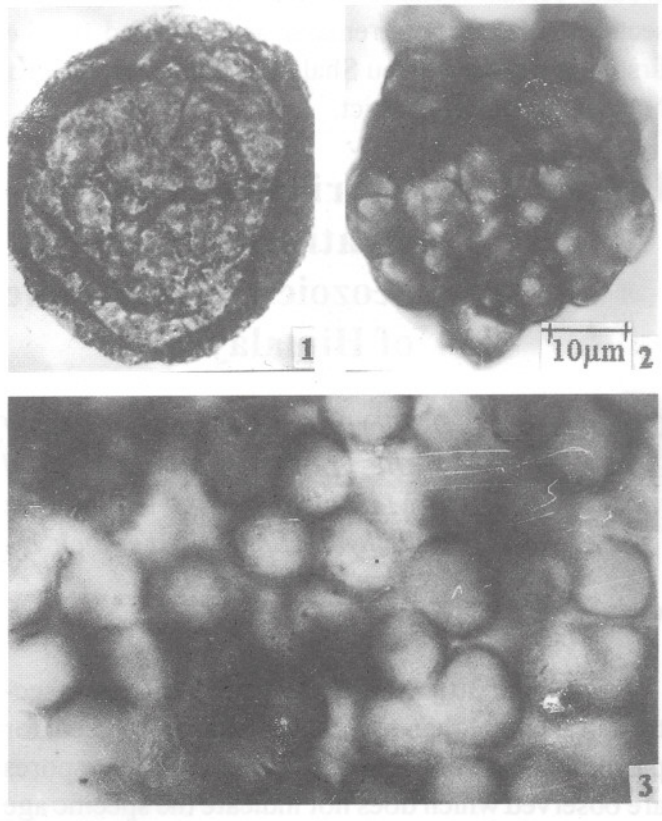
In Kasia Formation, Iron Ore Supergroup exposed near Barbil (Orissa) the carbonate sequence preserving stromatolites and algal mats were studied. The stromatolites are small in size. The *Conophyton* type of forms are small cones and associated with the commonly preserved columnar stromatolite *Colonella* type. The upper part of the carbonate sequence shows profuse development of algal mat indicating good biogenic activity. The small size of Archaean stromatolites possibly may be due to simple organisation of biota, which were not capable to form bioherms. The other possibility is that it may be due to ecological conditions. Possibly these cones occurred subaqeously most probably in quiet water condition.

Component 2 : Palaeobiology and biostratigraphy of the Meso-Neoproterozoic sediments with emphasis on Precambrian-Cambrian boundary

Manoj Shukla, Mukund Sharma & Rupendra Babu

Shukla and Sharma studied microfossils of the macerated samples of Owk Shale Formation, Kurnool Group. The microfossils present include smooth walled acritarchs, filamentous algae and interesting coiled forms belonging to *Obruchevella.* An assemblage of varied group of carbonaceous compressions and impressions recorded from this formation include Chuarid (*Chuaria circularis),* Tawuid (*Tawuia* sp.), Ellypsophysid, Moranid and Beltinid remains. The presence of *Chuaria-Tawuia* assemblage provides strong evidence of correlation between the assemblage of Rewa and Bhander groups of Vindhyans and to some extent with the Halkal Formation of the Bhima Group. *Chuaria-Tawuia* assemblage is being considered as potential biostratigraphic marker. On the basis of present fossil assemblage the Owk Shale Formation is considered to be of Neoproterozoic age. Finalized data on the carbonaceous remains belonging to *Chuaria-Tawuia.*

Babu recorded a well preserved rich biological assemblage comprising algae and acritarchs from the intercalated cherty bands in grey limestone of Raipur Limestone (=Chandi Limestone) Formation of Chhattisgarh Supergroup exposed around Kodwa and Ghattapara in Durg District (M.P.). The algae



Organic- walled microfossils from Raipur Formation, Chhattisgarh Supergroup, Durg District, M.P. *1. Leiosphaeridia plicatum 2. Myxococcoides minor 3. Ameliaphycus sp.*

are represented by sphaeroidal cells forming colonies referable to *Myxococcoides*, *Ameliaphycus* and unicellular sphaeroidal cells containing dark cellular content. The trichomes are of two types: (1) Irregularly branched trichomes comparable to extant cyanophycean algal family Stegonemataceae, and (2) Aseptate tubular forms to *Eomycetopsis*. Acritarchs comprise two groups: sphaeromorphida (mostly large sized ***Leiosphaeridia*** and *Nucellosphaeridium*) and sphaerohystrichomorphida (***Micrhystridium, Lophosphaeridium*** and ***Archaeohystricosphaeridium*****).** Also studied profusely branched organo-sedimentary structures of Tungussid Group (***Colonella, Baicalia,*** etc.) from the Raipur Limestone Formation. The recorded organic-walled microfossils and organo-sedimentary structures suggest Neoproterozoic age for the upper part of the formation. It compares to the assemblage from Lakheri Limestone Formation, Bhander Group exposed in M.P. and Rajasthan. Rock samples for OWM analysis, organo-sedimentary structures—stromatolites and megascopic remains are also collected from Bhander Group sediments exposed around certain localities of Rajasthan on measured sections. Megascopic remains are collected for the first time from the Sirbu Shale Formation exposed at Nayagaon, Bundi District.

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

About 30 rock samples from the Triassic section in Malla Johar area have been processed for palynofossils. Very few specimens of trilete spores are observed which does not indicate the specific age correlation for this strata.

Component 2 : Permian plant fossils from North-Eastern Himalayas

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

Palynological assemblages from Permian sequence of West Siang District, Arunachal Pradesh possess frequent occurrences of degraded spores and pollen. The study of morphological features of spores-pollen shows pyritic as well as fungal degradation. Investigations also indicate many grains possessing individual cell or colony of fungi but without any mark of degradation. Such palynomorphs with microbial association suggest the role of fungi in degradation of flora during early diagenetic stage.

An excursion was undertaken to make the survey and to collect plant fossils from different areas of Arunachal Pradesh, West Bengal and Sikkim. Well preserved plant fossils were collected from Pinjoli *Nala* section situated on Bhalukpong-Bombdila Road section and from Khuppi area in Kameng District. Traverses were taken all along Kimin-Zero Road section and Sagali area of Subansiri District. Coal balls and bulk maceration samples were collected from a section near Lichi Village. Traverses taken along Siliguri-Darjeeling Road section have yielded well preserved plant fossils near Tindharia and Pankhabari villages. Samples collected from Kalijhor River section near Sevok bridge contain fragmentary specimens of *Glossopteris* leaves, seeds and *Vertebraria*-axes. Well preserved plant fossils have been collected from Rohtak *Nala* section situated on Naya Bazar- Legship Road of South Sikkim.

Srivastava (SC) and Bhattacharyya studied the palynology of sediments exposed along the contact zone of Permian and Tertiary rocks from several locations in Kameng, Subansiri and Siang districts of Arunachal Pradesh. The investigations reveal that Eocene rocks have come up along the contact and are wedged deep into the Permian outcrops. Palynological evidences alongwith faunal evidences, wherever possible, have been summarised to decipher the stratigraphic resolutions, palaeogeography and palaeoenvironment of the region.

Srivastava (AK) and Bhattacharyya completed the study on morphology and palaeoecological significances of *Vertebraria*-axes recovered from Darjeeling District.

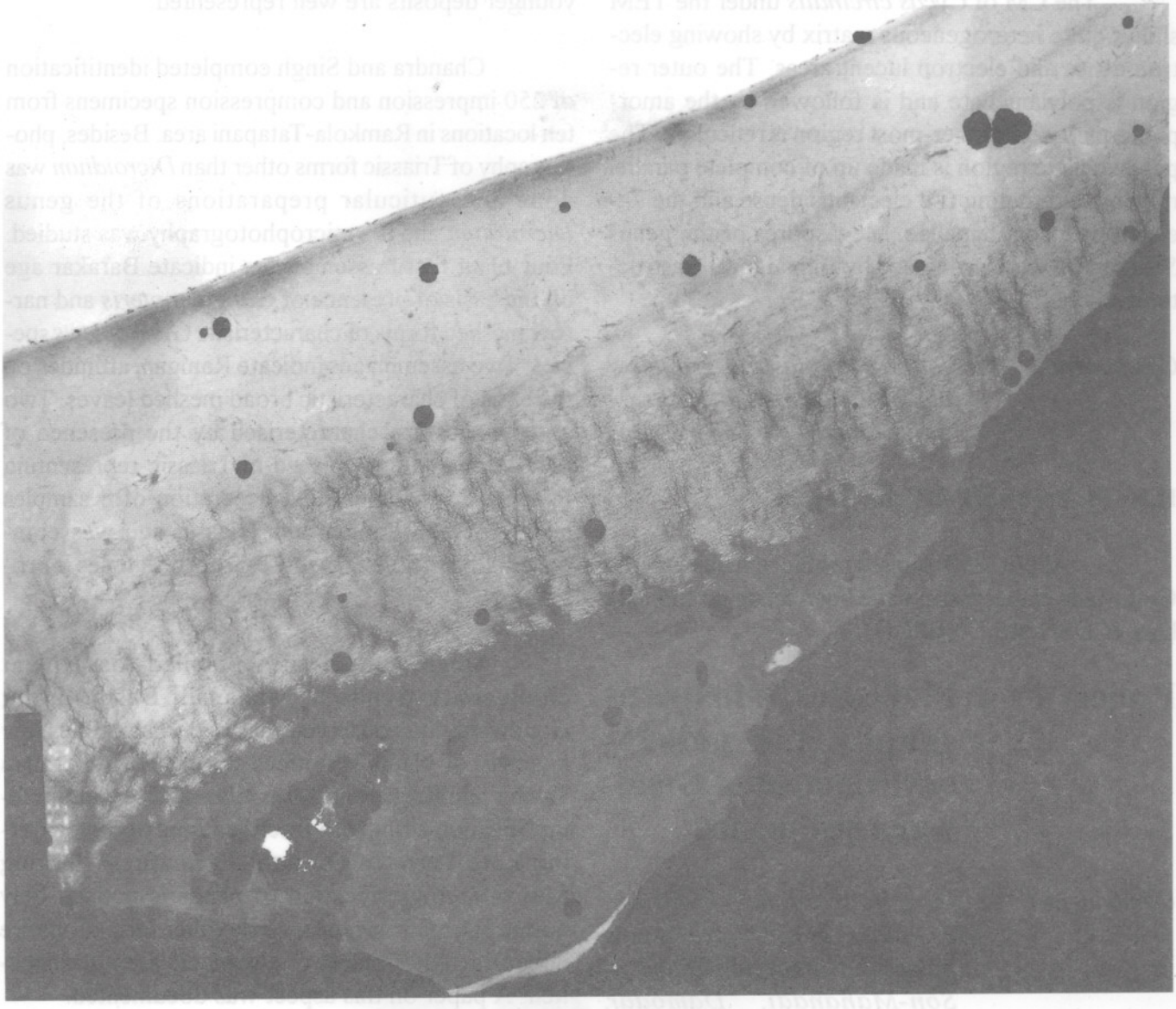
Srivastava (AK) and Tewari sorted out fresh collection of plant fossils from different areas of Darjeeling Coalfield (West Bengal), Arunachal Pradesh and Sikkim and grouped them under different categories. Observation and systematic description of flora of Pankhabari, Tindharia and Kalijhor localities of Darjeeling are under progress.

Project 3 : Ultrastructural studies of fossil cuticles and megaspores; data processing of Gondwana fossils

Component 1 : Ultrastructure of fossil cuticles and megaspores and comparative studies on selected modern taxa

Usha Bajpai & H.K. Maheshwari

Ultrastructure of the leaf cuticles of *Pachypteris indica* and *Komlopteris (Thinnfeldia) indica* has been investigated to work out the taxonomic relationship between the two genera. Appre-



Ultra structural variation in structural configuration of cuticle membrane of *Cycas circinalis* x 8800

ciable differences have been observed in the cuticular membrane (CM) of the above two species. The CM of *Pachypteris indica* shows close resemblance to CM Type-3 of Holloway in possessing an outer region which is mainly amorphous and a reticulate fibrillate inner region. The significant thickness of the outer homogeneous zone and the inner reticulate zone could be attributed to a number of factors, the most definite of which are ecological conditions. The electron density of the homogeneous layer is more than that of the underlying reticulate region. The CM of *Komlopteris indica*, on the other hand, shows a homogeneous matrix of Holloway's CM Type-6; its significant thickness suggests plant protection in the extreme dry climate.

The CM of *Cycas circinalis* under the TEM shows quite heterogeneous matrix by showing electron dense and electron lucent areas. The outer region is polylamellate and is followed by the amorphous matrix; the inner-most region is reticulate. The polylamellate region is made up of complete parallel running, alternating 6-8 electrons dense and the 7-9 electrons lucent lamallae. Megaspores of the genus *Selaginella* were processed by Bajpai for ultrastructural studies.

Component 2 : *Synthesis of biostrati-graphical and biogeographical data on Indian Gondwana Supergroup*

H.K. Maheshwari & Usha Bajpai

About 250 bibliographic entries on the Gondwana Supergroup have been made on the data base (CDS/1515.UNESCO).

Project 4 : Floristics, biostratigraphy and palaeoenvironment of Gondwana sediments

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

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

Chandra studied biodiversity of plant fossils during Indian Gondwana and finalized manuscript. The data from major basins combined and synthesised to build successive megafloras from the Early Carboniferous to the Early Cretaceous in India. In the peninsular region the Late Permian and Early Cretaceous deposits are the most productive for plants. The Early Permian, Triassic and Jurassic are intermediate in plant productivity. In the extra peninsular regions, the Late Devonian is poorly represented by plants and the Early Carboniferous and younger deposits are well represented.

Chandra and Singh completed identification of 250 impression and compression specimens from ten locations in Ramkola-Tatapani area. Besides, photography of Triassic forms other than *Dicroidium* was done and cuticular preparations of the genus *Dicroidium* and it's microphotography was studied. Four plant fossil assemblages indicate Barakar age on the basis of presence of *Gangamopteris* and narrow meshed forms of characteristic *Glossopteris* species. Two assemblages indicate Raniganj affinities on the basis of characteristic broad meshed leaves. Two assemblages are characterised by the presence of *Dicroidium* and are placed in Triassic representing Panchet Formation. Bulk maceration of 8 samples belonging to Permian and Triassic age was completed. Sorting of megaspores from 3 samples is progressing.

Singh studied and compiled fossil plant biodiversity trends in Mahanadi Basin during Gondwana. It is observed that in Permian times low diversity of plants is noticed during Early Permian Talchir and Karharbari formations and maximum diversification alongwith fructifications occurred during Late Permian (Kamthi Formation). During Mesozoic, diversification of plants is noticed only during Early Cretaceous, while other formations are either devoid of plants or sediments are not deposited. A paper on this aspect was documented.

Srivastava and Anand-Prakash studied the

palynology of sediments exposed along Deona *Nala* in Tatapani-Ramkola Coalfield (M.P.) The spore assemblage, characterised by *Scheuringipollenites maximus* dominance, indicates Lower Barakar affinity.

Tripathi analysed palynologically subsurface samples from bore-hole TCP-24 (depth 27-126. m), Talcher Coalfield (Orissa). The yield and preservation of spore and pollen in most of the samples is not good. The quantitative analysis indicates dominance of striated bisaccates *Striatopodocarpites* and *Crescentipollenites.* The other important taxa present are *Verticipollenites, Striatites, Densipollenites, Striamonosaccites, Striasulcites, Weylandites* and *Guttulapollenites.* The presence of *Arcuatipollenites, Krempipollenites* and *Alisporites* in the upper part of the run at 27.00 m depth impart qualitative characteristic to the assemblage. The composition of palynoflora represents *Densipollenites magnicorpus* palynozone. Outcrop samples representing Kamthi sediments from Binjsaur *Nala* in the field were also analysed palynologically. Due to poor yield of palynomorphs nothing conclusive could be commented upon.

A new acritarch genus *Talcheridium* is instituted from Early Permian sediments of Talcher Coalfield. It accommodates hollow, pear-shaped ovoidal to subcircular with punctate infrastructured, thin, two layered wall, vesicle beset with ornaments of varied shapes and sizes which do not communicate with the vesicle interear, produced by outer layer, having persistent peripheral compressional fold sometimes with distinct meridional fold also having an irregular opening at one pole. The two layered structure of the wall is similar to that seen in early dinoflagellates.

Vijaya investigated the Mesozoic succession in bore-hole PGD-4 of Panagarh sub-basin, West Bengal for its palynological dating. In between 258.30 and 383.30 m thick strata comprising Rajmahal and Panchet formations, has yielded three palynoassemblages. The oldest assemblage *Striatopodocarpites- Densipollenites* (at 383.30 m depth) evidence the proximity of Upper Permian (Raniganj Formation) coal deposits. The greyish-green sediments (310.50-358.25 m) designated as of Panchet Formation contain scanty occurrences of *Callialasporites- Araucariacites,* which indicates Jurassic affinity in this part. In the Intertrappeans of Rajmahal Formation (258.30-309.10 m), *Cicatricosisporites australiensis, Aequitriradites spinulosus, Crybelosporites stylosus* in association of other trilete spores are present, which reveal Tithonian-Berriasian age. The significant finding in this part of sub-basin, that is towards the eastern margin, is the slow sedimentation of Jurassic deposits.

Ram Awatar identified four palynoassemblages in bore-hole SSL-4 from Sohagpur Coalfield, M.P. They are (i) *Faunipollenites-Striatopodocarpites* Assemblage Zone (73.00-194.00 m; Middle Pali = Raniganj), (ii) *Faunipollenites-Scheuringipollenites* Assemblage zone (194.00-203.60 m; Upper Barakar), (iii) *Scheuringipollenites barakarensis* Assemblage zone (203.60-281.20 m; Lower Barakar), and (iv) *Plicatipollenites-Parasaccites* Assemblage zone (281.20-299.00 m; Upper Talchir). Besides, photodocumentation and quantitative analysis of B.H. SKM-6 from the field have also been completed. Collected bore-core and outcrop samples from Sohagpur and Mand-Raigarh coalfields.

Meena processed 50 samples collected from Basundhara *Nala* section from near northern side of Gopalpur Village, Ib-River Coalfield. Prepared slides of each productive samples and completed scanning and photography of important palynotaxa. The results have been finalized. Also completed quantitative analysis and correlation of bore-holes IBT-2, 3 and 7 from Tangadih block, District Jharsuguda, Orissa. Finalized palynological results and prepared manuscript. Finalized palynological data of bore-hole RGP-7 from Mand-Raigarh Coalfield, M.P. Also visited Ib-Himgir Basin coalfields, Orissa for collection of samples.

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

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

Srivastava and Tewari studied plant fossil from Rawanwara open cast mine, Rawanwara Khas and Rawanwara 14/15 mines of Pench Valley coalfield, Satpura Gondwana Basin. The flora is represented by the species of *Gangamopteris, Glossopteris, Euryphyllum, Palaeovittaria, Noeggerathiopsis,* seeds and scale leaves. Systematic study and specific delineation of different forms are in progress.

Distribution pattern of different forms of *Glossopteris* flora in Lower Gondwana formations of India are also studied. Data are compiled in computer to prepare bar diagrams and charts. The association, development and extinction of different elements are discussed from Lower to Upper Permian. Comparative distribution of *Glossopteris* flora in other Gondwana countries has also been discussed

Kumar studied the palynofossils of Denwa Formation exposed south of Anhoni village in Satpura Basin. Out of 7 samples from the artisan well-cutting, 4 clay samples are found productive. Sample no. 3 (between 13.60-13.90 m depth from surface) possesses significant forms such as *Minutosaccus crenulatus* and *Chordasporites australiensis.* Sample no. 4 (11.20-11.50 m) characterised by dinocysts Type A in dominance, whereas it has *Samaropollenites speciosus, Rimaesporites potoniei* and *Brachysaccus indicus* which are characteristic forms of Late Triassic. Sample no. 6 (7.00-7.30 m) also possesses dominance of dinocyst Type A with Type B along with characteristic Triassic pollen. Sample no. 7 (between 6.30-6.60 m) contains the dominance of *Brachysaccus indicus* pollen. These characteristic forms are also known from the Upper Triassic beds of Tiki Formation of South Rewa, Palynoassemblages B and C of Dubrajpur Formation of Rajmahal Basin and Krishna-Godavari Basin of Andhra Pradesh, India and Oppel zones, *S. speciosus* and *A. reducta* of Carnarvon Basin of north-western Australia.

Mallophagan type of parasitic (external) insects with branched hairs on the body and cuticles with long to elongate hairs have been recovered from the matrix of Bagra conglomerates and clays of Denwa beds (Upper Triassic) in Satpura Basin.

Jha studied palynology of the sub-surface samples (bore core and mine samples) from different areas in Kothagudem sub-basin of Godavari Graben which have revealed the presence of Karharbari, Barakar and Raniganj palynoassemblages. Existence of two coal horizons, one belonging to Early Permian (Barakar) and the other to Late Permian (Raniganj) have been observed in Rampur area. Late Permian palynoassemblage dominated by striate disaccates, chiefly *Striatopodocarpites* + *Crescentipollenites* have been identified at 54.60 m in bore-hole GKGD-27 in Rampur area.

Bhattacharyya macerated the bore-hole (NR-3) samples from Nanduri Block of Wardha Basin. At 179-181 m, the palynoflora is dominated by *Scheuringipollenites* and many tetrads of different forms. They are the best indicators of climate and temperature. The coal seams represent a *Scheuringipollenites* dominated assemblage along with high percentage of *Parasaccites.* The coal seams from Kondha (KR-61 and 62) represent almost same flora. The two coal seams have been correlated and found to be of Lower Barakar affinity. At 191-192 m *Parasaccites* dominated mioflora have been recorded.

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, Gujarat basins*

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

Banerji and Jana sectioned large number of

chert pieces from Sonajori locality of Rajmahal Basin. Numerous slides have been prepared and examined for identification of plant taxa on the basis of morphological and anatomical features. A few well preserved mature female Araucarian cones, Araucarian root, shoots and Pentoxylalean cones (female) have been recognised in the assemblage.

Araucaria mirabilis (Spegazzini) Windausen-ovulate cone from Sonajori, Rajmahal Hills, Bihar

Section cutting and examination of Nipania cherts are also in progress. Fresh collection of megafossils from Gumapahar locality has also been investigated. The assemblage confirms the presence of five taxa viz., *Phyllopteroides, Rienitsia, Ptilophyllum, Anomozamites* and *Taeniopteris*. The genus *Rienitsia* is recorded for the first time in India from this Basin. Also visited various fossil localities in Rajmahal Basin and collected petrified plant megafossils.

Tripathi analysed Dubrajpur sediments for palynodating in bore-holes RJU-5, (Pachwara Coalfield) and RJMC-4 (Chuperbhita Coalfield) from Rajmahal Basin. The assemblage is dominated by *Callialasporites/Podocarpidites*. The search for stratigraphically important taxa shows stray occurrence of *Murospora, Aequitriradites, Cicatricosisporites, Coptospora,* etc. The composition indicates Late Jurassic/Early Cretaceous age relationship.

Jana studied the plant assemblage collected from a new locality by the side of Morvi-Wankaner Road which has revealed the presence of *Cladophlebis* sp., *Pagiophyllum* sp. and *Brachyphyllum* sp. Unlike many other localities of Dhrangadhra Formation, this plant assemblage also shows the dominance of conifers (*Brachyphyllum*). The study of plant assemblage from a new Fire Clay Quarry near Than shows the exclusive occurrence of the genus *Isoetites* in the assemblage. The leaves of the genus are with entire margin. This genus was not known from Dhrangadhra Formation, so far. But it has been recorded from many Mesozoic localities of Kutch Basin.

Rajanikanth investigated plant megafossils collected from the Gangapur Formation, Pranhita-Godavari Graben. Significant morphological changes in various *Elatocladus* leaf fossils have been noticed. Two groups of leaves short and long have been categorised. A new species *Taeniopteris longifolia* has been instituted. Plant fossils of Lameta Formation, Pisdura have also been investigated. *Araucarites* along with dicot and monocot leaves have been recorded. A *Glossopteris* dominant assemblage with pteridophytes was collected from Pisdura has been systematically categorised and studied.

Prakash carried out the morphotaxonomic studies of palaeofloristics of Gollapalle Formation. The recovered genera and species are *Cladophlebis* sp., *Pachypteris indica, Taeniopteris spatulata, Bucklandia* sp., *Williamsonia kakadbhitensis, W. blandfordii, Elatocladus* sp., *Pagiophyllum gollapallensis, Brachyphyllum sehoraensis* and *Araucarites minutus*. In general, the assemblage is dominated by conifers and cycadophytes. The Gollapalle floral assemblage is contemporaneous to Sehora floral assemblage of Jabalpur Formation.

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

Shyam C. Srivastava & Neeru Prakash

Analysis of cutinized membranes of fertile structures has revealed two major types of fruiting bodies: the first type consists of epidermal cells showing smooth surface wall, whereas the other type possessing surface hollow-crescent or varied shaped papillae usually interspersed with wrinkles or creases all over the cell walls. The observation has been based upon nearly 300 specimens collected from bulk maceration. Morphographically both the types are quite distinct. Some of the specimens have been found to be attached to the rachis. But none of the specimens has shown any connecting fruiting structure whether seed/pollen bearing. Perhaps during the maceration pollen or seed organs have been shed off because of being delicate in nature. Text-figures and photodocumentation of fruiting structures have been completed. Their affiliation to the plant organs described from Nidpur bed has been attempted on the evidence of epidermal correlations. The photodocumentation of foliar forms depicting taeniopteroid venation appearing to be of cycadean affiliation have also been completed. Their cuticular processing has been done.

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

A.K. Sinha

Finalized the first palaeobotanical and geochemical data from eastern Karakoram to support the concept of accretion or mosaic tectonics to the Karakoram Block. For the purpose of palaeobotanical studies, samples were collected from plant fossil bearing horizon of Chhongtash Formation of Karakoram Tethyan Zone. The fossil bearing grey-brown sandstone is lying just above the pillow lava horizon, constituting the uppermost part of the formation. Presence of plant fossils *Noeggerathiopsis* sp., *Samaropsis* seed, ?*Gangamopteris* leaf impression and Equisetalean stem shows similarity with known Lower Gondwana Talchir assemblages of Indian subcontinent and Bacchus Marsh Tillites of Australia of the Early Permian age. The palynological assemblage is dominated by monosaccates and followed by bisaccates; which is very much similar to the basal Early Permian assemblages of India and Australia. Thus, on the basis of total absence of *Glossopteris* and the presence of Early Permian palynomorphs, the rocks of Karakoram shows Lower Gondwana affinity.

Petrographical observation show the presence of fresh grains of feldspar as found in glacial sediments. Besides, the rocks are also characterised by the occurrence of marine fusilinid which can be correlated with the marine Permian sequence of Salt Range in Pakistan and Arunachal Pradesh in Indian subcontinent. So far the Salt Range is concerned, it occupies an intermediate position between the Indian subcontinent and the Himalaya. It is therefore, postulated that the accreted terrane of Karakoram was not very far offshore from continents to which they are fused in its incipient.

Geochemistry of Karakoram batholith reveals that it is a composite granitic body and are granite, granodiorite and quartz-monzonite in composition. These are sub-alkaline to calc-alkaline, metaluminous as well as peraluminous rocks having both alumino-cafemic and cafemic magmatic rock associations. According to Alumina Saturation Index, the Karakoram batholith have both 'I' and 'S'-types, suggesting both infracrustal as well as supercrustal parentage. In trace element tectonic discrimination diagram, the Karakoram granitoids are pointing out in Volcanic Arc Granitoid and Syn-Collision Granitoid fields, which further suggests that Karakoram batholith have at least two phases of magmatism. An older metaluminous ('I'- type) subduction related arc magmatism of Jurassic-Early Cretaceous period having close affinity with continental arc granitoids of Baldwin and Pearce (1982). However, other peraluminous, ('S'-type) type represents the Syn-

Collision magmatic phase dated as 83±9 Ma age. Both of these magmatic phases are older than plutonism associated with the Indus Suture Zone. This further confirm that the accretionary and collision processes in the Karakoram region must have initiated prior to the India-Eurasia collision along the Indus Suture Zone (55-60 Ma). The successive episodes of magmatic phases must have acted as 'stitching' plutons for the accretion of Karakoram terrane with the Indian Plate. However, the above discussed data provides evidence to advocate that the Karakoram terrane belong to Gondwanian blocks, rifted away from Gondwana during the Late Palaeozoic and accreted along the southern Eurasian margin before final collision with the Indian Plate.

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

The insects and other related organic remains embedded in resin were studied for the first time from India. The insects include *Psylla* of the Order Hemiptera, *Ophion* of the Order Hymenoptera, insect galls, Chrysalis stage of insect belonging to the Order Lepidoptera and the mandibles of ants. The productive resin has been collected from the Upper Tertiary sediments exposed in the Mahuadanr Valley, Palamu, Bihar. A number of insects and other related remains were also recovered from the resin samples collected from the Upper Tertiary lignite beds of Kerala Coast. It includes a male culex mosquito, larval form of Beetle and galleries and chambers of Ambrosia Beetle. The productive resins from both the areas are excellent materials for the study of fossil DNA.

Resin embeded male culex mosquito from the upper Tertiary sediments of Kerala Coast

The dispersed organic matter types were studied from the Neogene sediments of Mahuadanr Valley. It has indicated that amorphous, structured terrestrial and biodegraded terrestrial organic matter represent the dominant types followed by the black debris and fungal fruiting bodies. The dominance of amorphous organic matter suggests the prevalence of reducing conditions, particularly during the deposition of lower part of the sequence. However, the characteristic presence of black debris and fungal fruiting bodies in the upper part of the unit indicates a gradual increase in oxic conditions. The organic matter dispersed in the Neogene sediments has also been studied from Amberivadi and Kalvivadi areas of Maharashtra Coast. It has shown the dominance of woody fragments, biodegraded terrestrial and granular amorphous organic matter types. In general, the study indicates that the deposition of sediments has taken place in shallow coastal depressions.

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

Studied microconstituents of Karharbari coals, represented by Lower and Upper Bachra seams from Ray-Bachra and Churi mines of the North Karanpura Coalfield, to assess the nature and composition of coals. The coals have variable proportions of macerals and mineral matter association. The coals dominantly contain mixed (vitrinite-rich as well as inertinite-rich) and fusic coal types and are of poor quality. The Ro max. values from 0.40% to 0.54%, determined through reflectance measurements on vitrinite particles, indicate that the coals have attained sub-bituminous to high-volatile bituminous C stages (low rank). On the basis of the rank and composition, the coals have been found to be unsuitable for coal bed methane prospect.

(II) Biopetrology of Wardha-Godavari Valley coals

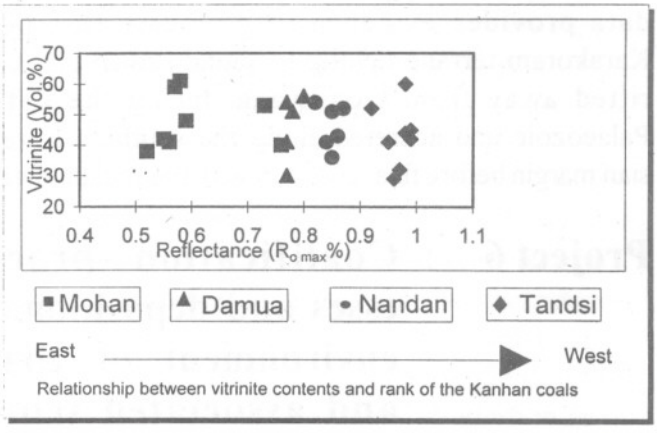
O.S. Sarate

The coal samples representing Kondha and Nanduri blocks, Wardha Basin have been investigated. The study has revealed that the coals of both the areas, in general, can be classified under fusic or inertinite-rich and mixed coal types. A comparative maceral study has revealed that the coals of Kondha Block are of better quality than the Nanduri Block as they contain less mineral matter and high liptinitic and vitrinitic contents. The reflectance analysis has indicated that both these coals have attained sub-bituminous A to high volatile bituminous C stages of rank. Exsudatinite has been frequently observed in durite-rich coals through cracks in vitrinite. The coals of Kondha Block are also thermally altered as oxidation rims are observed, besides cracks in vitrinite.

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

Alpana Singh & B.D. Singh

Studied microconstituents and determined the rank of coals from four underground mines (Mohan, Damua, Nandan and Tandsi) of Kanhan area under



Relationship between vitrinite contents and rank of the Kanhan coals

normal incident light. In general, the bright banded coals are found to be rich in the macerals of vitrinite group (vitric and fusovitric coal types) followed by the inertinite and liptinite groups. Coals from all the four mines are almost similar in respect to average contents of vitrinite (42-47%), inertinite (33-35%) and liptinite (10-11%). Likewise, their vitrite, clarite, vitrinertite and duroclarite microlithotypes are high. The mineral matter content is recorded persistently in low amount (4-15%) in these coals.

The rank values (Ro max. 0.52%-0.99%), determined by reflectivity measurements on maceral vitrinite, indicate that the Kanhan coals have attained high-volatile bituminous A and B stages. A westward increasing trend in rank (Mohan: 0.61%—Tandsi: 0.97%) has been observed. On the basis of nature and composition of coal macerals and rank, these Early Permian Barakar coals have been found to be within the threshold zone of methane generation; especially in the western part (Nandan-Tandsi sector) of the Kanhan area.

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

Rakesh Saxena & Jyotsana Rai

Thirty six bore core coal samples were crushed, pellets prepared, ground and polished. Coals belonging to seam I to seam IV of different bore cores were studied under fluorescence mode which suggest them to be rich in liptinite group of macerals. Vitrinite is mostly represented by desmocollinite. Pyrofusinite and corpocollinite were also recorded in these coals. Fluorescing tendency of vitrinite suggests their low rank nature. Infra-red studies of selected coal samples have suggested the dominant peaks at 2800^{cm-1} - $3000\ ^{cm-1}$ which indicates low rank coals.

Component 3 : Sedimentary organic matter characterization of Indian lignites

Rakesh Saxena & Jyotsana Rai

Selected lignite samples were processed for the pellet preparation and for IR studies. The qualitative studies of various microconstituents under fluorescence mode were carried out which suggest the richness of these lignites in liptinitic group of macerals, besides huminitic contents. The characteristic algal association suggest them to be formed under autochthonous condition. Resin bodies associated with other microconstituents viz., inertinite, huminite, sporinite were also recorded. Preliminary infrared studies have shown definite peaks at 1600^{cm-1} which indicates the presence of hydroaromatic complexes in these lignites.

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

B.K. Misra

Out of 36 samples only 15 samples from 60 feet seam of Tikak Colliery (Makum Colfield) were studied under normal incident mode. The coals have high amount of vitrinite (58-72%), dominated by desmocollinite. Among the liptinite macerals (up to 15%) resinite is the dominant maceral followed by sporinite, cutinite and suberinite accompanied with low amount of exsudatinite and fluorinite. The inertinite macerals range between 9 to 15% with common presence of fungal sclerotia, spores and hyphae. Pyrite is the dominant mineral present. Calcite and clastics are generally in low amounts. The observations were also made on 25 samples of Disang shales from Manipur, under incident fluorescence mode and 20 samples of Brail shales (Borholla and Champang), under normal transmitted light.

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

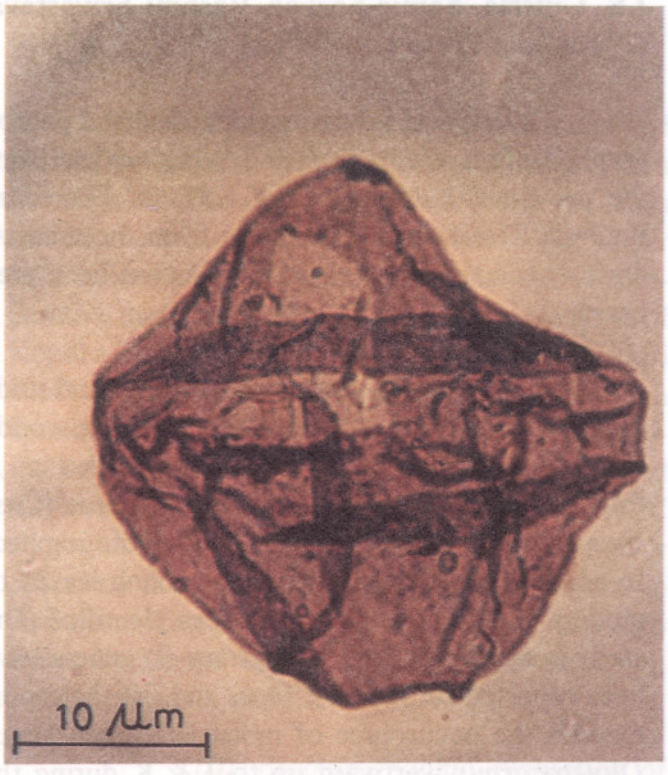
Guleria and Srivastava identified and photographed a fern *Arthromeris* and *Syzygium* leaf from the pre-Siwalik sediments of Kasauli, Himachal Pradesh. These are new records from the area. A draft manuscript on the leaf remains has been prepared.

A number of fossil woods were cut and studied from the Tertiary sediments of J & K. The woods belonging to Dipterocarpaceae (*Dipterocarpus* spp.), Euphorbiaceae *(Bischofia)* and Leguminosae (*Cassia* and *Sindora)* were identified and photographed. In addition, a leaf impression resembling leaves of modern *Dipterocarpus* has also been identified. The study is significant for two reasons: (i) genera have been reported for the first time, and (ii) the report extends the occurrence of moist evergreen genus *Dipterocarpus* westward up to J & K during the Upper Tertiary which is confined to Assam in the

northern region today. The material was provided by GSI, Jammu. A paper dealing with the woods was finalised.

Sarkar recovered spores of the Zygomycetes fungi *Glomus* in palynofloral assemblages from the Early Ypresian sediments in Subathu Formation of Banethi-Bagthan areas of Shimla Hills. This is the earliest record of vesicular arbuscular mycorrhizal fungi from the Tertiary rocks of Lesser Himalayas. The palaeoecologic significance of these fossils is interpreted in the light of ecologic distribution of their extant analogue. Stratigraphic distribution of this group of fungi in Indian Tertiary sediments have also been critically evaluated.

Sarkar and Prasad studied palynofloral assemblages recorded from the Subathu Formation (Ypresian to Lutetian) of Koshalia *Nala* Section, Shimla Hills, for biostratigraphic correlation and palaeoenvironmental interpretations. The vertical distribution of dinocysts indicates that the present succession is correlatable with the *Homotryblium, Cordosphaeridium* and *Thalassiphora* Assemblage Zones of Subathu Formation of other sections of Shimla Hills. The palynofloral assemblages indicate rather fluctuating condition of deposition in a shallow near shore marine environment.



Lejeunacysta hyalina (Gerlach) Artzner and Dörhöfer a dinocyst recorded from late Ypresian sediments of Morni Hills, Haryana.

A rich palynoflora consisting of dinoflagellate cysts, spores and pollen has been recovered from a measured section (Kharak Section) of Subathu Formation exposed in Morni Hills, Haryana. Dinoflagellate cyst genera *Homotryblium, Cordosphaeridium, Thalassiphora* and *Hystrichosphaeridium* are the most significant taxa in the assemblage. Based on palynofloral analysis two distinct palynological zones have been recognised. Distributional patterns of palynological assemblages have been integrated and plotted against the global NP Zones. The overall assemblage suggests that these rocks were deposited in a very shallow marine near shore environment with occasional influence of the open sea in the older horizons. The younger horizons appear to have been deposited in highly reducing environment. The recorded palynofossils indicate a late Early Eocene-early Middle Eocene age of the Subathu succession in the present area. The inferred palynological age, in general, is in agreement with the faunal age determination.

Chemical processing of the Subathu samples from Lain and Jangalgali sections and Larren Beds (Murress) J & K were also carried out. Samples are extremely poor in palynofossils, however several DOM rich horizons have been located in succession of Lain. Evaluation of DOM is now being carried out.

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

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

Rao completed morphotaxonomy and identification of spore-pollen recovered from Jassur-Nurpur and Jwalamukhi-Kangra Road section. The palynoflora is mainly represented by *Pinuspollenites* (Gymnospermous pollen) and *Striatriletes* and *Lygodiumsporites* (Pteridophytic spores). Angiospermous pollen are poorly represented.

A field trip was also undertaken to study various Siwalik sediments exposed in Panchkula and adjoining areas (Upper Siwalik sediments) and Morni Hills, Haryana; Kala-Amb area, Una District; Bilaspur, Haritalyangar and adjoining areas, Bilaspur District and Jwalamukhi-Ranital-Kangra Road section (Middle Siwalik sediments) Kangra District, Himachal Pradesh and collected samples (183) for palynological study.

Tripathi chemically processed rock samples (40) from Middle Siwalik sediments exposed around Jammu for the palynological studies. Recovery of palynofossils was generally poor. The assemblage is dominated by gymnosperm pollen. The pteridophyte spores and angiosperm pollen are rare. Occurrences of pollen belonging to the families Ctenolophonaceae, Malvaceae and Magnoliaceae are the characteristic features of the assemblage. Algal cysts and epiphyllous fungi are recorded in fairly good number.

Prasad studied 25 fossil woods collected from the Lower Siwalik sediments of Nalagarh, Himachal Pradesh. Most of them are duplicate belonging to the genus *Dipterocarpus, Cynometra, Cassia, Diospyros* and *Terminalia*. Only two woods seem to be new. The leaf impressions from Bilaspur and Ranital of Himachal Pradesh have also been processed and photographed. Some of them belong to the families Rhamnaceae, Fabaceae and Palmae.

Leaf impressions collected from Lower Siwalik sediments of Koilabas have been studied in detail comparable to 25 extant taxa belonging to 22 genera of 16 families. In this assemblage the fabaceous taxa are found in abundance and represented by 6 species, i.e. *Pongamia glabra, Dalbergia cultrata, D. volubilis, Millettia brandisiana* and *Cynometra erripa.* The analysis of present day distributions as well as habit and habitat of the assemblage indicate that most of them are evergreen taxa (16 species) and distributed in NE India, Java and Borneo; which suggests the prevalence of evergreen forests under warm humid climate around Koilabas in the Himalayan foot-hills as compared to mixed deciduous forest in the area today. Further, the presence of dipterocarpaceous, such as *Shorea trapizifolia, Anisoptera borneonsis* and *Dipterocarpus turbinatus* in this assemblage which are not found today in the foot-hills suggest that they have migrated to suitable land mass like Malaya, Java, Borneo and Myanmar, most probably due to climatic change from Miocene onward.

The study on already identified fossil woods from Siwalik sediments of Tanakpur area is being continued. The fossil woods were measured and described. Visited Siwalik localities in the Himalayan foot-hills near Koilabas, Seria Naka, Khangra Naka, Gorau (at Indo-Nepal Border) in Balrampur District of Uttar Pradesh. A lot of well preserved leaf and fruit impressions were collected. In all the localities outcrop sections were measured and photographed to show the nature of the rocks.

Trivedi processed 74 palynological surface rock samples from Dafla and Subansiri formations from Bhalukpong-Bomdilla Road section, West Kameng District, Arunachal Pradesh. Out of 21 samples from Dafla Formation, 5 were found to be productive, while out of 53 samples from Subansiri Formation only 3 were productive. The yield and preservation is very poor, therefore, nothing can be interpreted for Subansiri Formation. The forms identified to this effect are *Polypodiaceaesporites, Podocarpidites, Frasnacritetrus,* etc. Samples from Dafla Formation yielded Tertiary palynofossils like *Palmaepollenites, Striatriletes* and Palaeozoic *(Lunatisporites)* and Mesozoic (*Callialasporites*) palynofossils. Slides of the productive samples were prepared, scanned and photographed. Some new species of genus *Striatriletes* have been recovered. Sufficient palynodata has been generated. Tropical to subtropical, moist warm humid climate prevailed at the time of deposition of the Dafla Formation with fresh water ponding conditions prevailed near the site of deposition. This is supported by the presence of *Striatriletes* in good number and fungal elements. Reworked Permian and Lower Cretaceous forms in the assemblage indicating that the Gondwana sediments were near by and were the source rocks for the younger Tertiary sediments. Relevant literature for the area (Siang and Subansiri districts of Arunachal Pradesh) was consulted and undertook field work in the regions.

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 rich palynofloral assemblage, consisting of dinoflagellate cysts, fungal remains, pteridophytic spores and gymnospermous and angiospermous pollen, from the Siju Formation (Middle Eocene) exposed in Simsang River section (about 500 south-west of Siju Songmong) and Siju Cave section in South Garo Hills, Meghalaya. The palynoflora is dominated by dinoflagellate cysts, whereas spores-pollen are subordinately represented. Three species: *Cleistosphaeridium siguensis, Collumosphaera garoensis* and *Thalassiphora indica* are proposed as new from the palynoassemblage. The assemblage has been studied for assessing biostratigraphic and palaeoenvironmental significance. The Siju Formation was laid down over the unstable shelf in a shallow sea. Variation in facies and thickness of the formation indicates sea floor oscillations. The terrestrial microflora, including spores-pollen and fungal remains, derived from inland through water channels indicates tropical warm humid climatic conditions. Representation of *Areoligera undulata, Areospharidium arcuatum, Distatodinium ellipticum, Homotryblium floripes, etc.* suggests a Middle Eocene age for the Siju Formation. A manuscript incorporating this study is being finalized. Chemical processing of samples belonging to the Siju Formation of a stream section at Jenggitchakgre, about 10 km from Tura on Tura-Dalu Road, West Garo Hills has also been done and slides of the productive samples have been prepared.

Mehrotra visited various Oligocene localities of Assam and collected a large number of leaf and fruit compressions/impressions. Some of them are nicely preserved alongwith their cuticle. A manuscript dealing with 10 fossil woods collected from Upper Tertiary sediments of Siang and Subansiri districts, Arunachal Pradesh was finalized. A few leaf impressions collected from the Tirap District were studied in detail and a manuscript on the same was prepared. About 10 leaf impressions collected from the Tura Formation of Garo Hills were also identified and a manuscript dealing with the same was finalized. Samples collected from the Mikir Hills and Jowai-Badarpur Road were cleared and photographed.

Kumar macerated 32 samples collected from exposed measured sections from Koilajan, Saraijan, Digboi, Maja *Nala* (Karbi Anglong and Golaghat districts, Assam). A rich palynofloral assemblage consisting of spores-pollen, fungal fruiting bodies and palynodebris were recovered. The slides of productive samples have been scanned. Also undertook a field excursion to various fossil localities in Sibsagar, Dibrugarh and Tinsukia districts of Assam. 261 rock samples were collected on measured sections.

Mandaokar investigated samples from Surma sediments well exposed along the Ramrikawn quarry, Chandmari area, Mizoram. The palynoflora is dominated by pteridophytic spores followed by angiosperm and few gymnospermous pollen grains. Few fungal remains are also present. The assemblage also contains reworked Permian palynofossils. The presence of *Striatriletes, Malvacearumpollis, Graminidites, Todisporites, Compositoipollenites, Pteridacidites, Tricolporopollenites, Dangripites, Spinizonocolpites,* etc. shows diversified plant communities. The palynoflora suggests an Early Miocene age for studied sequence. The present day distribution of families represented by pteridophytic spores and abundance of fungal remains (*Multicellaesporites, Trichothyrites, Cucurbitariaceites)* indicate tropical-subtropical warm humid climate. *Spinizonocolpites* referable to coastal element *Nypa* suggests near shore environment of deposition. The composition of palynoflora indicates the existence of brackish water swamp and prograding delta complex with fresh water influx. Also visited various Tertiary localities in Nagaland and Mizoram and collected 175 rock samples for palynological studies.

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 a number of Neogene wood samples from Kutch, Gujarat. They were mostly found duplicates of already known genera, such as *Terminalia, Millettia-Pongamia, Cynometra* and *Dipterocarpus*. In addition, some woods from Infratrappean sediments of north western Kutch were also studied and most of them were found to be gymnospermous woods. These woods from the Infratrappean beds are being reported for the first time. Some fossil woods collected for the first time from the Eocene sediments of a lignite mine near Surat were also cut and studied. They were found to be dicot woods but could not be identified further due to poor preservation.

Ambwani processed lignite samples belonging to bore-hole SV-70 (Mine III) of Neyveli Lignite, Tamil Nadu and the rich and varied spores-pollen assemblage belonging to fungi, pteridophytes and angiosperms was recovered. *Diadosporonites constrictus, Inapertisporites kedvesii, Pluricellaesporites catanatus, Frasnacritetrus* sp. belong to fungi and *Dictyophyllidites grandulatus, Schizaeoisporites digitoides, Polypodiaceaesporites pandus* belong to pteridophytes. The assemblage is dominated by pollen of angiospermous group. The assemblage recovered was employed to determine the age of lignite sediments. Photography related to above work was completed. Histograms indicating qualitative and quantitative representation of taxa have also been prepared.

Mandal completed palynological investigation of the type section of Naredi Formation (Early Eocene) of Kutch Basin. The Palaeocene taxa like *Matanomadhiasulcites, Kielmeyerapollenites, Neocouperipollis* are common in the basal part, while *Meliapollis* and *Margocolporites* increase quantitatively in the upper part (above the glauconite bed). *Lakiapollis, Cheilanthoidspora* dominate in the middle part of the section. *Botryococcus*, mangrove elements and dinocysts are evenly distributed. Another section, situated 4 km east of type section, which lies over the trap has also been worked out. The major constituents of the assemblage are similar with the basal part of type section but the frequency of dinocysts and genera like *Retitrilatiporites, Cheilanthoidspora* and *Neocouperipollis* differ greatly. The section seems to represent the basal most part of Naredi Formation.

A fossil alga belonging to family Rivulariaceae has been recovered from the Panandhro lignite (Early Eocene) quarry of Kutch Basin. The colony is characterised by a number of sheathed, erect and parallel trichomes with heterocysts. The alga is recorded from the clay bed overlying the lignite seam.

Rao completed chemical processing of the samples collected from Amberiwadi and Kalviwadi sections, Sindhudurg District and Vidyamandir and Paruchuri wells, Ratnagiri District, Maharashtra. Slides were prepared for the productive samples. Scanning, morphotaxonomy and identification of spores-pollen have been taken up and continued. The assemblage is dominated by fungal remains/ pteridophytic spores and angiospermous pollen. Fungal remains are dominant and are represented by *Phragmothyrites, Notothyrites, Parmathyrites, Kutchiathyrites, Ratnagiriathyrites, Dicellaesporites, Pluricellaesporites, Multicellaesporites*. Pteridophytic spores pertain to *Lygodiumsporites, Striatriletes, Cyathidites, Pteridacidites, Osmundacidites, Dictyophyllidites,* and *Polypodiisporites*. Angiospermous pollen are mainly represented by *Dicolpopollis, Retipilonapites, Dipterocarpuspollenites, Plumbaginacipites, Margocolporites, Compositoipollenites, Malvacearumpollis, Clavaperiporites* and *Verrutriporites*.

Tripathi chemically processed rock samples (30) from Akli lignite mine, Barmer District, Rajasthan for the recovery of palynofossils. Rich and diversified palynofloral assemblages represented by algal cysts, fungal remains, pteridophytic spores and angiospermic pollen were recovered. The assemblage is dominated by angiospermic pollen. Pteridophytic spores are represented as subdominant constituent of the assemblage. Morphotaxonomic studies on the recovered palynotaxa are in progress. A manuscript incorporating results of palynological studies on 17 rock samples from the Thumbli Member of Akli Formation has been finalized.

Singh chemically processed subsurface samples from Quilon, Kerala from which planktonic foraminifera are reported (Singh, A.D. 1998) to recover spores-pollen. The recovered assemblage is correlated with the two planktonic zones ranging from Upper Burdigalian to Lower Langhian planktonic zones. Identified spores-pollen will help to correlate the equivalent Tertiary sediments of Quilon.

Agarwal carried out sectioning and study of 8 petrified woods from Boarding Road, Ratnagiri. Preservation found to be very poor. No structural details could be seen. Sectioning and photography of 10 carbonised woods from Ratnagiri were undertaken and study is in progress. Cuticular study of 4 fossil leaves was also done and slides were prepared and photographed. Study of one fossil fruit from Kalviwadi, Sindhudurg District, was completed and finalized. Study of remaining 2 fruits from Ratnagiri is in progress. Fruits tentatively identified belong to families: Guttiferae, Lecythidaceae and Rutaceae respectively. Also undertook field excursion to Pondicherry, Quilon, Payangadi, Kundra mines, Cannannore, Padappakara, Varkala and its adjoining areas for collection of materials.

Component 3 : *Palaeofloristics of sedimentary sequences associated with Deccan Traps*

R.S. Singh & Rashmi Srivastava

Singh palynologically investigated intertrappean sediments of Padwar and Jabalpur in M.P. and Ramdeo Baba section in Maharashtra. The assemblage recovered alongwith the data published on Maastrichtian sequences of India viz., Lameta, Bengal (subsurface), Meghalaya, Krishna-Godavari (delta) and Cauvery Basin were reassessed. The results of foraminiferal and nannoplankton data of the basins were also considered for the purpose of correlation. It has been observed that *Azolla cretacea, Ariadnaesporites* sp., *Gabonisporites vigouruoxii, Triporoletes reticulatus, Spinizonocolpites echinatus, Aquilapollenites bengalensis (=Striatriporites cauveriana)* are present in most of the localities. With help of these taxa, continental, onshore and offshore sections could be correlated. Palaeobiogeographical position of India during Maastrichtian is discussed on the basis of spores-pollen assemblages.

Srivastava studied and photographed petrified fossil palm woods, leaves, roots and one complete specimen of palm fruit from Ghansaur, Seoni District, M.P., besides dicotyledons represented by two genera *Gomphandra* (Icacinaceae) and *Dryoxylon mohgaonense* (*Sonneratia* of Sonneratiaceae). Palm fruit and dicot woods are being reported for the first time from this locality.

Project 9 : Marine micro-palaeontology of petroliferous basins

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

A.K. Ghosh

More than 250 slides containing thin sections of rock samples (collected from the Tertiary sediments of south-western Kutch) have been prepared and microscopically examined. Detailed morphotaxonomical study of the calcareous algae have been carried out. Photomicrography and identification of the taxa have been done. It has been visualised that coralline red algae *Lithophyllum* and *Mesophyllum* are the chief components of algal flora recorded from the Oligocene sequence. Interpretation of data is in progress and that will highlight biostratigraphy, palaeoenvironment and palaeobathymetry.

Modern analogues of marine algae have been studied in detail in the herbaria of Botanical Survey of India, Industrial Section of Indian Museum (Botanical Gallery of Indian Museum), Calcutta. Huge collection of marine algae done by K.S. Srinivasan has been critically examined for the correlation of fossil calcareous algae with their modern counterparts. Some relevant literature was also consulted in the Palaeobotany-Palynology Section, Botany Department of Calcutta University.

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

A manuscript entitled "Stratigraphic and palaeoenvironmental significance of dinoflagellate cysts from Lakadong Sandstone, Cherrapunji area, Shillong Plateau, north-east India" has been finalized. Another draft manuscript on biostratigraphic potential of dinoflagellate cysts in Late Cretaceous-Palaeogene succession of Meghalaya has been prepared. Documentation of Late Cretaceous dinoflagellate cysts from Weiloi-Mawsynram Road section is also completed.

Analysis of 23 samples of Lakadong Limestone (Late Palaeocene) from Nongthamai section, Cherrapunji revealed poor recovery of dinoflagellate cysts. Samples from Late Cretaceous Mahadek Formation exposed in Mausmai-Shella Road near Kynrem Falls have been chemically analysed and slides were scanned. The samples yielded a meagre dinoflagellate cyst assemblage.

Documentation of dinoflagellate cysts from Naredi Formation, Kutch Basin is completed. A draft manuscript on stratigraphic significance of dinoflagellate cysts from Naredi Formation has been prepared. Processing of samples from Harudi and lower part of Fulra Limestone formations has also been carried out. Dinoflagellate cysts productive levels in upper Harudi and basal Fulra Limestone have been identified.

Garg finalized a manuscript entitled "Calcareous nannofossils across K-T boundary in UmSohryngkew Section, Meghalaya, north-west India." Another draft manuscript on significant calcareous nannofossil events in the Late Cretaceous-Danian succession of Meghalaya is also prepared.

Sawai Bay Formation, North-East Coast section, Neil Island

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

Anil Chandra & R.K. Saxena

Fossil diatom and silicoflagellate assemblages obtained from two sections namely Lacam Point Section and Havelock Southwest Section of Havelock Island have been studied and photodocumented. Inglis Formation is developed in both sections. Both these sections have comparable diatom assemblages which are represented by various species of *Actinocyclus, Actinoptychus, Arachnoidiscus, Azpeitia, Biddulphia, Cocconeis, Coscinodiscus, Diploneis, Auliscus, Paralia, Grammatophora, Gephyria, Stictodiscus, Triceratium, Thalassiosira, Thalassiothrix, Nitzschia, Porosira?, Hemidiscus, Craspepodiscus, Rhaphoneis, Rossiella, Campyloneis* and *Navicula*. Well preserved silicoflagellate taxa are represented by a few species of *Distephanus*, *Dictyocha* and *Mesocena*. The diatom assemblages from the sections of Havelock Island show Miocene age for the Inglis Formation.

A diatom rich and silicoflagellate assemblage from two sections of Neill Island was studied. These sections are Neill East Coast and Neill Nipple Hill sections which are characterised by the exposure of Sawai Bay Formation.

The diatom assemblage is represented by various species of *Actinocyclus, Actinoptychus, Asteromphalus, Asterolampra, Campyloneis, Cocconeis, Diploneis, Paralia, Thalassiosira, Azpeitia, Mastogloia, Coscinodiscus, Hemidiscus, Stictodiscus, Nitzschia, Auliscus, Triceratium, Navicula, Gephyria, Cladogramma* and *Stephanogonia.* Silicoflagellate taxa are represented by a few species of *Distephanus, Dictyocha* and *Mesocena*. Both the diatom assemblages from these sections are identical and indicate a Miocene-Pliocene age for the Sawai Bay Formation. Field data from Little Andaman Island have been compiled. A bibliography covering all publications on the geology of Andaman and Nicobar Islands is under compilation. Attempts are being made to include the abstracts also.

Project 10 : Quaternary vegetation and palaeo-environment

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

Chhaya Sharma, M.S. Chauhan & Asha Gupta

Sharma and Gupta analysed 85 cm deep sedimentary profile (SRT-III) from Saria Tal, Kumaun Himalaya for the content pollen. Pollen diagram shows dominance of non-arboreals over arboreals. Among non-arboreals Poaceae is predominant. Other taxa, viz. Cyperaceae, Urticaceae, Cheno/Ams, Ranunculaceae, Caryophyllaceae, Brassicaceae, Tubuliflorae, *Artemisia*, Apiaceae, Polygonaceae, etc., are in low values. Arboreals show high values of *Quercus* followed by *Ulmus* and *Pinus. Carpinus, Celtis, Salix, Cupressus* etc., are encountered sporadically. Aquatics are represented by *Typha, Potamogeton, Nymphaea, Myriophyllum, Lemna, Pediastrum* with relative abundance near the middle part. Fern spores are in good numbers in the lower part of the sequence. Vegetational scenario reflects mixed Oak forest with warm humid conditions in the area. Also macerated 12 samples of profile SRT-1. Study of surface samples from Saria Tal shows presence of a large number of arboreal/ non-arboreal taxa reflecting the existing vegetation.

Sharma and Chauhan finalized the manuscript of a paper entitled "Late-Quaternary pollen record of vegetation and climate from Kupup Lake (Sikkim), Eastern Himalaya, India". Also prepared and finalised another manuscript of the invited paper (for *Vigyan Prasar)* entitled "Palaeoclimatic inferences from Quaternary palynostratigraphy of Himalaya".

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

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

Bera studied reference slides for pollen morphology of 20 important tree taxa of north east India for the identification of recovered fossil pollen grains. Study of 8 surface samples from forested as well as open land in Mikir Hills has revealed that pollen spectra do not cohere with the present day vegetation attributable to differential pollen and spore preservation and entomophilous mode of pollination in most of the plant taxa. Finalized paper entitled "Modern pollen deposition in Mikir Hills, Assam."

Analysed 1.5 m thick sedimentary profile from Karbi Anglong District, revealing dominance of non-arboreals pollen over arboreals. Among arboreals *Terminalia, Lagerstroemia, Adina,* Moraceae, *Melastoma* and Oleaceae are the chief constituents. The ground vegetation is dominated by high values of Poaceae, Cyperaceae, Asteraceae Caryophyllaceae, etc., *Pinus, Larix, Betula,* etc., are encountered in good values. Also undertook a field trip to the forest region of Lumding and Tinsukia, Assam and collected 3 sedimentary profiles along with 30 modern surface samples from forested as well as unforested regions for palynological studies.

Chauhan completed pollen analysis of a 1.5 m deep sediment core from Jagamotha Swamp, Sidhi

(M.P.). The study has revealed that around 16,000 yrs B.P. mixed open grassland vegetation with scattered trees of *Emblica officinalis*, *Syzygium* and *Terminalia* existed in the region under dry climatic condition. Around 8,000 yrs B.P., the mixed deciduous forests were established with the invasion of some more tree taxa, such as *Adina cordifolia*, *Holoptelea*, *Lagerstroemia*, *Diospyros*, etc., indicating thereby amelioration in the climate. *Shorea robusta* (Sal) appeared around 6,000 yrs B.P. in the forest floristics, however it assumed dominance over other deciduous elements around 2,500 yrs B.P. in response to further improvement in the climate.

Carried out pollen analytical investigation of 8 surface samples from Kerha, Sidhi. The study has shown the dominance of non-arboreals over arboreals. Among the arboreals, *Shorea robusta*, *Madhuca indica*, *Terminalia*, *Adina cordifolia*, *Emblica officinalis*, etc. are recorded in reduced frequencies as compared to their composition in the forest. The under-representation of these taxa could be attributed to their entomophilous mode of pollination. Grasses followed by sedges, *Justicia*, Asteraceae, Cheno/Ams are the major herbaceous elements and the representation of these taxa in the pollen spectra corresponds to some extent with their composition in the ground flora. In general, the pollen spectra do not reflect precisely the extant vegetation in the region. Also pollen analysed 10 samples of a 2 m deep core from Kerha Swamp. The results show good pollen assemblage of both arboreals as well as non-arboreals. *Shorea robusta*, *Madhuca indica*, *Terminalia*, *Emblica offcinalis* are the chief forest constituents. Herbaceous elements such as grasses followed by sedges, *Justicia*, Asteraceae, Cheno/Ams, *Artemisia*, etc., are also recovered in good frequencies. The overall floristic composition denotes the presence of mixed deciduous Sal forest in the region.

Farooqui carried out quantitative and qualitative studies of 5 surface samples which reveal the decrease in number of species with the abundance of *Rhizophora apiculata*, *Avicennia officinalis*, *Acanthus ilicifolius*, *Suaeda* spp. *Salicornia* spp. with rare occurrences of *Excoecaria*, *Xylocarpus*, etc. The palynological study of 40 soil samples from 2 m deep sedimentary profile shows two rhythmic dry and wet climatic conditions. The reconstruction of the past mangrove vegetation indicates the sea level and climatic changes during Holocene. The number of mangrove species have reduced as compared to the present day. However, the dominance of upland vegetation during 3,000-2,200 yrs B.P. indicate the dense forest cover beyond the coastal mangrove vegetation in Pichavaram, Tamil Nadu; which has been probably affected by the anthropogenic activity with the increase in coastal habitation. Studies on the mineral content (Na, K, Mg, Ca and Fe), total organic matter and the total carbonate in the core sediments (20 samples) also attribute to the evidences of sea level and climatic change during the Holocene.

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

Chhaya Sharma & Chanchala Srivastava

Completed chemical processing of a 2 m deep sedimentary profile from Degana Lake site, Nagaur District. Studies have revealed that around 9,000 yrs B.P., the region had predominantly non-arboreal type vegetation comprising Poaceae, Cyperaceae and elements of Caryophyllaceae, Cheno/Ams, Convolvulaceae, Asteraceae, Malvaceae, Ranunculaceae, Urticaceae, Brassicaceae, Primulaceae, Acanthaceae, etc. Among the arboreals, though represented in low numbers, are *Holoptelea*, *Ephedra*, Fabaceae, Mimosaceae, etc. Encountered *Pinus* pollen in the profile is a case of their long distance transportation to the site as it is not the element of Rajasthan desert vegetation. Few fern spores, fungal spores and microforams along with dinoflagellates and acritarchs have also been recovered. Overall pollen assemblage reflects that during this period savannah type of vegetation covered the region under arid climatic conditions. Photographed different taxa encountered in the profile and prepared their photoplates. Also photographed the pollen of extant plant taxa needed to facilitate the identification of fossil pollen of Rajasthan vegetation.

Pollen analysis of 3 surface samples from Degana region has also revealed the dominance of

non-arboreal vegetation as in profile, besides *Xanthium strumarium, Polygonum,* etc. Recovered arboreal taxa are in low numbers such as *Holoptelea, Prosopis, Ephedra, Acacia*, etc. The overall pollen assemblage reflects more or less the true composition of the surrounding vegetation or not very far existing vegetal patches. Chemical processing of a part of a 4 m deep sedimentary profile from Bagundi situated in District Barmer has also been completed. Preliminary investigations revealed very poor recovery of pollen.

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 a cumbersome amount of carbonised botanical remains collected through the archaeological excavations of a wide range of cultural deposits at Imlidih-khurd in Gorakhpur District of U. P. The evidences amply demonstrated a rich and varied plant econmy of Chalcolithic community at the site, during 1600-800 B.C. A rich data on agricultural economy is generated by the identifiable remains of rice (*Oryza sativa*), barley (*Hordeum vulgare*), bread-wheat (*Triticum aestivum*), dwarf-wheat (*Triticum sphaerococcum*), jowar-millet (*Sorghum bicolor*), pearl-millet/bajra (*Pennisetum typhoides*), kodon-millet (*Paspalum scrobiculatum*), lentil (*Lens culinaris*), field-pea (*Pisum arvense*), chick-pea (*Cicer arietinum*) grass-pea (*Lathyrus sativus*), green-gram (*Vigna radiata*), field-brassica (*Brassica juncea*), til (*Sesamum indicum*) and linseed (*Linum usitatissimum*). From the associated remains of weeds and wild taxa, seeds and fruits of *Ziziphus nummularia*, *Ziziphus* cf. *oenoplia*, *Ziziphus cf. mauritiana*, *Setaria* cf. *glauca*, *Chenopodium album*, *Eleusine indica*, *Cenchrus* cf. *ciliaris*, *Indigofera* sp., *Pongamia pinnata*, *Psoralea corylifolia*, *Dactyloctenium aegyptium*, *Rumex dentatus*, *Brachiaria* sp., *Fimbristylis* sp., *Datura* sp., etc., have been identified. A number of seeds and fruits in mutilated condition still remain to be identified, to reconstruct the regional picture of ground vegetation around the ancient settlement.

Fruit and seed remains of anwala (*Emblica officinalis*), haritaki\ chebulic myrabolan (*Terminalia chebula*), bahera/beleric myrabolan (*Terminalia belerica*), grape/raisin (*Vitis vinifera),* basil/tulsi (*Ocimum cf. tenuiflorum*), date (*Phoenix* sp.), nux-vomica/kuchla (*Strychnos nux-vomica*) and rhizome pieces of ginger (*Zingiber officinale*) provide an important archaeological narrative regarding the use of some rational herbal medicines, extolled in indigenous medical systems. Anatomical studies of a large number of wood charcoal pieces was also carried out. Identification of *Madhuca indica* , *Shorea robusta*, *Streblus asper*, *Pongamia pinnata*, *Casearia elliptica*, *Syzygium cumini*, *Holoptelia integrifolia*, *Albizia* cf. *procera*, *Alangium salvifolium*, *Acacia catechu/nilotica*, *Adina cordifolia*, *Diospyros montana*, *Dalbergia sissoo*, *Salmalia malabaricum* and *Bambusa* sp., favour the occurrence of mixed deciduous forest in the region, about 3,500 years ago.

Finalized two manuscripts: I) Plant economy of early farming communities at Senuwar, Bihar, and ii) Plant economy during Kushana Period at ancient Sanghol, Punjab (jointly with A.K Pokharia). A field trip was also undertaken to an ancient site in village Malhar, District Chandoli, U.P, situated on the bank of Karmanasa River in the Vindhyan plateau region. By the active participation in archaeological excavations going on here, a large amount of carbonised botanical material was collected from the cultural deposits, dated to about 1600-800 B.C. Srivastava finalized a manuscript entitled "Ancient plant economy at Mahorana in Sangrur District of Punjab (ca. 2300 B.C.- 200 A.D.)", based on earlier worked out data.

Component 2 : *Tree ring analysis for reconstruction of Quaternary environment*

R.R. Yadav & A. Bhattacharyya

Yadav crossdated tree-ring samples of *Cedrus deodara* collected from Tolma, Joshimath. The ring

widths of precisely dated 47 tree core samples were measured. Tree growth dynamics of individual trees was studied to identify the features common between the trees. Ring-width chronology extending back to AD 1606 was prepared. The statistical properties of the ring width chronology viz., inter-tree correlation, high mean sensitivity indicate the presence of strong climatic signal in the chronology. Ring width/climate relationship study was also carried out to identify the significant climate variables for climate reconstruction.

Ring width chronology of Himalayan cedar prepared by him from Uttarkashi was used to reconstruct mean temperature for previous year October to concurrent year August back to AD 1717. The reconstructed data show significant correlation ($r = 0.50$, $p<0.01$) with the instrumental records. Prepared skeleton plots of tree-ring samples of *Abies pindrow* collected from Dwali near Pindar Glacier. Ring-width of 24 dated tree-core samples was measured. A 366-year (AD 1627-1992) ring-width chronology has been prepared. Ring-width and climate relationship study to identify significant climate variables affecting tree growth is in progress. Also finalized a manuscript on "Temperature variations in the western Himalayan region since late twelfth century AD as inferred from tree-rings"

Bhattacharyya studied tree growth climatic relationship from teak samples collected from Dhekana under Tinmari Forest Circle, Hoshangabad, M.P. A sample of Teak has been dated 112 years. Dating and measurement of tree ring samples of *Cedrus deodara* collected from Kashipur near Malari, Garhwal Himalayas are 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

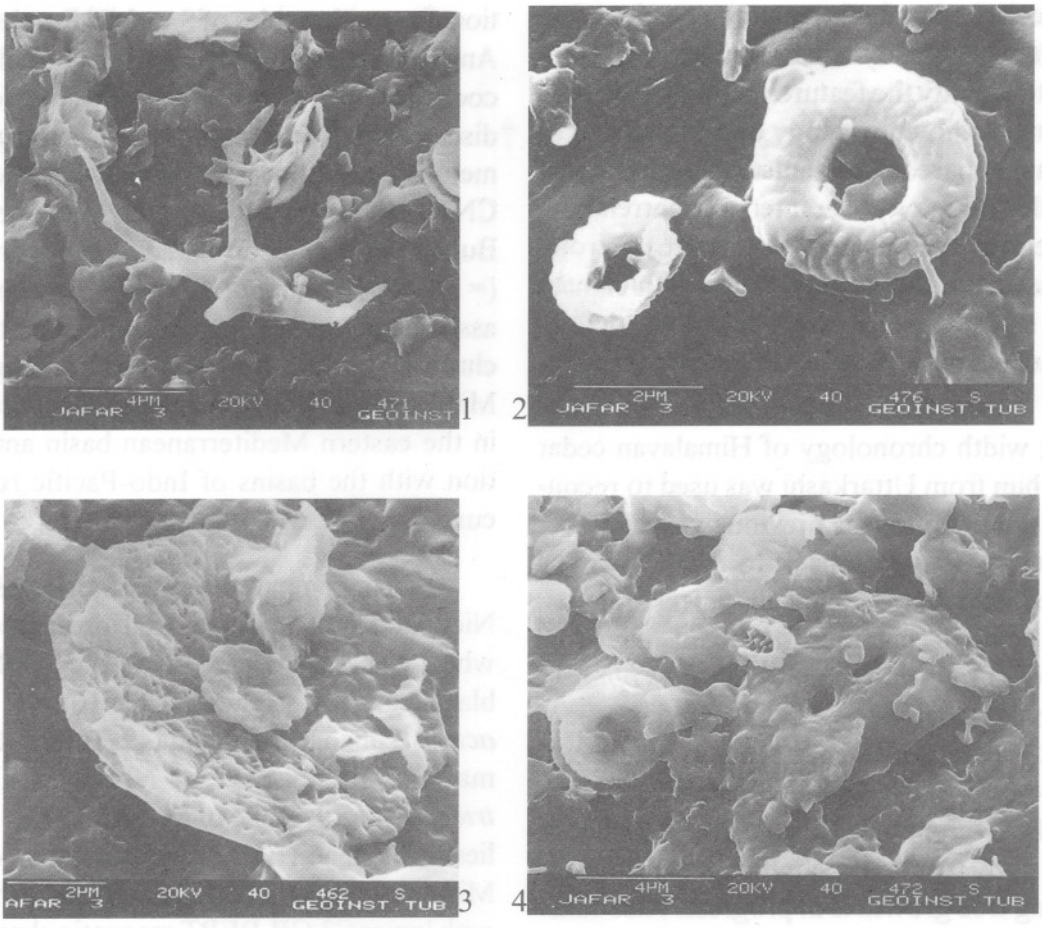
Mud-turbidite samples of Hut Bay Formation, from either sides of Saw Mill Road section, Little Andaman Island, yielded rare and heavily overgrown coccoliths and *Catinaster* with notable absence of discoasters. The nannofossil assemblage was documented under the Light microscope and assigned to CN7b (= *Catinaster calyculus* subzone of Okada & Bukry 1980) and correlated with upper part of NN9 (= *Discoaster hamatus* Zone of Martini 1971). The assemblage further matches upper part of magnetic chron C5 (= 9.5 Ma) and can be assigned to Late Miocene (Early Tortonian) age. Absence of this zone in the eastern Mediterranean basin and its correlation with the basins of Indo-Pacific regions is discussed and being compiled.

The samples from Passa Bridge section of Car Nicobar Island, yielded well preserved nannoflora which was documented under the SEM. The assemblage can be assigned to CN10b (= *Ceratolithus acutus* subzone of Okada & Bukry 1980), which matches upper part of NN12 (= *Ceratolithus tricorniculatus* Zone of Martini 1971), and is of earliest Pliocene (Early Zanclian) age, very close to Miocene-Pliocene boundary. This further correlates with lower C3 GILBERT magnetic chron (= 5.2 Ma). The problem concerning the absence of dark ceratoliths in Andaman-Nicobar Basin and other south-east Asian Basin is discussed for correlation of petroliferous basins and the data is being compiled.

Component 2 : *Palaeomangroves and palaeoclimate in Andaman and Nicobar Islands during Quaternary Period*

H.P. Gupta & Asha Khandelwal

Analysed 10 samples of sediment profile collected from Netaji Nagar, Little Andaman. The samples revealed good assemblage of pollen grains, fungal spores, microforaminifera, etc. *Rhizophora* pollen were recorded as dominant. The other core mangrove taxa such as *Sonneratia, Avicennia, Excoecaria* and *Xylocarpus* were also encountered in good frequencies. The peripheral and hinterland taxa were feebly represented.



Scanning electronmicrographs of calcareous nannofossils recorded from mud-turbidites of Sawai Bay Formation possibly exposing Miocene-Pliocene Boundary at Passa Bridge section of Car Nicobar Island (Earliest Pliocene = 5.2 Ma matching C3 Gilbert Magnetic Chron). 1. *Discoaster pentaradiatus* Tan Sin Hok 2. *Umbilicosphaera jafarii* Mueller 3. *Hayaster perplexus* (Bramlette & Riedel) 4. *Helicosphaera carterii* Kamptner

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 135 samples were processed in the Radiocarbon Lab during the year. Of these 120 samples were dated.

The routine dating has been continued using Quantulus Liquid Scintillation Counter. It was observed that the benzene prepared from the standard samples gave low count rates at a few instances. The SQP (spectral quench parameter) measured using the internal standard of the Quantulus system was also found to be correspondingly low. An efficiency *vs* SQP graph was made on the basis of measured values using a ^{14}C radioactive source obtained from M/S Wallac and progressive quenching by adding 10 nl of CCl_4 each time. Counting efficiency due to self quenching is obtained for the samples using this graph and counting data of the sample is corrected for quenching while calculating results. The Rack beta liquid scintillation counting unit is connected through a computer and programs have been incorporated for automatic recording of counting data. Test samples have been counted. Dating of high counting samples are being carried out using Rack beta system. Correction curves for counting efficiency on the basis of external standard ratio in the case Rack beta has also been obtained using ^{14}C source in the same manner as in Quantulus.

The microwave digestion system MDS 2100 is being used regularly for preparation of samples for chemical analysis.

Dating of sediment samples from Degana, Barmer District, Rajasthan were carried out for deriving the chronology of Quaternary vegetation and environment (Project 10). The base sample at a depth of 2 m in the profile has been dated as 8730±500 Yrs BP. Dating of sediment samples from Jagmotha Kerha, Sidhi District, M.P. were undertaken for finding the chronological demarcation of vegetational changes and climate during Quaternary Period (Project 10). The age of the sample at Jagmotha proflie at 1.5 m works out to 6250±90 Yrs BP. The Kerha profile at 1.9 m dates to 1440±160 Yrs BP. Dating of sediment samples from Saria Tal, Nainital, U.P. were also carried out for determining the chronology of the profile in which palynological studies are being carried out. The ^{14}C age at 1.95 m works out to 1300±70 Yrs BP. Dating of clay samples from Dokriani Bamak Glacier at Uttarkashi, U.P. was carried out for the reconstruction of climate around the Glacier. The ^{14}C age at 90 cm works out to 7060±380 Yrs BP.

Elemental analysis using Atomic Absorption Spectrometer have been carried out for the analysis of samples from Paradise lake, Selaass, Arunachal Pradesh and the interpretation of chemical data for inferring climatic changes on the basis of chemical analysis, ^{14}C dating and palynological data (A. Bhattacharyya) is in progress.

Component 2 : Fission track dating of minerals and fossil woods

G. Rajagopalan & C.M. Nautiyal

Glauconitic sandstone samples were crushed and size separated in fractions viz. 75-100, 100-150 and 150 to 200 microns by dry sieving. These size separates were subjected to magnetic isodynamic separation repeatedly (trying various positions for angle and current) to yield a relatively pure glauconitic separate. However, the fine changes (.05 A) in current did not bring out any change in the quality of mineral as seen under the stereo microscope. The finest (less than 75 microns) fraction was washed and dried in oven and then also subjected to magnetic separation. The microscope for track counting was also got serviced and repaired.

Project 15 : Special Activity

Component 1 : Floristics and phytogeography of tropical and subtropical forests

K. Ambwani & D.C. Saini

Ambwani collected polleniferous material of 70 extant taxa from Assam and Meghalaya (Garo Hills) belonging to the following families: Acanthaceae, Colchospermaceae, Euphorbiaceae, Caesalpinaceae, Sonneratiaceae, Baringtoniaceae, Apocyanaceae, Simaroubiaceae, Solanaceae, Sapindaceae, Sapotaceae, Elaeocarpaceae, Clusiaceae, Anonaceae, Asteraceae as well as Arecaceae. The taxa were processed and slides were prepared. Their description with salient features has been done. SEM studies of some of the morphologically important taxa was also carried out.

Saini identified 300 angiosperm species belonging to 200 genera and 70 families collected from Sidhi District, M.P. and Sonbhadra (Robertsganj), U.P. All these specimens are mounted on herbarium sheets and kept in almirah in their respective families for permanent record. Samples of polleniferous materials of about 200 species from the duplicate specimens, collected from Sidhi and adjoining areas and samples of fruits and seeds of about 250 species, collected from different localities in India, were deposited in Herbarium. A manuscript of preliminary report on the floristic diversity in Sidhi District has been prepared. 10 species are reported as new record for flora of Madhya Pradesh. During casual visit to the Unnao District, U.P. an interesting branched palm (*Hyphene dichotoma*) has been noticed near Harauni Railway Station. A photograph of the same has been taken. After scrutiny of literature it has been found that this rare and endangered species has never been reported from Upper Gangetic Plain.

Work other than Components Work

H.K. Maheshwari & Usha Bajpai

A chapter "History of Palaeobotany and Palaeobotanists" has been written for the book "History of Biological Sciences" being edited by Professor B.M. Johri. The chapter includes definition of a fossil, objectives of Palaeobotany, palaeobotanical techniques and different periods in the history of palaeobotany, for example, ancient history, non-believers, the pioneers, Palaeobotany comes of age, the early land plants, coal forming plants, Indian Palaeobotanists, American Palaeobotanists, the Glossopteris flora, Palaeobotany in Europe, fossil pollen spores and early life forms.

Usha Bajpai & S.M. Singh

From the Barakar Formation of South Karanpura Coalfield, Bihar an enigmatic fossil plant has been reported. It has an apparent whorl of heterophyllous leaves. Cuticle of only the non-stomatiferous surface has been recovered; both the anticlinal and periclinal walls are straight and thick. The specimen has a superficial resemblance with the leaf whorls of the sphenophylls; the latter, however differ in having sinuous-walled cells on the epidermis of both the surfaces. There is a distant possibility that this specimen represents a bunch of immature leaves of a taxon related either to *Euryphyllum* or *Pantophyllum*, members of the Cordaite group of plants.

Shaila Chandra

A key note address entitled "Colonisation and subsequent speciation/diversification on Gondwana - Gondwana biodiversity" was prepared and finalized for Alex Du toit Symposium Volume, South Africa. Also a paper on species diversification, floristics and evolutionary trends in Indian basins over the 300 Ma span from the Late Devonian to Early Cretaceous was completed.

Neerja Jha

Two articles in Hindi: "Hindi mein Vigyan lekhan- Samasyaen evam Nirakaran" and "Vigyan Shiksha evam Anusandhan chhetra mein Hindi ka asthan" have been prepared and finalized.

Rajni Tewari

Fossil wood specimens from Barakar Formation of Jharia Coalfield belonging to the genus *Araucarioxylon* were studied. The morphotaxonomy and distribution of lycopod fossils in Indian Gondwana flora were studied and report is being compiled.

Rajni Tewari & A.K. Srivastava

Systematic description, photodocumentation and comparison of plant fossils recovered from Talchir Formation of Jaitri River section, Auranga Coalfield were finalized and a draft manuscript is prepared.

Anand Prakash & Shinjini Sarana

Coal petrological study from Ramkola-Tatapani Coalfield, Surguja District (M.P.) has been finalized and documented in the form of Ph.D. dissertation. The data generated through microconstituents, reflectance and fluorescence studies have been utilized for the interpretation of nature, composition, rank and depositional environment of Early Permian Barakar coals of the field.

B.D. Singh

Petrographic data collected both under normal and fluorescence modes from Hura, Chuperbhita and Pachwara coalfields of Rajmahal Basin have been compiled and plotted on various biaxial and triangular parameters.

S.A. Jafar

Planktonic foraminifera and calcareous nannofossil documented across the well known Lattengebirge section of South Germany, under the SEM. Other K/T boundary section from Zumaya, Spain was studied for the planktonic fossil turnover across the K/T boundary for support of a Magnitude model of mass extinction. A manuscript entitled "A Magnitude induced Model of biotic turnover at the

Cretaceous-Tertiary boundary" was prepared and finalized. This model provides a new approach for understanding innovations and extinction/mass extinction of life as seen in the geologic record and which can be understood under the framework of Neodarwinian paradigm without invoking any catastrophic/non-gradualistic tempo of evolution.

S.A. Jafar & J.P. Mandal

A draft manuscript was prepared highlighting the source and significance of palynofossils on convergent plate margin terrain of Andaman Nicobar Island. Reworked palynofossils of Permian and Mesozoic age are recognised with autochthonous palynofossils of Eocene age in Middle Andaman sections.

J.S. Guleria & S.A. Jafar

Finalized a manuscript on the Eucalyptus type wood from the Eocene sediments of Great Nicobar Island.

B.K. Misra & S.A. Jafar

A manuscript was finalized explaining the genesis and significance of coal-pockets/streaks in the Eocene deep-sea flysch turbidites. Study of the Middle Andaman sections suggests the derivation and flushing of vegetal matter in the early stages of peatification from a deltaic region and the coalification process was completed in the deep sea.

Anil Chandra, R.K. Saxena & A.K. Ghosh

More than 200 slides containing thin sections have been prepared and studied for calcareous algae from Car Nicobar Island of Andaman and Nicobar Islands. Coralline algae have been reported for the first time from the Kakana Formation (Middle Pliocene). The algal assemblage is represented by 10 species of crustose and articulated coralline red algae belonging to 7 genera, viz. *Lithothamnion, Lithophyllum, Mesophyllum, Porolithon, Amphiroa, Corallina* and *Arthrocardia*. Biostratigraphical, palaeoenvironmental and palaeobathymetrical implications of this assemblage have been highlighted.

A rich assemblage of calcareous algae has also been recovered from the Hut Bay Formation (Middle Miocene) of Hut Bay in Little Andaman Island. The algal flora is represented by 32 species belonging to 12 genera of Rhodophyta and Chlorophyta. For the first time these forms have been described and illustrated from the Middle Miocene of Little Andaman Island. Coralline algae *Lithophyllum* (Crustose) and *Amphiroa* (articulated) dominate the assemblage with significant representation of green alga *Halimeda*. Three species, viz. *Amphiroa slendera, A. andamanensis* and *Subterraniphyllum minor* have been proposed as new. A manuscript has been finalied on this aspect.

R.K. Saxena

A manuscript entitled "Palynology of the Neogene sediments of north-western India" (under IGCP Project 329) was revised and submitted to GSI's publication.

R.K. Saxena & Anil Chandra

A manuscript (in Hindi) dealing with the origin of Andaman and Nicobar Islands was prepared and finalized.

R.K. Saxena & S.K.M. Tripathi

A manuscript dealing with taxonomy and nomenclature of *Tricolporopollis* recorded from Indian Palaeocene-Eocene sediments was prepared and finalized.

S.K.M. Tripathi & R.K. Saxena

Palynofloral assemblages from Middle Siwalik sediments of three localities exposed near Haridwar were studied. Gymnospermic pollen and pteridophytic spores are richly represented in the assemblage, whereas angiospermic pollen are less in number. Some of the angiosperm pollen recorded in the assemblage are *Ctenolophonidites* sp., *Caryophyllumpollenites* sp., *Liguliflordidites* sp., *Compositoipollenites* sp. and *Trisyncolpites* sp. Morphotaxonomic studies are in progress.

G.K. Trivedi & R.K. Saxena

Palynofloral study on the Kopili Formation (Late Eocene) exposed along Umrongso- Haflong Road, North Cachar Hills, Assam was finalized and documented.

Samir Sarkar

Visited Central National Herbarium, B.S.I., Howrah for comparing fossil pollen grains of Surai Khola Siwalik sediments (Mio-Plio-Pleistocene) with the pollen grains of the extant taxa as well as studied pollen grains of aquatic angiosperms.

Jyotsana Rai

A manuscript entitled "Late Miocene endoskeletal dinoflagellates from Sawai Bay Formation, Neill Island, Andaman Sea, India" is prepared and finalized.

Anil Agarwal & K. Ambwani

Studied a new record of Late Cretaceous fossil wood of *Araucaria* from Pondicherry Formation, Tamil Nadu and finalized the results (with Dr R.K. Kar) .

Mahesh Prasad

Photodocumentation of the plant megafossils collected from the Siwalik sediments of Arjunkhola, western Nepal has been done and preparation of manuscript is being continued.

Mahesh Prasad & J.S. Antal

Worked on plant megafossils comprising leaf impressions and carbonised woods from Siwalik sediments of Darjeeling District, West Bengal and two manuscripts have been finalized.

H.P. Gupta & Asha Khandelwal

Completed fine resolution palynostratigraphy of 5 m deep sediment profile from Bhowania, the northern-western flank of Chilka Lake, Orissa. In general, the samples have yielded rich assemblage of palynodebris such as pollen, spores, diatoms, dinoflagellate cysts, microforaminifera, Pseudoschizea, etc. The core mangrove taxa such as *Rhizophora, Avicennia, Sonneratia, Excoecaria, Heritiera*, etc. were encountered in low profile as compared to peripheral mangroves and hinterland taxa. The pollen analytical investigation tips towards the hypohaline conditions of the lake encouraging the growth and proliferation of salt-marshes and reed-swamps. Also synthesized and reviewed the palynological data generated from several sediment profiles, viz. Balugaon, Solari, Chandrapur, Geokhala, Rambha, Bhowania and Nalabana Island, from in and around Chilka Lake. The precise palaeoenvironmental secenario since 4,000 yrs. B.P. have been reconstructed and several remedial measures have been suggested for sustainable development of Chilka lake.

Asha Khandelwal

Significant contribution to the knowledge of airborne pollen grains, fungal spores, could be made by adopting internationally recognised methodology for aerobiological sampling over a period of 12 months. Burkard volumetric air sampler employed in present investigation had great advantage as it had provided both qualitative and quantitative estimates of pollen grains and fungal spores which were otherwise, not possible earlier. Besides quantitative estimates, the pollen and spores calendars were enriched with the addition of some new taxa such as *Datura* sp., *Bougainvillea* sp., *Botrytis* sp., *Ganoderma* sp., *Heterosporium* sp., *Monodictys* sp., *Sordaria* sp., *Sporomia* sp., *Teichspora* sp., etc.

A. Bhattacharyya

Supervised the Ph.D. thesis of Miss Vandana Chaudhary entitled "Dendroclimatic studies from the Eastern Himalayan region" which has been submitted to Lucknow University and also prepared a report of DST Project entitled "Reconstruction of past climatic changes in the Eastern Himalayan region using tree ring data".

S.K. Bera

Finalized the manuscript entitled "Fungal remains from the Holocene peat of Annamali Hills, south India".

Kavita Kumar

A report was compiled and finalized about the classification, cataloguing and indexing patterns of palaeobotanical literatures of BSIP Library.

Collaborative Work

P.K. Maithy & Rupendra Babu [& Professor S. Kumar (Lucknow)]

Submitted final report of the DST Project ESS/CA/A4-09/93 "Palaeobiological investigations across Archaeozoic-Early Proterozoic Transition". The report deals with the geology, sedimentology, palaeobiology, stromatolites and isotopic studies from the carbonate sequence of Kasia (near Noamundi).

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

Gondwana conifer forms *Buriadia* and *Birsinghia* are studied and results submitted for two conferences to be held in America and Canada.

Manoj Shukla & Mukund Sharma [& Dr B. Kumar (NGRI)]

Carbon isotope records in carbonates from the Bhima Basin are characterised by dC^{13} enriched up to .4‰ PDB values. Integration of these data with palaeontological records suggest Terminal Proterozoic age. Isotopic records of the Kathamdevarhalli Limestone and Sahabad Limestone exhibit two different trends which probably indicate long term temporal trends of the carbon isotope values.

Suresh C. Srivastava & Madhav Kumar [& Professor S.K. Dutta (Dibrugarh)]

Macerated 42 samples from Bihpuria borecore no. (1915-4440 m depth), North Lakhimpur District, Assam. Of which 32 samples yielded sporepollen, fungal fruiting bodies, dinoflagellate cysts and organic matter.

J.P Mandal & Madhav Kumar [& Professor S.K. Dutta, Dr D. Bhuyan (Dibrugarh) & Drs B. Das, B. Saikia (Duliajan)]

Palynological and organic matter analyses of Tinali # 7 bore core (1200-3800 m depth) from upper Assam representing from Barail to Dhekiajuli have been made. The study confirms that *Meyeripollis naharkotensis* is restricted within the Barail. Surma+Tipam is characterised by *Stiatriletes multicostatus, Crassoretitriletes,* and *Compositoipollenites,* while *Operculosculptites* and *Strobilanthidites* represent the Namsang and Dhekiajuli respectively. On the basis of distribution of palynotaxa, three palynozones have been recognised. The composition and frequency of palynofossils and palynodebris change sharply from Barail to overlying Surma. However, distinction between the other groups/formations are not sharp but the changes are gradual. Tertiary palynomorphs, in addition to Palaeozoic and Mesozoic taxa, are recorded as reworked in the younger successions, e.g. *Meyeripollis* in Namsang Formation.

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

Partially degraded pollen grains of *Phoenix sylvestris* were studied with the help of TEM with an object to study the molecular structure of exine. Pollen were kept in 2-aminoethanol for 24-78 hours at 30° C and in Potassium permanganate solution for 24 hours. This resulted into six stages of degradation in pollen wall. Linear and cyclic molecules arranged in pentagonal and hexagonal symmetries were observed in the degraded ectexine. On the tectal surface more or less radially oriented linear molecules were observed. A manuscript incorporating results of these studies has been finalized.

J.S. Guleria [& Drs C.A. Nunez-Vergas, H-J. Gregor (USA) & N. Awasthi (Lucknow)]

A number of fossil woods have been identified from the Tertiary sediments of Guatemala, Central America and prepared a draft manuscript on the systematic anatomy of the woods.

J.S. Guleria & Rashmi Srivastava [& K.S. Misra (GSI)]

Reported occurrence of intertrappean plant and animal remains in the Khargaon District of Madhya Pradesh, central India. The material was brought for investigation by the Geological Survey of India.

Rashmi Srivastava [& Professor Mitsuo Suzuki (Japan)]

Under INSA International Scientific Exchange Programme worked on Palaeogene fossil woods from Fukuoka Prefecture, Kyushu Island. Among the studied woods, 6 were identified with the genera, *Rhus* (Anacardiaceae), *Alnus* (Betulaceae), *Hamamelis* (Hamamelidaceae), *Aesculus* (Hippocasranaceae) , *Magnolia* or *Michelia* (Magnoliaceae) and *Sonneratia* (Sonneratiaceae). A paper dealing with aforesaid woods has been finalized.

Mahesh Prasad [& Dr U.M.S. Pradhan (D.M.G., Kathgodam)]

Study on the plant megafossils comprising well preserved leaves from the Siwalik sediments of Barelia and Surkhet areas in the foot-hills of Far Western Nepal has been done. The fossils show closest affinity with 6 extant taxa belonging to the families Poaceae, Dipterocarpaceae, Ampledaceae, Myrisinaceae and Ebenaceae. The present day distribution of the modern equivalent taxa indicates a phytogeographical link between Nepal and south east Asian countries during the Siwalik Period. The physiognomic character of the fossil leaves and the habit and habitat of extant taxa, suggest that a warm humid climate with plenty of rainfall prevailed in this region during the deposition of Siwalik sediments.

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

Sedimentary organic matter have been analysed in the light of available sedimentological and palaeontological evidences from 5500 m thick Siwalik succession (Mio-Pliocene) at Surai Khola and its adjoining areas of western Nepal. The data has been interpreted and plotted against a chronostratigraphic control based on the magnetostratigraphy. Sedimentary organic matter types viz., specks, comminuted debris, pre-Tertiary palynomorphs, Tertiary spore/pollen, amorphous matter, degraded bundles, unstructured debris, degraded debris, parenchyma, leaf cuticles, well preserved wood debris, black debris and fungal elements recovered from clay samples of five formations have been taken into consideration for the study. Variation in the abundance of SOM seems to indicate oscillations of sedimentary environment during the deposition of these sediments.

Vandana Prasad [& Drs Raymond Rauscher & Monique Schuler (France)]

A precise quantitative extraction and characterization of organic matter debris were done on Subathu sediments of Kharak Section, Morni Hills, Haryana and Paatlaadi. More section, Kalakot area of J & K. Different types of organic matter (wood, cuticle, black debris, amorphous debris, dinocyst, acritarch, spore-pollen) were studied and following criteria were taken in the interpretation of palaeoenvironment: ratio of continental and marine constituents, dinocysts, dinocyst diversity, and degree of biodegradation of land derived particles. The palaeoenvironmental curve thus derived, indicates open marine influence tidal flat environment in an ascending order of stratigraphy in the Kharak section Late Ypresian to Early Lutetian sediments were deposited during a transgressive phase, whereas Middle Lutetian sediments were deposited during a regressive phase. In Kalakot Section the palynofacies of lower horizon shows abundance of land derived phytoclast, pteridophytic spores and few palm pollen alongwith *Botryococcus* algal colonies. DOM constituents indicate brackish to fresh water environment of deposition.

Anil Chandra & R.K. Saxena [& Dr S.K. Kulsreshta (Chandigarh)]

Studies on radiolarians and foraminifers from the Miocene rocks of the Anderson Island, Andaman

and Nicobar Islands is continuing .

Rahul Garg [& Professors S.K. Singh & M.P. Singh (Lucknow)]

Field work was carried out to investigate Jurassic successions in selected areas of Kutch and Jaisalmer basins under DST Project "Integrated biostratigraphy, sea level changes and environmental patterns of Indian Jurassic Shelves". Sections exposed at Jumara Dome, Keera Dome, Ler in Kutch mainland; Pattahar in Wagad, Eastern Kutch; and Thaiyat, Hamira, Jaisalmer Ridge and its nearby extensions, Amarsagar, Badabag, Kuldhar, Baisakhi, Rupsi, Bhadasar, Mokal and Kaladongar in Jaisalmer were studied in detail. Samples for integrated phytoplankton and foraminiferal studies have been collected. A fairly rich collection of *in situ* trace fossils and ammonites have also been made for integrated biostratigraphic and palaeoecologic interpretations.

Rahul Garg [& Professor S.K. Singh (Lucknow)]

SEM documentation of a rich and exclusive agglutinated foraminiferal assemblage of Kimmeridgian age recovered from Rupsi Shale, Jaisalmer has been carried out. A manuscript dealing with morphologic, stratigraphic and palaeoecologic aspects of the assemblage and its precise integration with ammonite biostratigraphy is prepared. Rich and well preserved dinoflagellate cyst assemblages have also been recovered from Chari Formation (Jhurio Hill) and Wagad Sandstone, Kutch. Identification and documentation of dinoflagellate cysts is in progress. Processing of samples from Jaisalmer is carried out and dinoflagellate cyst productive levels have been identified.

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

Well preserved and datable nannofossil assemblage belonging to earliest Callovian age is recovered from Jaisalmer. Documentation and study of nannofossils is in progress.

Chhaya Sharma [& Professor K.S. Valdiya (Bangalore)]

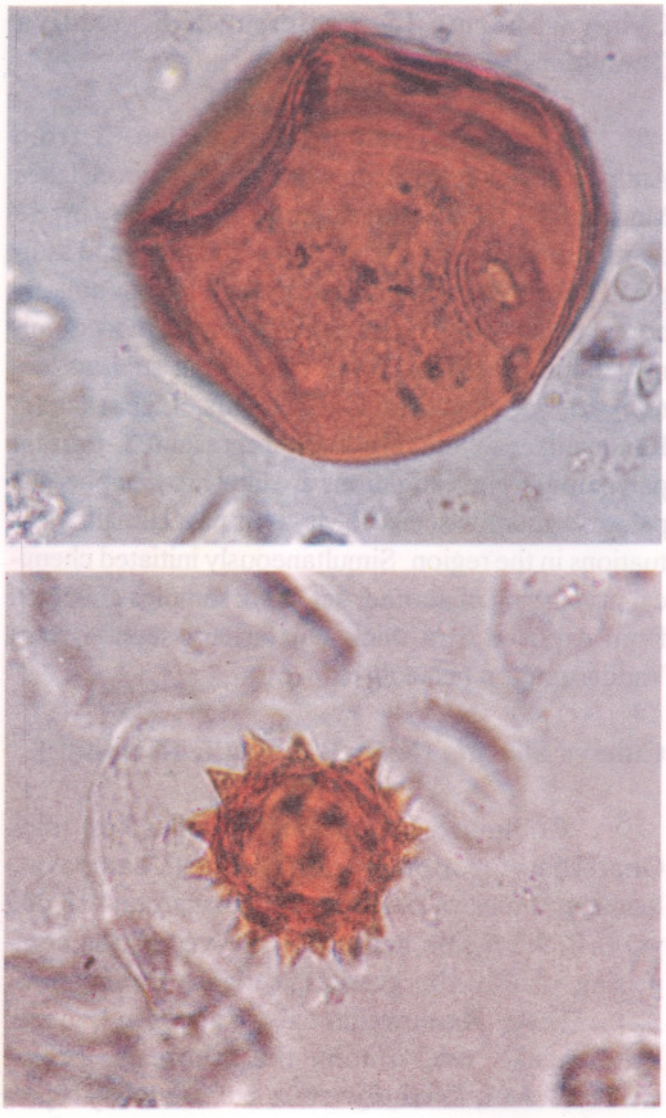
Analysed 4 samples for pollen, 2 from Anthaar Ganga River Valley and one each from lakes Manchalabela and Vaddaruguppe. Preliminary investigations have revealed that only Vaddaruguppe sample is palynologically productive and rich in non-arboreal pollen. Poaceae remains by far the most dominant family, whereas some other taxa such as *Artemisia*, members of Cheno/Ams, Cyperaceae, Ranunculaceae, etc. are lowly represented. Further palynological investigations are likely to decipher the palaeovegetation scenario vis-a-vis past climatic fluctuations in the region. Simultaneously initiated chemical processing of another set of six samples collected from exposed 6 m thick Quaternary section from Vaddaruguppe palaeolake.

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

Continued pollen analysis of 6.5 m thick Quaternary section from Phulera (Champavat) Kumaun Himalaya. Studies reveal that around 18,000 yrs B.P. the region had open type vegetation comprising chiefly the grasses, sedges, Cheno/Ams, Asteraceae, Ranunculaceae, Caryophyllaceae, Primulaceae, etc. Among the arboreals, *Pinus*, *Cedrus*, *Abies*, *Larix*, *Quercus,* etc. are lowly represented, thus depicting cold and dry climate.

Chhaya Sharma & M.S. Chauhan [& Dr Rajeev Sinha (Kanpur)]

Carried out pollen analytical investigations of 10 samples from Priyadarshani Lake, Antarctica situated near Maitri station. Preliminary analysis has revealed high concentration of moss and algal spores in addition to a very few pollen of Poaceae, Cheno/Ams, Asteraceae, *Larix*, etc.. Number of recovered palynomorphs have been photographed and prepared their pollen plates. Except the grass pollen, all other pollen taxa encountered have probably been transported from other distant landmass as only two taxa, viz. *Deschampsia antarctica* (Poaceae) and *Colobanthus quitensis* (Caryophyllaceae) have so far been recorded from the Antarctica continent.



Palynomorphs recovered from Priyadarshini Lake
1. Poaceae x 1200 2. Asteraceae x 850

A. Bhattacharyya [& Dr J.T. Gergan (WIHG, Dehradun)]

Ring width of 53 dated tree ring samples of *Abies pindrow* collected from trees growing around Dokriani Bamak glacier have been measured. Based on these measured data a tree ring chronology was prepared which extends back to 1614 A.D. This chronology shows several periods of higher and lower growth which might be linked with glacial fluctuation of this region. Detailed tree growth climatic analysis is in progress to understand glacial fluctuations of this region.

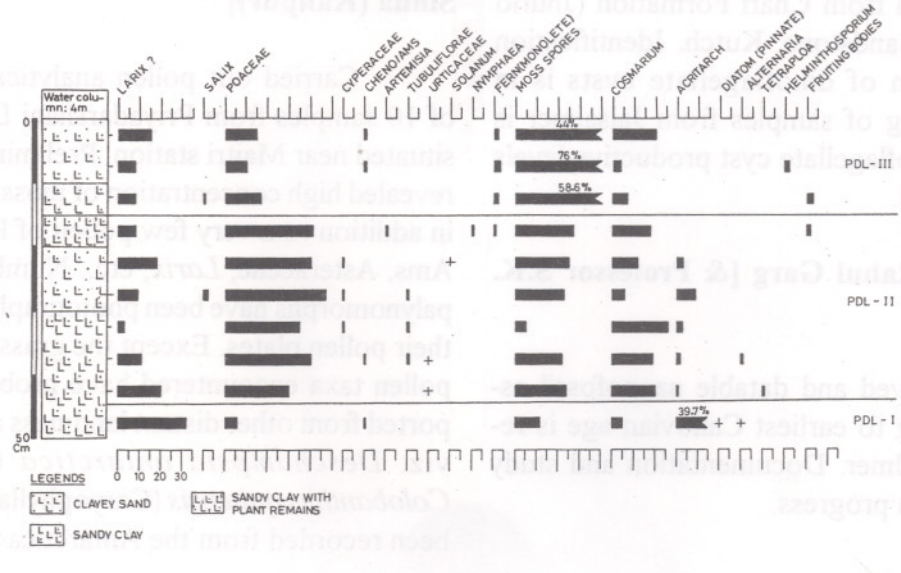
G. Rajagopalan [& Professor K.S. Valdia (Bangalore)]

Dating of palaeolakes in Karnataka (at Mosale Hosahalli, Hassan District and Vaddaruguppe, Mysore District) were carried out in order to understand the origin of these lakes in relation to Late Quaternary tectonic activity. Mosale Hosahalli profile at 4.6 m dates to 1,770±100 yrs B.P. Vaddaruguppe profile of thickness 7.25 m dates spans an age range of 20,700-2,5000 yrs B.P.

G. Rajagopalan [& Dr K.P.N. Kumaran (Pune)]

Ten samples of shell and wood were dated for a DST project to study the coastal evolution and climate of Saurashtra and north Maharashtra in Late Quaternary.

POLLEN DIAGRAM FROM PRIYADARSHANI LAKE, ANTARCTICA



Sponsored Projects

Project : Aeroallergens and human health : Aerobiological studies (Ministry of Environment and Forest, No. 42/14/94-RE)

Asha Khandelwal, Rashmi Tewary & Lily Misra

The tenure of the Project was extended for three months, i.e., up to June 1998. Accomplished Project report in two volumes convering 12 pages, 398 plates and many pollen and spore calendars (daily, weekly, monthly and annual). Prepared the ready-reckoner of significant pollen grains, fungal spores and fungal colonies in all the six investigated sites (Vikas Nagar, Chikan work place, Gaughat pumping station, Vegetable market. Vivekanand Polyclinic and Garbage disposal unit). In general, Poaceae, *Cladosporium* and *Alternaria alternata* were dominant among pollen grains, fungal spores and fungal colonies respectively. It is emphasised in the report that the information generated should be transmitted to the User Agencies, such as local Allergists and Physicians, State Pollution Board, Museums, Libraries, Research laboratories related with Horticulture, Forestry, Paleopalynology, Genetic engineering, etc. Two articles entitled "Chilbil, Doob ghaas swans rog ke karak" and "Dhool mein milne wali faafoond se saans ki beemaariyan" were published in *Rashtriya Sahara* for public awareness.

Project : Search of palyno-event evidences for the status of Jurassic sequence on Indian Peninsula (DST/ESS/CA-17/96)

Vijaya & Sanjay Singh

Palynological study is being completed in the Mesozoic succession of bore-hole DPD-15, Birbhum area, West Bengal. In between 57-220 m thick strata represented by Dubrajpur and Rajmahal formations, has yielded two palynozones. Record of *Callialasporites* along with *Contignisporites cooksoniae, Murospora florida* at 152-195 m depth evidence Upper Jurassic deposits in Dubrajpur Formation. The Rajmahal intertrappeans (57.00-107.47 m) contain *Foraminisporis asymmetricus* palynozone which is Barremian-Aptian in age. The critical review of the palynological data on Indian Peninsula about the Jurassic sequence has been completed and the manuscript is being finalized. Thirty samples have also been processed for palynological studies from Motayaksh and Rukmavati River sections in Kutch Basin, to find out the Jurassic deposits.

Project : The transition of lacustrine faunal and floral communities across Pleistocene- Holocene in Jammu and Ladakh (DST/ESS/CA/A-4-22/96)

Chhaya Sharma [& M.A. Malik (Jammu)]

Undertook field trip to Jammu to survey and select the suitable lake sites for the coring operation

Sampling of 40 m. deep sedimantory profile from Surinsar Lake

to procure the profiles. Pollen analysed trial samples collected from three lake sites, viz. Mansar, Surinsar and Sanasar were found barren. Undertook another field trip to Jammu to supervise the coring operation carried out on contract by the Calcutta Firm. Six deep sediment profiles were collected from the selected two lake sites- Mansar and Surinsar. The bore-hole profiles are from the lake bottom as well as from swampy margins, reaching up to 40 m in depth. Started chemical processing of Surinsar profile. Preliminary investigations of a few samples have revealed good palynoassemblage.

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

Chhaya Sharma & D.N. Yadav

Yadav consulted some reference as well as sample pollen slides to get acquainted with the morphological features of well known pollen species (e.g., *Pinus*, Poaceae, *Artemisia*, *Ephedra, Aerva, Calligonum, Capparis, Mimosa, Syzygium, Prosopis*, Malvaceae, Tubuliflorae, etc.) from Rajasthan desert. Counting of pollen in the sedimentary profile from Degana Lake, Rajasthan is in progress. He also visited Physical Research Laboratory, Ahmedabad during July-September for determination of major and trace elemental abundance in one of the sediment profiles (2 m depth) from Degana Lake, Rajasthan. The elemental measurement was done using Induced Coupled Plasma Atomic Emission Spectrophotometer and Atomic Absorption Spectrophotometer systems. A suite of about dozen elements with their concentrations ranging from percentage to ppm levels have been observed across the profile. Despite differences in chemical behaviour of various elements, their similar trends down the profile could be interpreted in terms of climatic fluctuations that prevailed during the sediment deposition covering the age or time span of the profile. Such an approach is limited to major shift in climate, and is supported by proxy climate indices as reflected from temporal changes in abundance of various pollen species. The past depositional period of sediment is calibrated by radiocarbon dating.

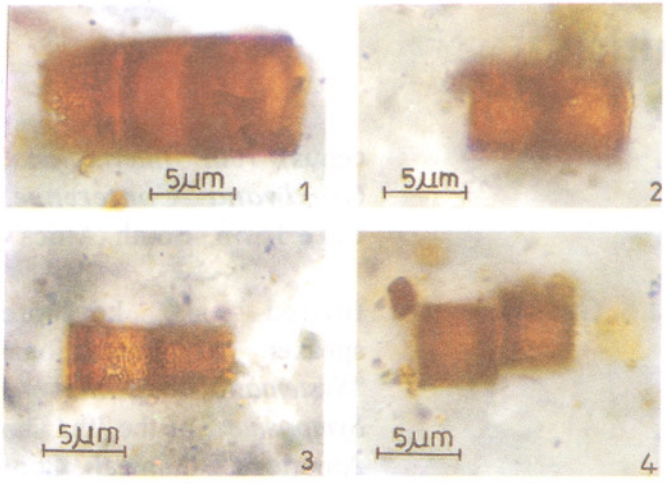
All major (Al, Fe, Ca and Mg) and trace (Mn, Ba, Sr, Pb, Cu, Ni, Zn, V) elements show distinct changes in their concentrations at about 1 m depth from the surface of profile. Most of these elements abruptly increase by a factor of two to three at this section and maintains relatively higher value up to the surface. Higher elemental abundance above 1 m boundary in the sediments could arise due to accelerated weathering as a result of greater amount of rainfall. Coupling radiometric date with major change in elemental abundance, results indicate maximum rainfall around 4200 yrs B.P. as compared to 5500 yrs B.P., which was indirectly inferred based on hydrological modelling and pollen distribution in an earlier study from the region. Inter-elemental correlation has further demonstrated the past climatic role in their distribution along the sediment profile.

Project : Deccan Intertrappean palynoflora and its implication for the demarcation of K/T boundary (DST / ESS/CA/A4-16/96)

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

Twenty samples collected from the Padwar dug out well near Jabalpur, were chemically processed, some new forms were recognised and the assemblages comprise *Azolla cretacea, Acrosticumsporites meghalayensis, Cyathidites minor, Todisporites kutchensis, Octaprojecta triradiata, Varicostisporites subcirculatus, Ericipites triradiatus, Diporoconia* sp., *Padwariapollenites triangulus, Deccaniasporites exoexinus, Barringtoniopollenites retipilatus, Sparganiumpollis mahabalea, Magnofoveosulcites intertrappius, Verrecmono-sulcites foveolatus, Aquilapollenites bengalensis* and *Ariadinaesporites.*

Eighteen samples were collected from Ranipur Intertrappean bed. The spores and pollen identified are *Cyathidites australis, Gabonisporites vigourouxii, Ariadnaesporites* sp., *Triporoletes reticulatus, Matanomadhiasulcites maximus,*



Diatom *(Melosira)* from chert section of Mohgaon Kalan, Chhindwara District, M.P.

Neocouperipollis kutchensis, Spinizonocolpites echinatus and *Aquilapollenites bengalensis.* 29 samples collected from Jhilmili Chhindwara District were macerated. Though the yield was poor, the presence of *Azolla cretaceae, Aquilapollenites bengalensis, Triporoletes reticulatus, Matanomadhiasulcites maximus* and *Gabqnisporites vigourouxii* were identified. 24 samples from Chhota Simla Hills and 18 samples from Bara Simla Hills, Jabalpur were also investigated. Only 6 samples yielded spore-pollen. The presence of *Todisporites kutchensis, Cyathidites minor, Triporoletes reticulatus, Neocouperipollis kutchensis* and *Matanomadhiasulcites maximus* was noted.

Thin sections of chert collected from the village Mohgaon Kalan, Chhindwara District, M.P. were studied. It was observed that besides other fossils they are rich in diatoms. These diatoms are identified as *Melosira* Agradh. Mostly solitary but sometimes filaments up to 5 cells were also noticed.

It was noticed that the palynoflora in different localities are more or less same. The marker Maastrichtian palynotaxa viz., *Aquilapollenites bengalensis, Gabonisporites vigourouxii* and *Ariadnaesporites* sp. are present in most of the sections. However, there are minor differences. In Chhota Simla and Bara Simla Hills, these palynomorphs are absent. The diatom genus *Melosira* which is found in plenty in Mohgaonkalan area is not found at Padwar, Ranipur, Chhota Simla and Bara Simla Hills.

Approximately 70 specimens of *Sahnipushpam* Shukla from the repository of the BSIP were studied. It was observed that the flower was probably described up side down by the earlier workers. The receptacle designated by them is infact upper part of the multilocular ovary, the basal part of hypenthium is lysigenous and without any vascular supply structures; previously interpreted as stamens are actually lacerated lower part of hypenthium. The pollen grains described previously are not *in situ* but fungal spores. The presence of bracts surrounding the peltate plate of earlier workers could only be explained by assuming that these were the basal part of the flower.

Recognition

A.K. Sinha - Appointed Convener for F-1 Special Symposium on "Global Tectonic Zones" at 31st *International Geological Congress* to be held in August, 2000 at Rio De Janario, Brazil.

Shaila Chandra - Invited as key-note speaker at *"International Gondwana-10 Conference"* held at Cape Town, South Africa.

- Nominated Indian representative for Gondwana Subcommission.

S.A. Jafar - Awarded visiting research fellowship by the President of German Academic Exchange Service (DAAD) for 1998.

Chhaya Sharma - Co-opted as an Organiser for the Symposium "Quaternary palynostratigraphy and palaeoclimate of the Himalaya (Poster Session-35)" for *INQUA XV International Congress* to be held in August, 99 at Durban, South Africa.

A.K. Srivastava - Elected Fellow of the International Society for Conservation of Natural Resources.

- Nominated, Advisory Committee of International Journal *"Vasundhara"*

Shyam C. Srivastava- Chairperson Gond-wana Flora-II (Permian-Cretaceous), *10th International Gondwana Conference,* Cape Town, South Africa.

J.S. Guleria - Invited as key-note speaker at International *"Systematic Wood Anatomy Symposium"* of the 7th Latin American Botanical Congress held at Mexico City.

Neerja Jha
S.S. Panwar
K.C Chandola - Awarded I, II, and III Prize respectively in the Short Essay Writing Competition on the subject *"Hindi me Vigyan Lekhan Samasyaen evam Nirakaran"* during Hindi Pakhwada at BSIP.

Rakesh Saxena - Elected as Advisor, Research Board of Advisors, American Biographical Institute, U.S.A.

A. Rajanikanth
Mukund Sharma - Members Jury, Science Model Competition, Regional Science Centre, Lucknow.

A. Rajanikanth
Mukund Sharma
Jyotsana Rai - Members of Jury in VIth District level Children's Science Congress (Oct.31-Nov. 15) and in VIth State level Children's Science Congress, at JB Academy, Faizabad (Dec. 5-6).

Sanjay Singh
A. Rajanikanth
Jyotsana Rai - Awarded I, II and III Prize respectively in the*"Prasnkunj Pratiyogita"*, during *Hindi Pakhwada* at BSIP.

Mukund Sharma
Rita Banerjee - Awarded 1st Prize in Hindi Debate on the subject

K.C. Chandola *"Adhunik Bharat ke Pariprekshya men paramparik Puravanaspati vigyan apekshit bhumika nibha raha hai"* on the occasion of *Hindi Diwas Samaroh.*

A. Gupta - Elected Fellow of the Indian Botanical Society.

A.K. Ghosh - Awarded "Dr Chunnilal Khatiyal Medal – 1998" (a medal and citation) for the best piece of research work done in BSIP (Scientist "A" category) from April, 1995 to March, 1998.

A. Farooqui - Woman of the Year 1998, International Who's Who of Professional and Business Women, American Biographical Institute, USA.

Hari Lal
Chitra Chatterjee
Ajay K. Srivastava - Awarded I, II and III Prize respectively in the "Hindi Typing Competition" during *Hindi Pakhwada* at BSIP.

Institute's garden received 7 prizes of Merits in different "Flower- shows" organised by various agencies in Lucknow. Campus garden has also been adjudged second in the District, for which a Trophy has been awarded to the Institute.

Representation in Committees/ Boards

A.K. Sinha
- Co-ordinator, National Earth Science in Indo-Russian Projects under DST.
- Chief Editor, "*The Palaeobotanist*".
- Member, National Organising Committee, "*Symposium Snow, Ice and Glacier a Himalayan Perspective*", GSI, Lucknow.
- 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.
- Member, Organising Committee, *"Workshop on Vindhyan Stratigraphy and Palaeobiology"* Palaeontological Society of India, Lucknow.
- Guest Editor, Special Issues of Himalaya, Indian Science News Association, Calcutta.

G. Rajagopalan
- Member, Academic Committee of School of Archaeological Dating, Jadavpur University, Calcutta

H.K. Maheshwari
- Member, Committee for Fossil Plants, International Association for Plant Taxonomy.
- Member, Editorial Board, "*The Palaeobotanist*".
- Chief Editor, Indian Association of Palynostratigraphers.
- Nominated Member on Advisory Council for Regional Science Centre, Lucknow.
- Nominated Member on Advisory Committee of Uttar Pradesh Council for Science and Technology.

P.K. Maithy
- Member, National Working Group I.G.C.P. Project No. 380: Biosedimentology and correlation of microbial buildups.
- Member, Organising Committee, *"Workshop on Vindhyan Stratigraphy and Palaeobiology"*; Palaeontological Society of India, Lucknow.
- Member, Executive Committee, Palaeontological Society of India, Lucknow.

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

H.P. Gupta
- Secretary, The Palaeobotanical Society.

Suresh C. Srivastava
- Chief Editor, *"Geophytology"*.

Anand Prakash
- Member, Executive Council, The Palaeobotanical Society.
- Treasurer, Indian Association of Palynostratigraphers.
- Member, Bureau of Indian Standards, Solid Mineral Fuels Sectional Committee - PCD - 7.

S.A. Jafar
- Organising Secretary, Lucknow Chapter, Zaheer

Science Foundation, New Delhi.
- Member, International Professional Planning "Architekten ueber Grenzen-Initiativkreis".

Chhaya Sharma -
- Vice President, International Council of Biodeterioration of Property.
- Member, Advisory Committee, Journal of Bengal Natural History.
- Member, Executive Council, The Palaeobotanical Society.

A.K. Srivastava -
- Member, Advisory Board Journal "*Neo Botanica*".
- Member, Organizing Committee, "*International Scientific Conference on Dichotomy and Homology in Natural Sciences*", Tyumen, Russia.
- Treasurer and Member, Editorial Board, Indian Society of Geoscientists.

G.P. Srivastava -
- Treasurer, The Palaeobotanical Society.
- Member, International Commission of Museums (ICOM), Paris.
- Member, Editorial Board, "*Geophytology*".

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

Rahul Garg -
- Member, Editorial Board, Palaeontological Society of India.
- Member, Managing Council, Indian Association of Palynostratigraphers.

B.K. Misra -
- Member, Bureau of Indian Standards, Solid Mineral Fuels Sectional Committee-PCD - 7.
- Joint Secretary, Indian Society of Geoscientists.

R.K. Saxena -
- Secretary and Member, Editorial Board, Indian Society of Geoscientists.

Manoj Shukla -
- External Member, Research Committee- Botany, Lucknow University (to evaluate Research Projects for submission to UGC).

Shyam C. Srivastava-
- Convener- Secretary, Birbal-Savitri Sahni Foundation, Lucknow.
- Convener, Birbal Sahni IOP Medal Committee.
- Honorary Affiliate Member, Palaeobotany Section, Botanical Society of America.

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

Neerja Jha -
- Editor, "*Geophytology*".

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

"Vegetos" - An International Journal of Plant Research.

Madhav Kumar - Joint Secretary, The Palaeobotanical Society.

A. Rajanikanth - Assistant Editor, *"The Palaeobotanist"* (since February 15, 1999).

Rakesh Saxena - Associate Member, International Committee for Coal and Organic Petrology, Germany.

- Member, Latin American Association of Organic Geochemistry, Brazil.

Mukund Sharma - Assistant Editor, *"The Palaeobotanist"* (since February 15, 1999).

- Editor, *"Geophytology"*.
- Executive Editor, *"Vigyan Alok"*.

A. Farooqui - Executive Member, International Society of Environmental Botanists, Lucknow.

Lectures Delivered

By Institute's scientists outside:

A.K. Sinha - *"Tectonic configuration of Indian-Asian collision and building of Himalaya-Karakoram mountains"* at Kleiner Horsalldes Geologischen Institute, Koln, Germany (March 29, 1999)

G. Rajagopalan - *"Conventional ^{14}C dating, limitations in applications"* at DST sponsored awareness workshop on "Accelerator Mass Spectrometry : Applications to earth and planetary sciences" held at Institute of Physics, Bhubaneshwar (August 10-14, 1998).

- *"Radiocarbon dating method - Principle and techniques"* at a short course on "Active Tectonics and Palaeoseismology" sponsored by DST and held at J.N. Centre for Advanced Scientific Research, Bangalore (September 14-19, 1998).

J.S. Guleria - *"Tertiary flora of India"* at the Florida Museum of Natural History, University of Florida, U.S.A. (October 27, 1998).

C.M. Nautiyal - *"Science and Technology Communication"* at the workshop organised by Punjab State Council for Science and Technology (under a scheme of NCSTC, DST) at Naya Nangal.

- *"Earth as a Planet"* at CMS, Gomti Nagar, Lucknow (December, 1998).

Rakesh Saxena - *"Coal Fire (an enigma) vis-a-vis implications of Coal Petrography"*, at Senior Mine Managers Course, Indian Institute of Coal Management (IICM) Ranchi (April 15, 1998).

- *"Coal petrography - its implications in mining industry"* dealing with particular reference to the prospects of Coal Bed Methane at Bokaro Basin, Coal Management Trainees at IICM, Ranchi (April 17, 1998)

- *"Coal petrography and its importance in coal mining sector"*, Ranchi University, Ranchi (April 18, 1998).

- *"Recent advances in coal petrography"* at Fuel Research Institute, Ranchi (April 21, 1998).

A. Bhattacharyya - *"Himalayan Dendro-chronology"* at INSA council meeting held in Simla/ Chail during May 8-9, 1998.

A. Rajanikanth - *"Scientific Temper"* at Orientation course of Science organised at Kendriya Vidyalaya Sanghatan, Lucknow (May 11, 1998).

- *"Biodiversity"* at Army Public School, Lucknow (July 25, 1998).

- *"Science Communication"* at the Institute of Environment Management, Lucknow (September 26, 1998).

Rashmi Srivastava - *"Tertiary flora of India"* at Osaka Museum Natural History, Osaka, Japan (June 10, 1998).

By outside scientists in the Institute :

Dr Hari Narain - Member, Advisory Council, Directorate General of Hydrocarbons, Govt. of India, New Delhi- *"Oil crisis"*, April 17 and *"Diamonds are for ever"*, April 22, 1998.

Prof. Leon Stuchlik- Director, Institute of Botany, Polish Academy of Sciences, Krakow, Poland- *"General information: W. Szafer Institute of Botany"*, October 16, 1998.

Mr W. Granoszewski- Institute of Botany, Polish Academy of Sciences, Krakow, Poland- *"Late Pleistocene pollen sequence from Eastern Poland"*, October 16, 1998.

Prof. B.B. Lal - Former Director General, Archaeological Survey of India, New Delhi- *"New dimension of Indus Civilization"*, November 19, 1998.

Dr Gene Mapes - Director, Department of Environmental and Plant Biology, Ohio University, Athens, Ohio- *"Permo-Carboniferous coniferophyte from Kansas U.S.A."*, November 27, 1998.

Dr G.W. Rothwell- Department of Environmental and Plant Biology, Ohio University, Athens, Ohio- *"Reconstruction of plants for the reconstruction of fern phylogeny"*, November 27, 1998.

Prof. R.A. Spicer - Department of Earth Sciences, The Open University, Milton Keynes, U.K.- *"Mid- and Late Cretaceous climate of Asia and Northern Alaska using CLAMP Analysis"*, December 4, 1998.

Dr Mike Widdowson- Department of Earth Sciences, The Open University, Milton Keynes, U.K - *"Stratigraphy and Structure of the Southern Deccan Traps: A Chemo-stratigraphical approach"*, December 4, 1998.

Prof. Helmut Wopfner - Emeritus Professor for Applied Geology, University of Cologne, Germany - *"A palaeoclimatic transect for the Late Palaeozoic from Africa to the Alps: Can it apply to India ?"*, January 13, 1999.

Prof. Bharat Bhaskar- Indian Institute of Management, Lucknow - *"Harnessing Information Technology"*, February 24, 1999.

Deputation/Training/Study/Visit Abroad/in Country

Rashmi Srivastava

Under INSA-JSPS International Scientific Exchange Programme, visited Japan for three months from 27th March to 28th June, 1998. The major stay was in Botanical Garden, Tohoku University, Sendai for about 9 weeks. Besides, visited Archaeological sites at Aomori with the members of National Museum of Japanese History, Kyoto; Wood Research Institute, Kyoto at Uji City, Nara; Botanical Garden, Osaka City University; Osaka Museum of Natural History; Lake Biwa Museum and site of Shiga Prefecture, Museum of Nature and Human Activities, Sanda City of Hyogo Prefecture, Natural History Museum and Institute, Chiba; Geoscience Department, Chiba University; Institute of Natural History, Tokyo; Natural History Museum, Tokyo; Laboratory of Geoscience and Biology, Chuo University; Forestry and Forest Product Research Institute, National Institute of Agrobiological Resources and Geological Museum of Geological Survey of Japan at Science City, Tokyo.

Vandana Prasad

Spent three months (May-July, 1998) as a Visiting Scientist at the Centre De Geochimie De La Surface of Institute of Geology, Strasbourg, France and acquired expertise on Dispersed Organic Matter studies through transmitted light microscope. These studies were applied on Subathu sediments of Morni hills, Haryana and Kalakot area of J & K with a view to interpret palaeoenvironment. Techniques involved in the TEM studies of palynodebris were also learnt.

M.R. Rao, A. Rajanikanth & Pawan Kumar

Deputed to erect the Institute's exhibition at Allahabad during State level Golden Jubilee Science and Technology Exhibition and Festival during June 17-20, 1998.

A.K. Sinha

Visited Moscow from June 24-30, 1998 under Indo-Russian Integrated Long Term Project (ILTP) between DST and Russian Academy of Sciences. Visited Russian Academy of Sciences Laboratories: Institute of Geochemistry and Petrography of Mineral Deposits and Geological Institute at Moscow. A new collaborative programme between the Geological Institute of Academy of Sciences and BSIP was drafted and presented before ILTP Reviewing Committee for acceptance. In principle DST and Academy of Sciences agreed on the proposal. Besides above two mentioned Institutions, Institute of Oceanography will also participate in the project.

After attending the "14th Himalaya-Karakoram-Tibet International workshop", Germany in March, 99 visited Geological Institute at Cologn and Erlangen University at Nurnberg; had scientific discussions with Prof. Helmut Wopfner (at Cologn) and Prof. Werner Schwan (at Nurnberg) on the topic "Terrane accretion and geological evolution of NW Higher Himalaya and Karakoram tectonic belt".

Shaila Chandra & K.J. Singh

After attending the Gondwana-10 Conference in June-July, 1998 visited National Botanical Institute, Pretoria; Natural History Museum, Cape Town, South Africa.

Archana Tripathi & Madhukar Arvind

Attended *'LOTUS Seminar'* held at Taj Hotel, Lucknow on July 1, 1998. Archana Tripathi also attended *'Intel Vision Seminar'* held at Lucknow on May 21, 1998.

H.K. Maheshwari, Anil Chandra, J.S. Guleria, Manoj Shukla, A. Rajanikanth, K.J. Singh & Madhav Kumar

Deputed to act as volunteers at Institute's Exhibition (erected and manned by G.P. Srivastava and P.K. Bajpai) at India's Science and Technology Exhibition "*AGRASAR*- Achievements of Science and Technology since Independence and vision for the Future", organised to commemorate 50 years of Independence at India Gate lawn, New Delhi from August 3-16, 1998.

Vijaya

After attending the "5th International Symposium on Jurassic System", Canada in August, 1998 visited Palynosurvey Company at Tokyo, Japan to discuss the Jurassic-Cretaceous palynoflora in Mesozoic sequences of India and Japan.

A. Bhattacharyya

Presented project entitled "Analysis of climatic changes in the Eastern Himalayan region using tree ring data" for the approval for funding from DST before PAC-ES committee at CAMMS, Bangalore, August 29-30, 1998.

Presented project entitled "Analysis of climatic changes *vis-a-vis* glacial fluctuations using pollen and tree ring data in Gangotri Glacier area, Garhwal Himalayas" for the approval for funding from DST before PAGES committee at DST, New Delhi, October 27, 1998

S.A. Jafar

Under reinvitation programme of the German Academic Exchange Service (DAAD), Bonn, Germany, visited the Geological Institutes of the Universities of Tuebingen (2 months) and Munich (1 month) from September 01 to November 30, 1998.

G. Rajagopalan

Attended DST sponsored short course on *"Active Tectonics and Palaeoseismology"* held at J.N. Centre for Advanced Scientific Research, Bangalore from September 14-19, 1998.

A.K. Srivastava & Kavita Kumar

After attending the "International Scientific Conference on Dichotomy and Homology in Natural Sciences, Tyumen" in September, 1998 visited Palaeontology laboratories, Museums and Libraries of All Russian Geological Institute, St. Petersburg; Geology Faculty of Moscow State University, Moscow; and Tyumen State Oil and Gas University, Tyumen, Russia. Two excursions to Tyumen city and Kremlin Toblosk areas of Russia were under taken. Srivastava examined and discussed the Angara flora in relation with Gondwana flora of India with concerned scientists. Kavita Kumar discussed classification of literatures, display pattern and organisation pattern of libraries with concerned librarians.

J.S. Guleria

Visited Palaeobotany Laboratory of Professor David L. Dilcher at the Florida Museum of Natural History, University of Florida, U.S.A. for a week from October 25-30, 1998.

Asha Gupta

After attending the Conference and Symposium in Iran in November-December, 1998 visited Research Centre for Conservation of Cultural Relics, Iranian National Museum, Malek Public Library and Museum, Carpet Museum, Post Museum, National Islamic Museum, Coin Museum and Archaeological Museum in Tehran. Also participated in associated

field excursion to Qom and Esfahan.

Usha Bajpai, Ram Awatar, Khowaja Attequzzaman & V.K. Singh

Underwent in-house training on the operation of the newly procured Leo 430 Scanning Electron Microscope. The training was given by engineer of the Vendor.

Mukund Sharma

Invited by the DST to participate in Special Young Scientist Session held during 86th Indian Science Congress, Chennai from January 3-7, 1999.

All the Scientific, Technical and Administrative staff participated in the "Civil Defence Training" organised at BSIP from August 8-16, 1998.

Deputation to Conferences/Symposia/Seminars/Workshops

A. Bhattacharyya- *"Tree Science Conference-98"* held at New Delhi from April 10-13, 1998.

A.K. Sinha - *"13th Himalaya-Karakoram-Tibet International Workshop"* held at Peshawar, Pakistan from April 20-22, 1998.

- *"14th Himalaya-Karakoram-Tibet International Workshop"* held at Kloster Ettal, Germany from March 24-26, 1999.

Rashmi Srivastava- *"Annual Meeting and Seminar of Society of Himalayan Botany of Japan"* held at Kanazawa University, Kanazawa, Japan from May 12-13, 1998.

- *"Palaeobotanical Seminar"* held at Chuo University, Tokyo on June 20, 1998.

P.K. Maithy - *"10th International Gondwana Conference"* held at Cape Town, South Africa from June 28 July 4, 1998.
Shaila Chandra
Jayasri Banerji
Shyam C. Srivastava
Vijaya
K.J. Singh

G. Rajagopalan - "*Workshop Accelerator Mass Spectrometry : applications to earth and planetary sciences* "held at Institute of Physics, Bhubaneshwar from August 10-14, 1998.
A. Bhattacharyya

Vijaya - *"5th International Symposium on Jurassic System"* held at Vancouver, Canada from August 16-20, 1998.

A.K. Srivastava - *"International Scientific Conference on Dichotomy and Homology in Natural Sciences"* held at Tyumen, Russia from September 7-12, 1998.
Kavita Kumar

Archana Tripathi- *"CIMP Symposium and Workshop"* held at Pisa, Italy from September 11-14, 1998.

J.S. Guleria - *"Systematic Wood Anatomy Symposium"* of the 7th Latin American Botanical Congress held at Maxico City, Mexico from October 18-24, 1998.

A. Gupta - *" 21st All India Botanical Conference"* held at Ujjain from October 24-26, 1998.

- *"4th International Conference on Biodeterioration of Cultural Property"* held at Tehran, Iran from November 21-25, 1998.

- *"3rd International Symposium on Conservation and Restoration of Historical Objects and Architectural Decorations"* held at Tehran, Iran from November 29 -December 2, 1998.

P.K. Maithy - *"International Seminar on Field Workshop on Precambrian Continental Crust in Eastern and Central India"* held at Bhubaneshwar from October 29-31, 1998.

- *"50 Years of Progress in Precambrian Geology of India"* held at Calcutta from

November 1-2, 1998.

Anjum Farooqui - *"National Symposium on Late Quaternary and climatic changes"* held at Cochin from November 4-6, 1998.

H.P. Gupta - *"International Workshop on Sustainable Development of Chilka Lake, Orissa"* held at Bhubaneshwar from December 12-14, 1998.

Suresh C. Srivastava, A.K. Srivastava, R.C. Mehrotra, S.K. Bera, Madhav Kumar, Rajni Tewari, A.P. Bhattacharyya - *"National Workshop on Geodynamics and Natural Resources of North-Eastern, India"* held at Dibrugarh from December 18-22, 1998.

A.K Sinha, G.P. Srivastava, Samir Sarkar, A. Rajanikanth, Asha Gupta, P.K. Bajpai - *"86th Indian Science Congress,"* held at Anna University, Chennai from January 3-8, 1999. An exhibition was erected about the BSIP to educate visitors.

Rajni Tewari - *"18th" Annual Convention and Conference on Sharing Information Resources through Net Working"* held at Chandigarh from February 12-13, 1999.

K. J. Singh - *"National Seminar on Plant Genetic Diversity : Evaluation and Conservation"* held at Chandigarh February 22-23, 1999.

A.K. Sinha, Chhaya Sharma, A. Bhattacharyya - *"Bio-Geo data base and ecological modelling from Himalaya"* Brain Storming Meeting held at New Delhi from March 4-5, 1999.

A.K. Sinha, Chhaya Sharma, R.R. Yadav, A. Bhattacharyya - *"Symposium Snow, Ice and Glaciers: A Himalayan Perspective"* held at Geological Survey of India, Lucknow from March 9-11, 1999.

A.K. Sinha, G. Rajagopalan, P.K. Maithy, Manoj Shukla, Mukund Sharma - *"Workshop Vindhyan Stratigraphy and Palaeobiology"* held at Dept. of Geology, University of Lucknow, Lucknow from March 19- 20, 1999.

Papers presented at Conference/Symposia/Meetings

Banerji J - Megafloral diversity of the Upper Gondwana sequence of the Rajmahal Basin, India. *10th Int. Gondw. Conf.*, Cape Town, South Africa, June-July 1998.

Bera SK - Modern pollen deposition in Mikir Hills, Assam. *Nat. Workshop Geodynamics and natural resources of north-east India*, Dibrugarh, December 1998.

Bhattacharyya A - Dendrochronological investigations in India. *Tree Sci. Conf.*, New Delhi, April 1998.

Bhattacharyya A - Climatic and vegetational scenario in the north west Himalayas since last 75,000 yrs B.P. *Bio-Geo Database for Himalaya:* Brain Storming Meeting, New Delhi, March 1999.

Chandra S - Colonisation and subsequent speciation/diversification on Indian Gondwana subcontinent - Gondwana Biodiversity. *10th Int. Gondw. Conf.*, Cape Town, South Africa, June-July 1998.

Chandra S - Plant colonisation of Gondwana and subsequent speciation/diversification on Gondwana fragments. *10th Int. Gondw. Conf.*, Cape Town, South Africa, June-July 1998.

Farooqui A - Holocene sea level/climatic changes evidenced by palynostratigraphical and geochemical studies. *Nat. Symp. Late Quaternary Geology and Sea-level Changes*, Cochin, November 1998.

Guleria JS, Nuzez Vargas CA, Gregor HJ & Awasthi N - Systematic wood anatomy of fossil trees from the Tertiary sediments of Guatemala, Central America. *Syst. Wood Anatomy Symp.* Mexico, October 1998.

Gupta A - Modern pollen deposition in Nainital District, Kumaun Himalaya. *21st All India Bot. Conf.*, Ujjain, October 1998.

Gupta A - Fungal remains from Tertiary deposits exposed at Sirmaur, Himachal Pradesh, India. *4th Int. Conf. Biodeterioration of Cultural Property*, Tehran, Iran, November 1998.

Gupta A - Liverworts : useful for study of pollen vegetation relationship and climatic interpretations. *86th Indian Sci. Cong.*, Chennai, January 1999.

Gupta HP & Khandelwal A - Chilka Lake: Testimony of environment. *Int. Workshop Sustainable development of Chilka Lake,* Bhubaneshwar, December 1998.

Kotlia BS, Sharma C, Phartiyal B & Bhalla MS - Palaeoclimatic conditions in Late Pleistocene lacustrine profiles of Central Himalaya, India. *13th Himalaya-Karakoram Tibet Int. Workshop,* Peshawar, Pakistan, April 1998.

Kumar K - Dichotomous and homologous patterns in cataloguing and classification of palaeobotanical literatures. *Int. Sci. Conf. Dichotomy and Homology in Natural Sciences,* Tyumen, Russia, September 1998.

Kumar M - Palynological analysis of Miocene sediments of the North Cachar Hills, Assam. *Nat. Workshop Geodynamics and natural resources of north-east India,* Dibrugarh, December 1998.

Maithy PK - Gondwanic structural biological life from the India before the Permian Times. *10th Int. Gondw. Conf.*, Cape Town, South Africa, June-July 1998.

Maithy PK - Biological remains and organo-

sedimentary structures from Iron Ore Super Group. (Archaean) of Barbil, Singhbhum Craton. *Int. Sem. Precambrian Crust in eastern and central India*, Bhubaneshwar, October 1998.

Maithy PK - Vindhyan organic-walled microfossils : A tyro's view. *Workshop Vindhyan Stratigraphy and Palaeobiology,* Lucknow, March 1999.

Maithy PK & Babu R - On conundrum remains from the Rohtas Limestone Formation, Semri Group, Vindhyan Supergroup, exposed around Akbarpur, Bihar. *Workshop Vindhyan Stratigraphy and Palaeobiology,* Lucknow, March 1999.

Mehrotra RC - Study of plant megafossils from the Tura Formation of Nangalbibra, Garo Hills, Meghalaya. *Nat. Workshop Geodynamic and Natural Resources of north-eastern India,* Dibrugarh, December 1998.

Misra L & Khandelwal A - A survey of airspora of vegetable market of Lucknow in relation to market diseases. *Symp. Microbes, Environment and plant diseases,* Lucknow, February 1999.

Ravi Shanker, Maithy PK, Singh G & Kumar G - Palaeogeographic evolution and biotic changes of Indian subcontinent from Terminal Palaeo-proterozoic to Early Palaeozoic. *Int. Sem Precambrian Crust in Eastern and Central India,* Bhubaneshwar, October 1998.

Ravi Shanker, Singh G, Kumar G & Maithy PK - Pre-Gondwana events and evolution of Indian subcontinent as part of Gondwanaland. *10th Int. Gondw. Conf.*, Cape Town, South Africa, June-July 1998.

Sarkar S - Fossil spores of *Glomus* (Vam Fungi) from the Subathu Formation (Early Ypresian-Middle Lutetian) of Himachal Pradesh, India. *86th Indian Sci. Cong.*, Chennai, January 1999.

Sharma M & Shukla M - Aspect and appraisal of megascopic fossils in the Vindhyan sediments. *Workshop Vindhyan Stratigraphy and Palaeobiology,* Lucknow, March 1999.

Singh KJ - Plant biodiversity in Mahanadi Basin, India during the Gondwana period. *10th. Int. Gondw. Conf.*, Cape Town, South Africa, June-July 1998.

Singh KJ - Pre-angiosperm plant diversity in Mahanadi Basin, India. *Nat. Sem. Plant Genetic Diversity : Evaluation and Conservation*, Chandigarh, February 1999.

Sinha AK - Himalayan subduction and accretion tectonics of Karakoram Block in central Asian Mountain Complex. *86th Indian Sci. Congr.,* Chennai, January 1999.

Sinha AK, Chandra R & Upadhyay R - Accretion of terrane in Karakoram microcontinent: New palaeobotanical and geochemical data. *14th Himalaya-Karakoram-Tibet Int. Workshop,* Germany, March 1999.

Sinha AK, Rai H, Upadhyay R & Chandra R - A regional tectonic framework of Karakoram terrane: Interpretation from recent stratigraphic, geochemical and geochronological data. *13th Himalaya-Karakoram-Tibet Int. Workshop,* Pakistan, April 1998.

Srivastava AK - Dichotomous development pattern in Glossopterid *Int. Sci. Conf. Dichotomy and Homology in Natural Sciences,* Tyumen, Russia, September 1998.

Srivastava AK & Bhattacharyya AP - Vertically preserved *Vertebraria* - axes from Damuda beds of Darjeeling District, West Bengal. *Nat. Workshop Geodynamics and Natural Resources of north-eastern India,* Dibrugarh, December 1998.

Srivastava R - Tertiary wood flora of India. *Palaeobot. Sem.*, Tokyo, June 1998.

Srivastava Shyam C - Climatic fluctuation during Triassic of India: A palaeofloral approach. *10th Int. Gondw. Conf.*, Cape Town, South Africa, June-July 1998.

Srivastava Suresh C & Bhattacharyya AP - Palynology in stratigraphy of Lesser Himalayan sedimentary sequences from Arunachal Pradesh. *Nat. Workshop Geodynamics and Natural Resources of north-eastern India,* Dibrugarh, December 1998.

Srivastava Suresh C, Srivastava AK, Bhattacharyya AP & Tewari R - Microbial association in some Permian spore-pollen assemblage of North East Himalaya. *Nat. Workshop Geodynamics and Natural Resources of north-eastern India,* Dibrugarh, December 1998.

Tripathi A- *Talcheridium indicum* gen *et* sp. nov., a new organic walled microfossil from the Barakar Formation, Early Permian, Talcher Coalfield, Orissa, India. *CIMP Symp. and workshops,* Italy, September 1998.

Vijaya - Palyno-event stratigraphy of Neocomian palynoflora on Indian peninsula. *10th Int. Gondw. Conf.*, Cape Town, South Africa, June-July 1998.

Vijaya - Potential palyno-events in Jurassic palynoflora on Indian peninsula. *5th Int. Symp. Jurassic System,* Vancouver, August 1998.

Yadav RR - Climatic variations over the western Himalaya as deduced from tree rings. *Symp. Snow, Ice and Glaciers: A Himalayan Perspective*, Lucknow, March 1999.

Doctoral Degree awarded

Name	Supervisor	Title of the thesis	University
E.G. Khare	N. Awasthi	"Studies on plant fossils of Deccan Intertrappean sediments of India"	Lucknow University, Lucknow
Ratan Kar	Anand Prakash	"Palynostratigraphy of the Gondwana sediments from Ramkola-Tatapani Coalfield, Surguja District, M.P., India"	Lucknow University, Lucknow
A.K. Pokharia	K.S. Saraswat	"Palaeoethnobotanical study in Kushana Culture (ca. 100-300 A.D.) at Ancient Sanghol, Punjab"	Lucknow University, Lucknow

Consultancy/Technical assistance rendered

Fifty-three samples have been dated in the Radiocarbon Lab as a part of consultancy services offered by the institute and a sum of Rs. 1,32,500/- has been earned.

Technical Assistance (Radiocarbon dating of samples) rendered to other Agencies:

Geological Survey of India, Lucknow.
Wadia Institute of Himalayan Geology, Dehradun.
Kumaon University, Nainital.
Professor P.K. Banerji, Emeritus Scientist, CSIR, Jadavpur University, Calcutta.
Centre for Study of Man and Environment, Calcutta.
Centre for Earth Science Studies, Trivandrum.
Agharkar Research Institute, Pune.
National Institute of Oceanography, Goa.
National Bureau of Soil Survey and Land Use Planning, Nagpur.
Deccan College, Pune.
G.B. Pant Institute, Almora.
G.B. Pant Institute of Himalayan Environment and Development, Sikkim.

Consultancy alongwith technical assistance was rendered for SEM application in different disciplines of biological sciences to:

Central National Herbarium Garden, Howrah (West Bengal).
Department of Botany, Lucknow University, Lucknow.
Department of Zoology, Lucknow University, Lucknow.

Newly installed Scanning Electron Microscope (LEO 430) at BSIP

Department of Dentistry, K.G.M.C., Lucknow.
Department of Applied Chemistry, Z.H. College of Engineering and Technology.
Aligarh Muslim University, Aligarh.
Department of Botany, University of Rajasthan, Jaipur.

Chhaya Sharma

Completed the chemical processing of 5 soil samples received from Baroda University and the studies are in progress.

Chhaya Sharma, S.K. Bera & M.S. Chauhan

Completed chemical processing of 45 core samples received from Geological Survey of India for palynological investigation.

J.P. Mandal

Twenty-seven samples, received from Mineral Exploration Corporation, Nagpur have been analysed to determine the age based on palynology.

Neerja Jha & O.S. Sarate

Technical assistance rendered to Sri. P.V. Shankara Rao, Jr. Geologist, Singareni Collieries Company Ltd., Kothagudem for processing and study of palynological and coal petrological entities of coal from Kothagudem sub-basin of Godavari Graben. Qualitative and quantitative estimation and interpretation of data of the coal-bearing sequence has been provided in quest to identify the presence of Queen Seam, which is the most potential and economically important coal seam in the area.

A. Rajanikanth

Investigated petrified woods sent by the Divisional Forest Officer, Wild Life Management, Warangal, Andhra Pradesh.

Units

Publication

Journal - *The Palaeobotanist*

Research papers for the Volume 47 of the Journal were processed and handed over to press for necessary corrections.

Monograph

Monograph on "An Introduction to Gymnosperms, Cycas and Cycadales" by Professor D.D. Pant has been processed. Galley proof is in press for corrections and necessary additions.

Newsletter

BSIP Newsletter Number 1 (June, 1998) was processed and printed incorporating information on activities of the Institute.

Biographical sketches

On the occasion of Founder's Day celebrations and related memorial lectures two booklets on the biography of Professor Birbal Sahni and Professor A.C Seward were brought out. Contributions made by these two great Palaeobotanists were highlighted.

A brief account of Institute and its activites in the form of a small handout (compiled by Museum Personnel of the Institute) was also printed to popularise science of palaeobotany amongst general public.

Annual Report

The Annual Report for the year 1997-98, both in Hindi and English were published supplemented with details of research work done along with coloured, black and white photographs. These reports comprise about 83 printed pages. The printed copies of the Reports were sent to DST, New Delhi and other organisations.

A revised document on thrust areas has also been printed with a focus on various thrust areas of research and their significance.

Circulars of International Symposia

Information on two International symposia namely : (a) *International Symposium* on *Multi-faceted Aspects of Tree-Ring Analysis* (Final Circular), and (b) *International Symposium and Field Workshop on Geodynamic Evolution of Himalaya- Karakoram Eastern Syntaxis (Indo- Burma Range) Andaman Nicobar Island Arc and adjoining regions,* (First Circular) were printed.

Sale of Institute Publications

This year the publication of the Institute netted an income of Rs. 1,14,197.00

Library

Library services were made available to its users efficiently during the period by the Institute's scientists as well as visiting scientists, teachers and students of other research organisations and universities in India and abroad.

The current holdings of BSIP Library are as under:-

Particulars	Additions during 1998-99	Total
Books	80	5,228
Journals	558	10,818
Reprints	406	35,916
Reference Books	1	257
Reports	—	46
Maps & Atlases	—	61
Microfilms/Fisches	—	294
Ph.D. Thesis	3	89
Hindi Books	3	146

Library is subscribing 70 journals and has at present 148 registered Card holders.

Exchange Unit

Journals received on exchange basis	69
Reprints of research papers purchased	20
Reprints sent out in exchange	9,648
Institutions on exchange list	59
Individuals on exchange list	370

Address list of about 370 individuals and institutions on the Library's Exchange List was revised. The following institutions availed the Library facilities during the year :

Lucknow University, Lucknow.
Cochin University of Science and Technology, Cochin.
Oil and Natural Gas Corporation, Sibsagar, Assam.
Institute of Ethnobiology, C/O NBRI, Lucknow.
Exploration Division, Singareni Collieries Co. Ltd., Kothagudem.
University of Reading, U.K.
Jammu University, Jammu.
Kumaun University, Nainital.

Computer aided Library

Computerisation of the Library assets is being done through LAN under UNIX O/S. The Software employed is UNIFY RDBMS and the utilities are programmed in 'C' giving different levels of securities. Data entry is in progress. Documentation, data management, exchange list report generation, subscription of journal records, etc., are also done by the computer to enhance the efficiency and accuracy of Library working.

Xeroxing facility

Better xeroxing facilities through revised system are now available to Institute's scientists on yearly quota basis. This facility is also available to the scientists of other organisations on payment .

Museum

The Institute participated in a big way in three S & T Exhibitions which were organized at Allahabad, New Delhi and Chennai in order to propogate and popularise the Science of Palaeobotany.

The exhibition at Allahabad was part of the State level *"Golden Jubilee Science and Technology Exhibition and Fair"* from June 17-20, 1998. Dr Murli Manohar Joshi, Honourable Minister for Science and Technology, Human Resource and Development, Govt. of India, and Shri Hari Shankar Tiwari, Minister of State of Science and Technology, Govt. of U.P. were the distinguished visitors at our stall. The Institute stall was adjudged best amongst Central Government organisations and a certificate/gift was presented. The second exhibition was held at India Gate lawns, New Delhi from August 3 -16, 1998 entitled *"AGRASAR"* - Achievement of Science and Technology since Independence and vision for future.

Sri Krishna Kant, Vice President of India and Professor M.M. Joshi, Union Minister, HRD greeted by Prof. Anshu Kumar Sinha at the BSIP Stall, DST Pavilion, *"AGRASAR"*, New Delhi

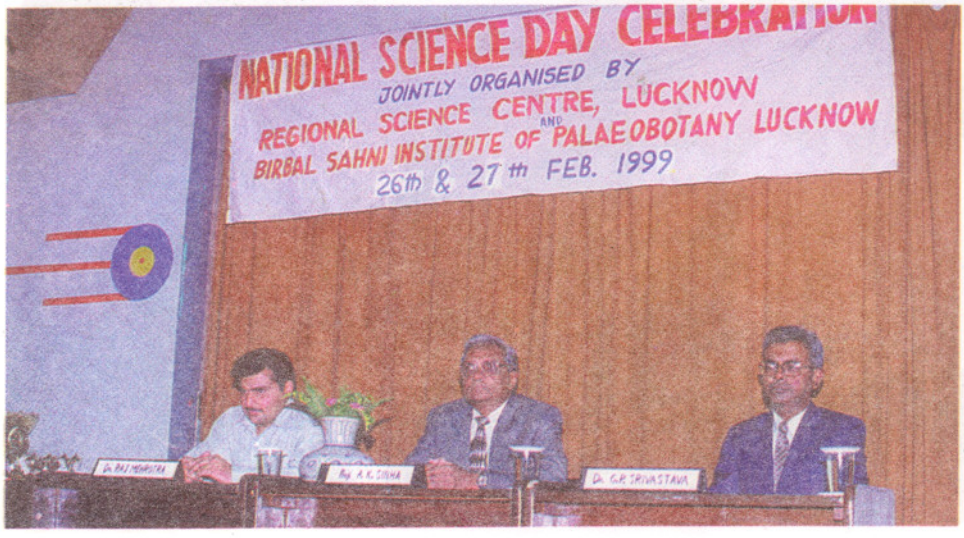
Bharat Ratna Dr. Abdul Kalam showing interest in BSIP exhibits.

The Vice President of India Shri Krishnakant, inaugurated the exhibition. The third exhibition was held at Chennai from January 3-7, 1999 during 86th session of Indian Science Congress on the theme *"New Bio-Science: Opportunities and challenges as we move into the next millennium"*. Important dignitaries who visited the stall include Bharat Ratan Dr A.P.J. Abdul Kalam, Dr R. Chidambaram, Chairman, AEC, Professor P. Rama Rao and Professor V.S. Ramamurthy. Visitors whose number runs in lakhs took keen interest in our exhibits and were fascinated to see the panorama of the plant life on the earth and the bearing of our

work in the fossil fuel exploration. Institute also participated in Science Fair in Mahanagar Boys' Inter College, Lucknow on November 14, 1998.

In order to inculcate scientific temper amongst the students in particular National Science Day was celebrated at the Institute on the theme *"Harnessing information technology"*. A lecture on the main theme was delivered by Professor Bharat Bhaskar of Indian Institute of Management, Lucknow. An art competition was held for students on February 27, 1999. Besides this, film and slide show on scientific topics, screening of educational films, an exhibition on fossil plants, open house on February 28, 1999 were also arranged for the benefit of visitors. In all 375 students from 20 educational Institutions visited the Institute and took keen interest in our activities. In addition to this, National Science Day was also jointly held at Regional Science Centre, Lucknow on 27th February by holding various programmes, i.e. science quiz, essay competition and astronomy quiz, etc. Prize distribution was done at both places. The local electronic and print media gave a wide coverage of activities.

School children participating in an Art competition at the Institute and prize distribution by the Director, BSIP.



National Science Day Celebrations at Regional Science Centre, Lucknow

A large number of students, members of general public, teachers of refresher courses of Academic Staff College, Lucknow University, besides scientists of Russia, U.K., Germany and U.S.A. also visited the Institute.

Type and Figured Specimens/ Slides/Negatives

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

Particulars	Addition during 1998-1999	Total
Type and Figured Specimens	270	5826
Type and Figured Slides	224	11,688
Negatives of the above	380	15,469

New Collection:

Specimens/samples were collected by the scientists from 198 localities of the country and deposited in Museum for investigations :

	Specimens	Samples
Project- 1	70	133
Project- 2	201	79
Project- 4	202	501
Project- 5	467	-
Project- 6	-	312
Project- 7	167	185
Project- 8	439	1370
Project- 9	-	217
Project- 10	-	63
Project- 11	-	90
Project- 12	-	87

Samples deposited under other than Institute's Project:

D.S.T. Sponsored Project - 91 samples | for K/T. Boundary (ES/64/A4/16/96)

D.S.T. Sponsored Project - 50 samples |

Professor S.K. Dutta, Dibrugarh University, Assam (under collaborative project) samples - 100

Manager, Mineral Exploration Corporation Limited, Nagpur (under consultancy work) samples - 27

Mineral Exploration Corporation Limited , Barmer, Rajasthan (under consultancy work) samples - 40

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 Earth Sciences, University of Allahabad, U.P.

Reader and Head, Dean Science Convenor, B.O.S. & R.D.C., H.N.B. Garhwal University, Srinagar, U.P.

Department of Botany, Punjab University, Chandigarh.

Geologist, Airborne, Mineral Survey of Exploration Wing, Geological Survey of India , Vashudha Bhawan, Bangalore, Karnataka.

Art Science and Commerce College, Chikwaldara, District, Amarawati, Maharashtra.

Department of Botany, Handique Girls College, Guwahati, Assam.

Department of Biology, Govt. Inter College, Dhokane, Distt. Naini Tal, U.P.

Co-ordinator, Department of Studies in Environment Science, University of Mysore Mysore, Karnataka.

Assistant Director, Govt. Museum, Egmore, Chennai.

Institutional Visitors

Govt. P.G. College, Pithoragarh, U.P.

M.M.M. College, Bhatpar Rani, Deoria, U.P.

Kokrajhar Degree College, Assam.

Botany Department, Nagaland University, Lumani, Nagaland.

Lucknow University, Lucknow.

I.T. College, Lucknow.

St. Marry's School, Lucknow.

Herbarium

Reference collection of extant plant materials and their preparations are being maintained in the Herbarium for comparative morphological study of fossil specimens. About 500 plant specimens, 10 samples of wood blocks, 200 samples of polleniferous materials, 250 samples of fruits and seeds were collected from different localities in India. About 33 wood slides, 50 leaf specimens and 52 pollen slides were added to the Herbarium. Feeding of data in computer, for preparation of the *Inventory of Carpothek* has been completed. Preparation of cards and data feeding in computer for preparation of *Inventory of Sporothek* and Xylarium are being done.

Herbarium Holdings :

Particulars	Additions during 1998-99	Total
Herbarium		
Herbarium sheets of plant specimens	500	16,325
Herbarium sheets of leaf specimens	50	520
Laminated mounts of venation pattern	-	40
Xylarium		
Wood block	10	4,044
Wood disk	-	60
Wood cores	-	470
Wood slides	33	4,023
Palm slides (stem, leaf, petiole, root)	-	3,195
Sporothek		
Polleniferous materials	200	1,390
Pollen slides	52	11,691
Carpothek		
Fruits/seeds	250	2,816

Materials received

A gift of about 20 various kinds of seeds was received from Dr Veena Chandra, Seed Laboratory, Forest Research Institute, Dehra Dun.

Herbarium facilities provided to

Professor Dr Leon Stuchlik & Mr Wjciech Granoszewski. Institute of Botany, Polish Academy of Science, Krakow, Poland.

Dr A. Banerjee, Gauhati College, Guwahati, Assam.
Dr Gene Mapes & Dr G.W. Rothwell , Ohio University, Athens, Ohio.
Dr S.D. Bhagat, Government Rajendra College, Bhatinda, Punjab.
Dr R.M. Painoli, H.N. Bahuguna Garhwal University, Srinagar, Garhwal.
Dr R.P. Singh, Government Degree College, Gwalior.
Dr B.D. Srivastava, D.A.V. Degree College, Indore.
Dr Loknath Sahu, Government College, Patna.
Dr (Mrs.) S. Mohanty, Utkal University, Bhubaneshwar, Orissa.
Dr (Mrs.) B. Sreedevi, Osmania University, Hyderabad.

Other Visitors

Dr Surya Prakash, Cultural Department, U.P. Secretariat, Lucknow.
Dr P.N. Tripathi, B-6, Sachiwalaya Colony, Mahanagar.
Dr V.K. Dikshit, Additional S.P., E. O. W., Lucknow.
Dr Veena Chandra, Seed Laboratory, Forest Research Institute, Dehra Dun.
Dr. N.K. Dubey, Department of Botany, Banaras Hindu University, Varanasi.

Institutional Visitors

Teachers attending Refresher Course, Academic Staff College, Lucknow University
Students of Botany Department, U.P. College, Varanasi, U. P.
Students of Rajendra College, Bhatinda, Punjab.
Students of St. Andrew's College, Gorakhpur, U.P.

Electronic Data Processing

The Institute's Electronic Data Processing (EDP) Unit carried out software development, prepared the inventory of the hardware and data-base of the software and manuals available in the Unit. The Unit is pursuing for the Internet facility in the Institute for better and faster communication world over. This will facilitate the scientific interaction between different laboratories, collaborative projects, extracting information regarding international conferences and meetings, etc. The procurement of equipment for Internet is being processed. Dr Solomon Anti-virus Software has been procured.

The Unit has assisted scientific, technical and administrative staff in various ways.

A slide show was developed for National Science Day on 28th February 1999. The folders were designed for Professor Birbal Sahni Memorial and Sir Albert Charles Seward Memorial lectures. The display material (coloured and black and white) was prepared for Exhibition arranged in Indian Science Congress, State level Golden Jubilee Science and Technology Exhibition and Fair, *"AGRASAR"* Achievements of Science and Technology since Independence and Vision for Future.

The jobs carried out for scientists include graphical presentation, preparation of charts and tables, text layout for transparencies and OHP sheets, manuscript layouts and printing, scanning, modifying and printing of pictures, graphs and other illustrations.

The database for daily Hindi word was prepared for Hindi Rashtra Bhasha Samiti. The assistance to account section includes development of a menu driven package for Income Tax computation, modification of the menu driven payrolls and pension software packages and software package for Budget Estimates for year 1998-99 and Revised Estimates for the year 1999-2000.

Foundation Day and Founder's Day Celebrations

On 10th September, 1998 the Foundation Day of the Institute was celebrated. On this occasion Professor Doralrajan Balasubramanian, FNA, Director of Research, L.V. Prasad Eye Institute, Hyderabad delivered Second Golden Jubilee Commemoration Lecture on the topic "*New Biology in the help of old Botany*". Professor C.V. Subramanian, FNA, Chairman, Governing Body presided over the function. Many

Prof. D. Balasubramanian, Director of Research, LV Prasad Eye Hospital, Hyderabad, Guest Speaker, Second Jubilee Lecture gracing the dais and honoured by the Chairman GB, BSIP, Prof. C.V. Subramanian

guests and scientists from and outside Institute attended the function.

On 14th November, 1998 - 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. Same day in the evening two memorial lectures were organised as usual. Professor Tamrapu Vedant Desikachary, FNA,

Former Professor, Centre of Advanced Study in Botany, Madras University, Chennai delivered the 28th Birbal Sahni Memorial Lecture on *"Some aspects of Palaeophycology"*, and Professor Shashi Bhushan Bhatia, FNA, Former Professor of Geology and Emeritus Scientist (CSIR), Panjab University, Chandigarh delivered the 44th Sir Albert Charles Seward Memorial Lecture entitled *"Post-Palaeozoic Charophyta: Phylogenetic, biostratigraphic and palaeoecologic implication"*.

Prof. T.V. Desikachary, FNA, Former Professor, Centre of Advanced study in Botany, Madras University, Chennai, lightening the lamp on the occasion of Founder's Day.

Distinguished Visitors

Dr Hari Narain
Member, Advisory Council,
Directorate General of Hydrocarbons, New Delhi.

Dr K. Muralidharan
Principal Scientist, Directorate of Rice Research,
Hyderabad, A.P.

Professor Leon Stuchlik
Director, Institute of Botany,
Polish Academy of Sciences, Poland.

Laurene Douglas and Dara Eyde, Washington, U.S.A.

Professor B.B. Lal
Former Director General,
Archaeological Survey of India, New Delhi.

Dr Eugeny Drbinin and Dr. Vlodinir Vitritoky
Moscow State University, Earth Science Museum,
and Polytechnical Museum, Moscow, Russia.

Silke Michael Schlire,
Institute Palaontologie, Weirzburg, Germany.

MC Pandya, Birmingham, U.K.

Dr Gene Mapes and Dr G.W. Rothwell
Department of Enviromental and Plant Biology,
Ohio University, Athens, U.S.A

Dr J.G. Vaidya
Department of Botany, University of Pune, Pune.

Mikhail P. Andrew
Komarov Botanical Institute, St. Petersburg, Russia.

Professor R.A. Spicer
Department of Earth Sciences,
The Open University, Milton Keynes, UK

Professor S.B. Bhatia
Centre of Advanced Study in Geology,
Panjab University, Chandigarh.

Professor T.V Desikachary
Centre of Adavance Study in Botany,
Madras University, Chennai.

Professor Helmut Wopfner
University of Cologne, Germany.

Professor M. Kedves
J.A. University, Szeged, Hungary

Status of official language

Many concret steps were taken, according to the Government of India official language policy, to promote the usage of Hindi in official work. The Institute continued to be an active member of City's Implementation Committee of official language, Unit-6. The meetings of the Institute's Implementation committee were also held as per schedule during 1998-99. A post of Hindi Translator was filled during this year & the process of filling of the post of Hindi Officer is on progress.

"*Hindi Pakhwara*" was organised in the Institute from 14th September to 28th September 1998, in which all staff of the Institute took keen interest. The main function was held on September 16, 1998 with renowned Hindi poet & satirist Shri Ravindra Kumar "Rajesh" as the chief guest along with Professor Dinesh Kumar, Director Mass communication & Science & Technology Institute as distinguished guest. On this occasion a debate was held between "*Rajbhasha*" and "Rashtrabhasha" teams. The topic of the debate was-"*Adhunik Bharat ke paripreksh̄ya mein paramparik Puravanaspativigyan apekshit bhoomika nibha raha hai*". A Short essay contest, *Prashnakunj,* Hindi type writing contest & a " *Kavya Goshthi* " were the other attractions of this function. Besides employees were awarded *prizes* for using Hindi language in day to day work.

Dr. B.C.Saini
Awardee

A large number of Hindi books were purchased for the Library of the institute. To generate awareness among the staff members, one administrative Hindi term has been on display daily since January 1, 1999. Besides, Hindi electronic data processing as well as Hindi translation work of Museum & office literature is in progress.

Mr. Ajay K. Srivastava
Awardee

काव्य गोष्ठी समारोह में मंच पर आसीन मुख्य अतिथि डॉ शकुन्तला कालरा, निदेशक प्रो. अंशु कुमार सिन्हा तथा संचालक डॉ. हरि कृष्ण महेश्वरी.

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 'F'

Dr Anand Prakash
Dr Anil Chandra
Dr (Mrs) Shaila Chandra
Dr Prabhat K. Maithy
Dr Govindraja Rajagopalan
Dr Suresh C. Srivastava

Scientist 'E'

Dr (Ms) Jayasri Banerji
Dr Syed A. Jafar
Dr Kripa S. Saraswat
Dr (Mrs) Chhaya Sharma
Dr Ashwini K. Srivastava
Dr Gajendra P. Srivastava

Scientist 'D'

Dr Krishna Ambwani
Dr (Mrs) Usha Bajpai
Dr Rahul Garg
Dr Jaswant S. Guleria
Dr (Mrs) Neerja Jha
Dr (Mrs) Asha Khandelwal
Dr Pramod Kumar
Dr Jagannath P. Mandal
Dr Basant K. Misra
Dr Chandra M. Nautiyal
Dr Mulagalapalli R. Rao
Dr Samir Sarkar
Dr Ramesh K. Saxena
Dr Manoj Shukla
Dr Rama S. Singh
Dr Shyam C. Srivastava
Dr (Mrs) Archana Tripathi
Dr S.K.M. Tripathi
Dr (Ms) Vijaya
Dr Ram R. Yadav

Scientist 'C'

Dr Anil Agarwal
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 Annamraju Rajanikanth
Dr Ram Awatar
Dr Dinesh C. Saini
Dr Omprakash S. Sarate
Dr Rakesh Saxena
Dr Mukund Sharma
Dr (Mrs) Alpana Singh
Dr Bhagwan D. Singh
Dr Kamal J. Singh
Dr (Mrs) Chanchala Srivastava
Dr (Mrs) Rashmi Srivastava
Dr (Mrs) Rajni Tewari

Scientist 'A'

Dr (Mrs) Anjum Farooqui
Dr Amit K. Ghosh
Dr (Mrs) Vandana Prasad
Dr Gyanendra K. Trivedi

Birbal Sahni Research Scholar

Mrs Shinjini Sarana (till 31.08.1998)

Sponsored Project (DST)

Miss Poonam Sharma (JRF, till 14.07.1998)
Mr Jagdish Prasad (Field/Lab Attendant)

Technical Personnel

Publication

Mr R.L. Mehra (Technical Assistant 'E')

Library

Mrs Kavita Kumar (Technical Assistant 'E')
Mr V.K. Nigam (Technical Assistant 'E')
Mr S.R. Yadav (Technical Assistant 'C')
Mr Avanish Kumar (Technical Assistant 'A')

Museum

Mr P.K. Bajpai (Technical Officer 'B')
Mr Prem Prakash (Technical Officer 'A')
Mr Pawan Kumar (Technical Assistant 'A')

Herbarium

Mr Diwakar Pradhan (Technical Officer 'A')

Photography

Mr Pradeep Mohan (Technical Assistant 'E')

Laboratory Services

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

Technical Services

Mr K. Nagapooshanam (Technical Officer 'B')
Mr Madhukar Arvind (Technical Assistant 'E')
Mr Y.P. Singh (Technical Assistant 'D')
Mr V.S. Panwar (Technical Assistant 'E')
Mr A.K. Ghosh (Technical Assistant 'E')
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 (Technical Assistant 'A')

Administrative Personnel

Registrar

Mr S.C. Bajpai

PS to Director

Mr S.P. Chaddha

Accounts Officer

Mr J.C. Singh

Section Officers

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

Accountant

Mr I.J.S. Bedi

Maintenance Officer

Mr R.B. Kukreti

Assistants

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

Stenographer

Mrs M. Jagath Janani

Upper Division Clerks

Mr Hari Lal
Mr Koshy Thomas
Mrs Swapna Mazumdar

Mr K.P. Singh
Mr Gopal Singh
Mr M. Pillai
Mr N. Unnikannan

Lower Division Clerks

Mrs Shail S. Rathore
Mrs Renu Srivastava
Mr S.S. Panwar
Mr Rameshwar Prasad
Mr Mishri Lal
Mr A.K. Srivastava
Ms Chitra Chatterjee

Driver

Mr Nafees Ahmed ('II')
Mr D.K. Mishra ('I')
Mr V.P. Singh ('I')
Mr M.M . Mishra ('I')

Attendants 'III' (SG)

Mr Sarju Prasad
Mr Sia Ram
Mr Raja Ram

Attendants 'III'

Mr Kesho Ram
Mr Ram Deen
Mr K.C. Chandola
Mr Prem Chandra
Mr Sunder Lal
Mr Haradhan Mohanti
Mr Satruhan
Mr Ram Kishan
Mr Ram Singh

Attendants 'II'

Mr Sri Ram
Mrs Munni
Mr Bam Singh
Mr K.N. Yadav
Mrs Maya Devi
Mr Kailash Nath
Mr Mohammad Shakil
Mr Mani Lal Pal

Attendants 'I'

Mr Ram Ujagar
Mr Ram Dheeraj
Mr K.K. Bajpai
Mr Dhan Bahadur Kunwar
Mr Hari Kishan
Mr S.C. Mishra
Mr V.S. Gaikwad
Mr Ramesh Kumar
Mr R.K. Awasthi
Mr Inder Kumar
Mr Deepak Kumar

Mali

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

Appointments and Promotions

Appointments

Mr Pavan Singh Katiyar, Technical Officer 'B', w.e.f. 30.12.1998.
Dr Punit Bisaria, Hindi Translator, w.e.f. 14.08.1998.
Mr Sanjay Singh, Junior Research Fellow (DST Sponsored Project) w.e.f. 15.05.1998.
Miss Debi Dutta, Junior Research Fellow (DST Sponsored Project) w.e.f. 28.12.1998.

Promotions (with effect from 01.04.1998)

Dr Suresh C. Srivastava, Scientist 'F'
Dr Anil Chandra, Scientist 'F'
Dr Anand Prakash, Scientist 'F'
Dr G.P. Srivastava, Scientist 'E'
Dr R.S. Singh, Scientist 'D'
Dr S.K.M. Tripathi, Scientist 'D'
Dr B.D. Mandaokar, Scientist 'C'
Dr K.L. Meena, Scientist 'C'
Dr (Mrs) Neeru Prakash, Scientist 'C'
Mr V.K. Singh, Technical Officer 'B'
Mr V.K. Nigam, Technical Assistant 'E'
Mr Keshav Ram, Technical Assistant 'E'
Mr C.L. Verma, Technical Assistant 'C'

Retirements

Dr Hari K. Maheshwari, Scientist 'F' retired on 31.01.1999.
Dr Hari P. Gupta, Scientist 'F' retired on 31.01.1999.

Relieved on lien

Mr Suresh C. Bajpai, Registrar relieved on lien for one year (w.e.f. 15.12.1998) to join the post of Registrar at Baba Saheb Bhim Rao Ambedkar University, Lucknow.

Obituaries

Dr J.S. Antal, Scientist 'E' expired on 07.02.1999.
Mr Mahadev Prasad, Attendant 'I' expired on 01.03.1999.

Papers published

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Agarwal A - Contributions to the fossil leaf assemblage of Neyveli lignite deposits, Tamil Nadu, India. *Palaeontographica*.

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Internal Committees

(w.e.f. May 04, 1998)

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Dr (Mrs) Archana Tripathi	Member
Dr B.D. Singh	Member

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Dr (Mrs) Chhaya Sharma	Member
Dr K.S Saraswat	Member
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Dr Promod Kumar	Member
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Mrs Kavita Kumar	Member -Convener

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Dr G.P. Srivastava (Ist Incharge of Museum)	Member- Convener
Dr Rahul Garg	Member
Dr J.S. Guleria	Member
Dr A. Rajanikanth (IInd Incharge of Museum)	Member
Dr Madhav Kumar	Member

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Mr K.Nagapooshnam	Member
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Staff Welfare Committee

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Mrs Sunita Khanna	Member
Mr Keshav Ram	Member
Mrs Swapna Mazumdar	Member
Mrs Renu Srivastava	Member

Prize distribution to child participants on Indepence Day celebrations organised by the Staff Welfare Committee

Audit Report
to the Governing Body of the
Birbal Sahni Institute of Palaeobotany, Lucknow

We have audited the attached Balance Sheet of the Birbal Sahni Institute of Palaeobotany, Lucknow as at 31st March 1999 and the Income and Expenditure & Receipt and Payment Accounts for the year ended on that date, subject to our comments given in "Annexure A" attached and report as under:

In our opinion and to the best of our informations and according to the explanations given to us the said account give a true and fair view :

1. In the case of Balance Sheet of the state of affairs of the Institute as at 31st March, 1999.

2. In the case of Income and Expenditure Account of the excess of expenditure over Income for the year ended on that date, and

3. In the case of Receipts and Payment Account of the receipts and payments of the Institute for the year ended on that date.

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

Sd/-
(R.N. Khanna)

Place : Lucknow
Dated : 14 July, 1999

Audit Report of the Birbal Sahni Institute of Palaeobotany, Lucknow for the year ended 31ST March,1999.

Comments on Accounts for the year ending 31st March, 1999

Annexure "A"

ACCOUNTS

1. Accounts of the Institute have been maintained on cash basis, except the Government of India grant of Rs. 38 Lacs for the year 1997-1998 from department of Science & Technology were accounted last year on the basis of sanction, received this year.
2. Various advances were noted, pending for recovery or adjustment for unduly long period, the efforts are to be made for their early settlement.

PUBLICATION

3. On scrutiny of record of it has been observed that during the last several years, the Institute has brought out publication on different subjects to sell out in the market. The Stock position of these priced publications as on 31.03.1999 is about Rs. 27.18 lacs including reserve stock of Rs. 3.88 lacs.

LIBRARY

4. No physical verification was made during the year under audit. As explained to us, library stocks are being physically verified after five years, as per Central Government rules.

FIXED ASSETS

5. Fixed Asset register has been maintained w.e.f. 1988 onwards and no record has been maintained regarding fixed assets acquired out of grants or otherwise before 1988.

   According to information & explanations furnished before us, no physical verification of fixed assets has been made.

   No identification marks on the fixed assets have been made for proper verification of assets.

6. No depreciation on fixed assets has been charged, as per accounting policy of the Institute.

7. The backlog for the maintenance of fixed assets register be updated.

RESERVES

8. During the year appropriation for Reserve Fund and Pension Fund of Rs. 50,00,000/- and 10,00,000/- respectively are made out of Institute fund. These funds are reflected as balance with the bank, which is not backed by any Investments and to that extent the Institute Bank Balance are under shown.

9. The Government grants received are not in communsurate with the Institute expenditures.

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

Place : Lucknow
Dated : 14 July, 1999

Seriatim replies to the comments offered by the Chartered Accountants on the Annual Accounts of the Institute for the year 1998-99

ACCOUNTS

1. No Comments.

2. The list of unsettled advances as on 31.03.1999 is submitted for perusal which shows that total amount of unsettled advances has been considerably reduced from Rs. 19,95,725/- to Rs. 8,83,815/-.

PUBLICATION

3. The stock position of the Publication is Rs. 27,11,207.76 as on date.

LIBRARY

4. No Comments.

FIXED ASSETS

5. The asset Register has been maintained showing the total assets of the Institute since its inception. However efforts are being made to specify the break-up of the assets pertaining to the year prior to 1988.

6. No Comments.

7. Register has been updated.

RESERVES

8. No Comments.

9. No Comments.

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

Sd/-
G. Rajagopalan
(Registrar)

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

Sd/-
Anshu K. Sinha
(Director)

BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY, LUCKNOW
BALANCE SHEET AS AT MARCH 31, 1999

Fig.in Rupees

PREVIOUS YEAR 1997-98	(LIABILITIES) SOURCES OF FUNDS	CURRENT YEAR 1998-1999
92615315	1. A) CAPITAL FUND	95615315
-3404142	B) INCOME & EXPENDITURE	-18086644
7650889	2. RESERVE FUND	12650889
3942816	3. PENSION FUND	4942816
853417	4. DONATED FUND	882587
53034	5. DEPOSIT ACCOUNT	48784
60	6. CURRENT LIABILITIES	6000
19424206	7. GENERAL PROVIDENT FUND	21950013
121135595	**TOTAL**	**118009760**

PREVIOUS YEAR 1997-98	(ASSETS) APPLICATION OF FUND	CURRENT YEAR 1998-1999
	1. FIXED ASSETS	
63554107	i) OWNED ASSETS	78984556
671075	ii) DONATED ASSETS	671075
89000	2. INVESTMENTS	192000
6752029	3. CURRENT ASSETS	-13334328
19051473	4. LOANS & ADVANCES/DEPOSITS	11952739
7650889	5. RESERVE FUND	12650889
3942816	6. PENSION FUND	4942816
19424206	7. GENERAL PROVIDENT FUND	21950013
121135595	**TOTAL**	**118009760**

CERTIFICATE

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

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

Sd/-
G. Rajagopalan
(Registrar)

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

Sd/-
Anshu K. Sinha
(Director)

BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY, LUCKNOW
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING MARCH, 1999

Fig.in Rupees

PREVIOUS YEAR			SCHEDULE	CURRENT YEAR		
PLAN	NON PLAN	TOTAL		PLAN	NON PLAN	TOTAL
			INCOME :			
16800000.00	16862000.00	33662000.00	1. GRANTS	15890000.00	17800000.00	33690000.00
0.00	454307.00	454307.00	2. R AND D RECEIPTS	0.00	523947.00	523947.00
0.00	81506.00	81506.00	3. MISC. INCOME & RECOVERIES	0.00	129970.00	129970.00
0.00	895185.00	895185.00	4. INTEREST	0.00	382000.00	382000.00
16800000.00	18292998.00	35092998.00	TOTAL .	15890000.00	18835917.00	34725917.00
			EXPENDITURE :			
1277281.00	24064133.00	25341414.00	1. PAY & ALLOWANCES	1576711.00	33418402.00	34995113.00
1691669.00	22500.00	1714169.00	2. ACADEMIC EXPENSES	1229272.00	109000.00	1338272.00
855558.00	15420.00	870978.00	3. EXPENSES ON UNITS/SERVICES	733568.00	9045.00	742613.00
			ANCILIARY TO RESEARCH			
691969.00	-4317.00	687652.00	4. TRAVELLING EXPENSES	565934.00	0.00	565934.00
86046.00	153492.00	239538.00	5. PUBLICATION EXPENSES	147508.00	139859.00	287367.00
2806754.00	444396.00	3251150.00	6. CONTINGENCIES	3240436.00	457722.00	3698158.00
1888777.00	0.00	1888777.00	7. MAINTENANCE & REPAIRS	1780962.00	0.00	1780962.00
7501946.00	-6402626.00	1099320.00	BALANCE CARRIED DOWN	6615609.00	-15298111.00	-8682502.00
16800000.00	18292998.00	35092998.00	TOTAL	15890000.00	18835917.00	34725917.00
7501946.00	-6402626.00	1099320.00	BALANCE OF INCOME & EXPENDITURE	6615609.00	-15298111.00	-8682502.00
			Less Appropriation during the year			
-6500000.00	0.00	-6500000.00	Reserve Fund	-5000000.00	0.00	-5000000.00
0.00	-1000000.00	-1000000.00	Pension Fund	-1000000.00	0.00	-1000000.00
			Balance transfered to Capital Fund			
1001946.00	-7402626.00	-6400680.00	NET EXCESS OF EXPENDE. OVER INCOME	615609.00	-15298111.00	-14682502.00

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

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

Sd/-
G. Rajagopalan
(Registrar)

Sd/-
Anshu K. Sinha
(Director)

BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY, LUCKNOW
RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDING MARCH, 1999

Fig. in Rupees

RECEIPTS		PLAN	NON-PLAN	TOTAL	PAYMENTS	PLAN	NON-PLAN	TOTAL
TO	OPENING BALANCE				BY FIXED ASSETS	8825390.00	0.00	8825390.00
	BANK CURRENT ACCOUNT							
	REVENUE	154083.00	-6704497.00	-6550414.00				
	CAPITAL	0.00	0.00	0.00	SAVINGS BANK A/C	13155540.00	0.00	13155540.00
					BY PAY AND ALLOWANCES	1576711.00	24361478.00	25938189.00
					BY RETIRING EXPENCES	0.00	9056924.00	9056924.00
	DEPOSIT A/C CAPITAL	26034.00	0.00	26034.00				
	REVENUE	22000.00	5000.00	27000.00	BY ACADEMIC EXPENSES	1229272.00	109000.00	1338272.00
					BY EXPN SERVICES/UNITS	733568.00	9045.00	742613.00
					ANCILIARY TO RESEARCH			
	CASH IN HAND	31.00	497.00	528.00	BY TRAVELLING EXPENSES	565934.00	0.00	565934.00
					BY PUBLICATION EXPENSES	147508.00	139859.00	287367.00
					BY MAINTENANCE & REPAIRS	1780962.00	0.00	1780962.00
	DONATION ACCOUNT	0.00	93341.00	93341.00	BY CONTINGENCIES	3240436.00	457722.00	3698158.00
TO	PROJECT ACCOUNTS							
	OPENING BALANCE	183288.00	0.00	183288.00				
	GRANTS	2531375.00	0.00	2531375.00	BY GENERAL PROVIDENT FUND	217664.00	6673225.00	6890889.00
TO	GRANTS :	18890000.00	17800000.00	36690000.00	BY PAYMENT OF MISC.	69486.00	2704177.00	2773663.00
TO	REFUND OF CNR ADVANCE	382459.00	0.00	382459.00				
TO	DONATION & ENDOWMENT				RECOVERIES			
					BY INVESTMENT/APPROPRIATION OF FUND	6000000.00	0.00	6000000.00
	MATURITY				BY DEPOSIT ACCOUNT	1750.00	5000.00	6750.00
	INTEREST	0.00	29170.00	29170.00	BY PROJECT ACCOUNT	723311.00	0.00	723311.00
TO	R & D RECEIPTS	0.00	523947.00	523947.00	BY DONATION ACCOUNT	0.00	103000.00	103000.00
TO	ADMN. RECEIPTS	287150.00	10473576.00	10760726.00	BY CLOSING CASH & BANK BALANCES			
TO	DEPOSIT ACCOUNT	2500.00	0.00	2500.00	DEPOSIT ACCOUNT (C.N.R.)	26034.00	0.00	26034.00
TO	INTEREST	56508.00	0.00	56508.00	CURRENT ACCOUNT(CAPITAL)	7769117.00	0.00	7769117.00
TO	MISC INCOME & RECOVERY	0.00	128454.00	128454.00	DEPOSIT ACCOUNT (REVENUE)	22750.00	0.00	22750.00
TO	PENSION FUND				G.P.F	0.00	6000.00	6000.00
	OPENING BALANCE	0.00	3942816.00	3942816.00				
	ADDITION	0.00	1000000.00	1000000.00	CURRENT ACCOUNT (REVENUE)	149723.00	-21327708.00	-21177985.00
TO	RESERVE FUND				CASH IN HAND	0.00	245.00	245.00
	OPENING BALANCE	7650889.00	0.00	7650889.00	DONATION ACCOUNT	0.00	19511.00	19511.00
	ADDITION	5000000.00	0.00	5000000.00	PROJECT ACCOUNTS	1991352.00	0.00	1991352.00
TO	OTHER RECEIPT	0.00	0.00	0.00	PENSION FUND	0.00	4942816.00	4942816.00
					RESERVE FUND	12650889.00	0.00	12650889.00
	TOTAL	**48341857.00**	**27292304.00**	**75634161.00**	**TOTAL**	**48341857.00**	**27292304.00**	**75634161.00**

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

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