

Annual Report

1997-98



BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY, LUCKNOW

(An autonomous organisation under Department of Science & Technology, Government of India)



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ANNUAL REPORT 1997-98





- Front Cover** : An *in situ* fossil wood in Middle Siwalik sandstones exposed in Ghish River, Darjeeling District, West Bengal.
- Back Cover** : Siliceous microfossils from the Miocene deposits of Havelock Island, Andaman & Nicobar Islands.
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Preface

Birbal Sahni Institute of Palaeobotany is engaged in identifying and describing plant fossils to reconstruct the past vegetational scenario and to decipher palaeogeography, palaeoecology and palaeoclimate. This information, besides updating the history of Plant Kingdom, also helps to locate and explore coal and hydrocarbon resources.

The research activities during 1997-98 have been carried out under the following five proposed Thrust Areas identified to steer the Institute with wider vision and perspective.

- Origin and antiquity of life,
- Gondwana Supercontinent : Regional geology, terrane accretion, plate tectonics and Gondwana configuration,
- Coal bed methane (CBM) investigation,
- Petroliferous basins of India and abroad, and
- Palaeoclimatology and palaeomonsoon.

In order to achieve the above objectives an integrated and multidisciplinary approach is adopted. The targets defined under various projects/components have been by and large achieved; the details are being given in the following pages of this Report.

I am grateful to the Governing Body and the Research Advisory Council of the Institute for the valuable suggestions and advice. I am also grateful to Professor P.S. Ramakrishnan, Chairman, Research Advisory Council and Dr V.C. Thakur, Member, Governing Body for valuable advice and suggestions to improve the Annual Report. The members of the Research Coordination and Planning Cell of the Institute— Drs Suresh C. Srivastava, Archana Tripathi and B.D. Singh, Dr J.S. Antal of Publication Unit and Administration Unit of BSIP have greatly helped in compiling 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, Lucknow is carrying out its Founder Professor Birbal Sahni's, vision in all botanical and geological aspects having application in earth sciences and overwhelmingly applied in fundamental research like the origin of life and exploitation of economic minerals, especially the fossil fuels. The research activities during 1997-98 have been carried out under the following five thrust areas, of IX Five Year Plan, identified to steer the Institute with wider perspectives.

- Origin and antiquity of life,
- Gondwana Supercontinent : Regional geology, terrane accretion, plate tectonics and Gondwana configuration,
- Coal bed methane (CBM) investigation,
- Petroliferous basins of India and abroad, and
- Palaeoclimatology and palaeomonsoon.

In order to achieve the aforesaid objectives of Thrust Areas an integrated and multidisciplinary approach is adopted. The targets defined under various project components have been by and large achieved. The major achievements and activities of the Institute during 1997-98 are as given below.

Origin and antiquity of life

The biological remains are recovered in the form of compressions and impressions from Karnool Basin. The presence of *Tawuia-Chuarua* assemblage defines the Neoproterozoic age for the Owk-Shale Formation. The presence of akinetes in the chert bands associated in the upper part of Lower Bhandar Limestone and Sirbu Shale Formation of Bhandar Group in Bundi, Rajasthan shows that the environmental conditions were unfavourable for the growth of algae.

Gondwana Supercontinent : Regional Geology, terrane accretion, plate tectonics and Gondwana configuration

The plant megafossil assemblages are investigated in the Tatapani-Ramkola and Panch Valley coalfields, South Rewa and north-eastern Rajmahal Basins, Pranhita Godavari Graben, Gujarat and Himalayas. For the first time carbonized leaves of *Dicroidium* and *Lepidopteris* and some other fertile forms have been recovered from Tatapani-Ramkola Coalfield. The cherts from Sonajori locality, Rajmahal Basin have shown presence of well preserved seed remains, viz., *Pakurispermum*,

Sonajorispermum, *Paradoxospermum* and *Triangulospermum*. The megafossil assemblage from Saurashtra region has evidenced the presence of bryophytic remains for the first time.

The coal-bearing sequences of Sohagpur, Talcher, Ib-Himgir, Tatapani-Ramkola, Wardha Valley coalfields, Satpura Basin and Godavari Graben have been dated palynologically and correlated. The palynofloral composition of Denwa Formation exposed in Anthoni Village in Satpura Basin suggests a Late Triassic age and is comparable to *Samaropollenites speciosus* and *Ashmoripollis reducta* zone of Carnarvon Basin, Australia.

The Middle and Upper Jurassic palynoassemblages are recorded for the first time in the Infra- and Intertrappean of Chuperbhita Coalfield, Rajmahal Basin. The palynological investigation of subsurface sediments of Panagarh sub-basin reveals the Jurassic-Cretaceous transition in the Infra- and Intertrappean sequences.

Shales containing megafossils from Karakoram area have yielded palynofossils. The composition of palynoflora (dominance of monosaccates along with fair representation of disaccates) suggests that Karakoram palynoassemblage is equivalent to Upper Karharbari (Asselian-Sakmarian) palynoflora of peninsular India. Except for the presence of *Corsaitina*, this assemblage has typical Gondwana aspect. Presence of acritarchs and microplanktons indicates marine influence during the deposition of these sediments.

Coal bed methane (CBM) investigation

The Tertiary sediments of Mahuadanr (Bihar) have been analysed for organic matter characterization. Besides amorphous, semiamorphous, biodegraded, granular and structured terrestrial types, the fungal spores and hyphae are abundant alongwith few angiospermous pollen grains. The petrological study has shown dominance of vitrinite and a few fusinite grains. The vitrinite grains seem to be gelified and termed as gelocollinite. The survey of coal seams of KanhanValley area (Satpura) indicates the potential for coal bed methane generation.

Petroliferous basins of India

The Tertiary sequences of India have been analysed to understand the floristics and biostratigraphy. The sediments from Himachal Pradesh have shown the presence of leaves of *Dipterocarpus*, *Bauhinia*, *Cassia*, *Leguminophyllum*, *Amoora*, *Bambusa* and *Amesoneuron*.

The plant remains recovered from the Himalayan foothills of Darjeeling District (West Bengal) and Uttar Pradesh have been identified. Majority of identified taxa shows the prevalence of tropical climate with excessive rainfall during Siwalik sedimentation. The fossil woods belonging to families Dipterocarpaceae, Anacardiaceae, Fabaceae, Lythraceae and Lauraceae have been recorded from Tipam Sandstone of Mizoram. Carbonised woods are collected for the first time from Surat in Gujarat and Barmer, Rajasthan.

The palynological studies of sediments from Shimla Hills show correlation with the *Homotryblium* and *Cordosphaeridium* Assemblage Zones. The dinoflagellate assemblage suggests that the sediments have been deposited under shallow near shore marine environment. The palynocomposition of Oligocene sediments in Borjan Coalfield, Nagaland suggests tropical to subtropical warm humid climate with high rain fall as indicated by the presence of taxa *Striatriletes*, *Crassoretitriletes*, *Eximispora*, *Lygodiumsporites*, *Phragmothyrites*, *Cucurbitariaceites*, *Inapertisporites*.

The dinoflagellate cysts *Achomosphaera*, *Spiniferites* and coastal plant element *Spinizonocolpites* suggest nearshore environment of deposition. The palynoflora of Thumbli Formation from Giral Lignite mine, Barmer is dominated by angiospermic pollen. Most of the palynotaxa present in the assemblage show affinity with plants presently confined to tropical to subtropical regions. The palynotaxa recovered from Cannanore, Varkala and Quilon beds belong to heterogeneous complex representing diverse ecological groups ranging from montane to back mangrove floral communities. The Oligocene sediments of south western Kutch show dominance of Rhodophyceae belonging to Corallinaceae. The dinoflagellate assemblage recovered from the calcareous sandstone nodules in Mawsynram area provides oldest marine phytoplankton in this area.

Palaeoclimatology and palaeomonsoon

The Quaternary sediments have been analysed to understand the palaeovegetation and palaeoclimate. The pollen spectra recovered from Nainital District, Kumaon Himalaya exhibit presence of mixed chirpine-oak forest with diversified arboreals/nonarboreal ratio. *Pinus* represents high values throughout and *Quercus* dominates at high elevations. The pollen analysis of samples from Boodandol and Jagmotha shows that *Shorea robusta* together with *Madhuca indica*, *Emblica officinalis*, *Terminalia*, Sapotaceae is recorded in low frequencies as compared to its occurrence in the forest floristics. The

under representation of these could be attributed to low pollen production or poor preservation in sediments. The representation of nonarboreals Poaceae, Cyperaceae Ranunculaceae, Chenop/Ams, Asteraceae and *Justicia* in the pollen spectra corresponds more or less to this composition in the ground flora.

The investigations have been carried out to understand the ancient plant economy of pre- and proto-historic sites in northern and western India. The study of carbonised plant remains from Kunal, Hissar District, Haryana has demonstrated the development and gradual advancement of agricultural economy in one of the earliest Harappan culture-complexes in India dated from ca. 3,000 to 2,500 B.C. starting with cultivation of *Hordeum vulgare* and *Lens culinaris* (3,000-2800 B.C.) with advancement of agricultural economy with addition of *Triticum* spp., *Oryza sativa*, *Pisum arvense* and *Linum usitatissimum* (2800-2600 B.C.). Finally the transition phase between early and mature Harappan culture (2600-2500 B.C.) shows addition of *Lathyrus sativus*, *Sorghum bicolor*, *Gossypium arboreum/herbaceum*, *Sesamum indicum*, etc. The fruit remains of *Zizyphus nummularia*, *Phoenix* sp., *Emblica officinalis*, *Vitis vinifera*, etc. are also encountered.

In order to reconstruct the Quaternary environment tree ring analysis has been carried out from Deodar tree growing around Malari Glacier. The dates range from 100 to 686 years, each ring is dated to the calendar year of its formation.

The Radiocarbon dating of kankar and shell samples from Yamuna River Section in Kalpi and Nala section in Sanger River show three phases of kankar deposits with ages ranging from 36200 to 22000 yrs. The gastropod and bivalve samples from a tectonically disturbed sequence in Sanger Nala near Kalpi indicate a mid to late Holocene (8800-8500 yrs B.P) tectonic event in the region. The age data of lake deposits in Sirmuri Tal, Himachal Pradesh indicate that the origin of lake dates back to 1400 yrs B.P. Likewise the Machanabela Lake was formed about 1900 yrs B.P.

Other Activities

During the year 72 research papers and 46 abstracts have been published and 58 papers were submitted for publication, 35 research papers were presented in National and International conferences. During the year, about 40 members including scientists, technical and administrative personnel were deputed in the conferences in the country and 6 scientists to International conferences abroad. Seven scientists delivered lectures in other organisations.

During the year the Institute's scientists undertook

field excursions to 255 localities. About 1027 fossil specimens and 3352 rock samples were collected and deposited in the Museum. The modern plant materials were collected by herbarium and other staff members of the Institute.

The Institute has provided technical assistance and consultancy services to personnel from various organisations in the field of electron microscopy, palynology, identification of fossil remains and radiocarbon dating. The Institute generated revenue of Rs.2,69,650/- during 1997-98. The Herbarium facilities were extended to scientists from various colleges and universities. The Institute has gifted fossil specimens and sent relevant information to 14 educational institutions in the country and one abroad. Scientists and visitors representing various organisations from the country and abroad visited the Institute and Museum. The continuous inflow of new literature has added to the present holding of the Library. Scientists from various organisations in India have availed the Institute's Library facilities. One Doctoral degree was awarded by the Lucknow University, Lucknow on the 'chemical analysis and ^{14}C dating and environmental reconstruction aspect'.

The Institute has published Volume 46 (numbers 1, 2, and 3) of the journal *The Palaeobotanist*. The numbers 1 and 2 have been published as a special publication which comprises the proceedings of the conference on "*Physical and biological changes across the major geological boundaries*" held at the Institute in November, 1997.

The Electronic Data Processing Unit has provided technical support to the staff members. The unit has acquired hardware and softwares to enhance the working in central facility. It is planned to have the Internet Services.

The Institute celebrated the National Independence Day and Republic Day with full enthusiasm. On the occasion of National Science Day a week long activity was organised on the theme "50 Years of Independence" including art competition, photo exhibition, debate competition and screening of educational films.

To commemorate the 50th Anniversary of the Institute a set of four stamps on fossil plants was issued by the Department of Posts. This set was released by the Minister of Communications, Government of India.

The Institute continued to promote the usage of Hindi in office work and also continues to be incharge of the unit in the city's Implementation Committee of official language, Unit II. "*Hindi Pakhwara*" was organised from 14 September to 28 September, 1997. A type writing

contest in Hindi was also organised during the "*Hindi Pakhwara*". The use of Hindi Electronic Data Processing is in progress.

The Government of India orders issued from time to time for reservation in respect of blind, or orthopaedically handicapped candidates are applied rationally. The General Reservation Orders of the Government of India as applicable to Autouomous Bodies are also followed by the Institute.

The total employee's strength of the Institute is 175, out of which 68 (+4 BSRS) are scientists. The scientific man power under various age groups is as follows : 35 scientists between 36-45 years; 20 scientists between 46-55 years and 13 scientists above 55 years. During the year 6 appointments and 59 promotions were made. Three staff members retired after superannuation.

Founder's Day and Foundation Day Celebrations

10 September, 1997 was observed as the Foundation Day. On this occasion Dr N.S. Murali, Professor of Surgery, Ragas Dental College, Chennai delivered First Golden Jubilee Commemoration Lecture.

This year on 11th September, 1997 four Postal stamps on fossil plants and reconstructions along with first day cover were released by Sri Beni Prasad Verma, the then Minister of Communications, Government of India. A philatelic exhibition was also arranged to mark this memorable event.

On 14 November, 1997 the Institute staff and members from other organisations offered *Pushpanjali* on the *Samadhi* of Professor Birbal Sahni. Same day Dr P.D. Dogra, FNA, INSA Senior Scientist delivered 27th Birbal Sahni Memorial Lecture on "*Endangered tree genetic resources of forests of India-High subspecific variation : its conservation and utilization in tree breeding and silviculture*". Dr P.K. Das, FNA, Retired Director-General, Indian Meteorological Department delivered 43rd Sir Albert Charles Seward Memorial Lecture entitled "*Vagaries of the summer monsoon rains*".

The Institute also participated in the exhibition organised by the Department of Science & Technology, New Delhi during 85th Annual Session of Indian Science Congress, at Hyderabad in January, 1998. During the exhibition brochures, pamphlets and Annual Report were distributed to popularise palaeobotany.



ANSHU K. SINHA
Director

Research Projects

Thrust areas, Projects and Components

THRUST AREA 1: ORIGIN AND ANTIQUITY OF LIFE

Project 1 : **Palaeobiology and biostratigraphy of Precambrian Basin**

Component 1 : *Search for oldest biological remains in Archaean*

P.K. Maithy

Studied the biological remains in thin sections from the carbonaceous chert horizon of Kashia Formation, Iron Ore Supergroup exposed in the Kashia Mine, Noamundi area, Orissa. It is basically an argillo-calcareous lithounit with well developed stromatolitic horizon. Two distinct types of organic-walled microfossils (OWM) have been identified. The sphaeroidal types are either solitary or arranged in irregular groups. One of the sphaeroidal forms is large in size (10-15 μm) and has a large organic sheath around the cell. The other sphaeroidal form has margin thickening with a vacuole in the centre. Asexual reproduction stage, binary fission and budding are also seen. Occasionally, palmelloid stages are preserved. In filamentous type, the rectangular cells are arranged end to end and belong to two distinct types.

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

Manoj Shukla, Mukund Sharma & Rupendra Babu

Manoj Shukla and Mukund Sharma studied samples from the Kurnool Basin to record the carbonaceous megaremain and OWM from the Owk Shale Formation, Kurnool Group. An assemblage of carbonaceous compressions and impressions has been recorded. It includes *Chuarina circularis*, *Tawuia* sp., *Beltina danai* and *Morania antiqua*. The presence of *Tawuia-Chuarina* in the assemblage provides a strong evidence for correlation between the assemblages of Rewa and Bhandar Groups of Vindhyan and to some extent with the Halkal Formation of the Bhima Group. Besides, some forms of carbonaceous compressions and impressions belong to the group of ellipsophysid remains. On the basis of present fossil

assemblage the age has been considered as Neoproterozoic.

Visited Kurnool Basin and collected samples of Banganpalle Quartzite exposed near Banganpalle Taluka on Tadpatri-Ankireddipalle Village road, Tummalpenta-Gudipadu Village road, and Narji Limestone around Tummalpenta, Ankireddipalle, Kankadripalle, Kolimigundla, Guruvanapalle and Gudipadu. Owk shales are well exposed all around the scarp edges of hills ranges and plateau between Banganpalle, Kurnool and Khundair Valley and Panium Quartzite exposed near Panium, Cherlopalle, Vobalpuram.

Rupendra Babu studied OWM in thin sections and macerated residues from the chert bands associated in the upper part of Lower Bhandar Limestone and Sirbu Shale



Branched stromatolites (age : 700 Ma) from the Lower Bhandar Limestone Formation, Bundi District, Rajasthan.

Formations of the Bhandar Group, Vindhyan Supergroup exposed in Bundi District, Rajasthan. The biological assemblage recovered comprises algae, acritarch and vase-shaped microfossils. The algal forms are represented mostly by group of sphaeroidal cells cf. *Sphaerocongregus*, *Gloeocapsomorpha* and *Ameliaphycus*. Filaments are elongated spiral-shaped containing spherical to oval shaped dark structures ?akinetes. The presence of akinetes shows that the environmental condition was not favourable for the growth of algae. The large sized acritarchs are *Leiosphaeridia*, *Micrhystridium*, *Lophosphaeridium*, *Margominuscula* and VSM belong to Desmochitina. The organo-sedimentary structures belonging to Tungussied Group from the Lower Bhandar Limestone Formation of Bundi-Indergarh section were studied. The identification is based on slicing. The analyses of the recovered OWM and the organo-sedimentary structures indicate Neoproterozoic age for the Bhandar Group.

Visited Chhatisgarh Supergroup exposed around Durg District, Madhya Pradesh for the collection of samples belonging to argillo-calcareous and organo-sedimentary structures. Megascopic and flute remains from the Khairagarh sandstone were also observed.

THRUST AREA 2: GONDWANA SUPERCONTINENT : REGIONAL GEOLOGY, TERRANE ACCRETION, PLATE TECTONICS AND GONDWANA CONFIGURATION

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

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

Vijaya

Chemical processing of about 100 rock samples from the Malla Johar area in Tethys Himalaya has been done. The samples represent the Spiti shale of Jurassic sequence. Recovery of spores-pollen is scanty, only few grains of the genus *Callialasporites* and trilete spores could be observed. In totality, it is not effective to comment about the palynocomposition and age of this horizon.

Component 2 : Permian plant fossils from North-eastern Himalayas

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

Horizontally lying and vertically preserved *Vertebraria* axes have been discovered from the coal-bearing strata exposed in Ghish, Lish and Kalijhora rivers of Oodlabari area of Darjeeling District, West Bengal. The morphological study, preservational aspect (of axes) and palaeoecological significance of the flora are in progress. Carbonaceous shale samples collected from Ghish and Kalijhora sections are being chemically processed to recover seeds and megaspores. Some of the samples contain tracheids and cuticles but most of them are highly oxidized (difficult to identify them).

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

Carbonified crusts of leaves of the genus *Pachypteris* collected from the Jabalpur Formation (Early Cretaceous) exposed in the Sher River near Sehora, Narsinghpur District, M.P. were lifted with cellulose acetate and treated with HF for the removal of silica particles. The pieces of the carbonified crust were washed in distilled water, fixed in glutaraldehyde in cacodylate buffer under specific pH. Post-fixation was done in osmium tetroxide in buffer solution. After dehydration, the pieces were embedded in plastic.

Thick sections of the specimens were cut for LM studies to check the orientation. Ultrathin sections (600-800A) were stained in uranyl acetate and lead citrate for investigation under the TEM. The investigation has shown that :

- the cuticular membrane (CM) is variable in thickness,
- a part of the CM is amorphous with electron dense zone; rest of the CM shows reticulate/fibrillate zone,
- fibrillae branch frequently at the sub-cuticular level, and
- extensive cutinisation of the CM has stages of development similar to that seen in a species of the extant genus *Cycas*.

Ultrastructure of the CM of a species of *Cycas* has been studied under TEM. The sample preparation pre-

sented difficulties due to vacuolated cells; therefore, for removal of vacuoles a technique is being standardised. The ultrathin sections of the CM of the leaf of *Cycas* sp. prepared so far show that :

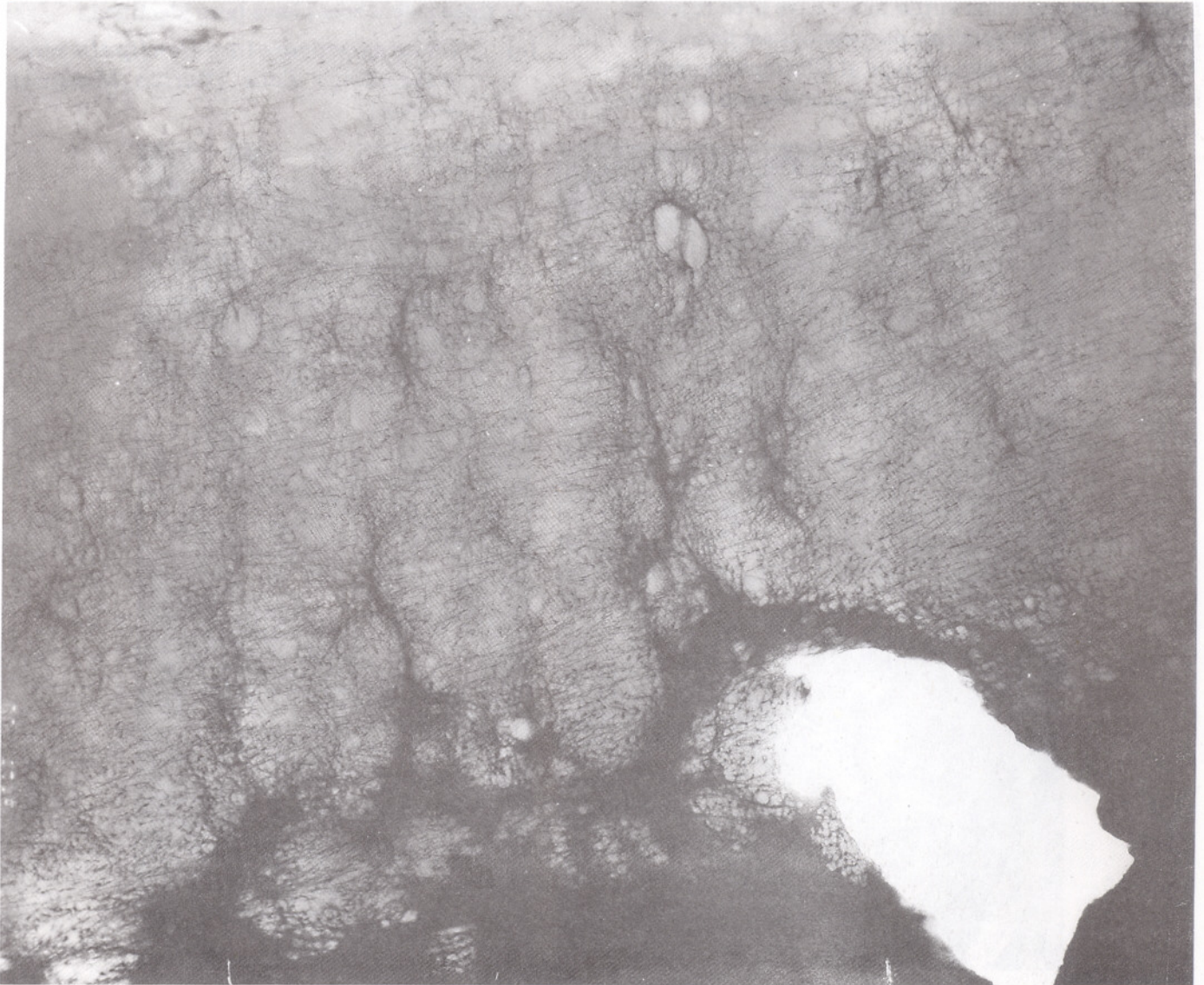
- the epicuticular wax layer on the outside of the polylamellate region is an electron lucent zone marked by a thin superficial deposit of osmiophyllic material,
- a web of reticulations and the distinct stages of development of extensive cutinisation are present in the inner periclinal region of the subcuticular layer, and
- different stages of lipid synthesis are probably represented.

Megaspores were picked from the bulk macerate of shale samples of Barakar Formation exposed in a quarry near Hahajor Village, Lalmatia Coalfield, Bihar for investigation of the ultrastructure of the sporoderm under the scanning and transmission electron microscopes. Two types have been chosen for further processing.

Component 2 : Synthesis of biostratigraphical and biogeographical data on Indian Gondwana Supergroup

H.K. Maheshwari & Usha Bajpai

Published literature on the palaeobotany, palynology and biostratigraphy of the Gondwana Supergroup was sorted. A data base was designed on CDS/ISIS to enter relevant data for synthesis. About five hundred biblio-



Ultrathin section of the cuticular membrane of *Cycas* sp. showing a web of fine reticulations x 33,800.

graphic entries were made.

Project 4 : Floristics, biostratigraphy and palaeoenvironment of Gondwana sediments

Component 1 : Morphotaxonomy, floristics, evolution, biostratigraphy and palaeoenvironmental studies of Son-Mahanadi, Damodar, Panagarh, Birbhum Basins

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

Shaila Chandra and K.J. Singh identified and photographed Permian and Triassic plant fossils. For the first time, carbonized leaves of *Dicroidium* and *Lepidopteris* and some fertile forms have been recorded from the area. The cuticular preparations are under way. The Permian plants include typical *Glossopteris* species indicating Late Permian age. Further collection from few

more exposures has added to the assemblage. The identified species belong to *Schizoneura*, Calamitales, *Gangamopteris*, *Trizygia*, *Neomariopteris* and stem casts.

K.J. Singh visited Ramkola-Tatapani Coalfield and collected plant fossils from the Permian and Triassic sequences exposed in Iria Nala, Uro Nala, Khorai Village, Balujharia Nala, Moran River, Sukhnaiya Nala, Kerwa Nala and Dundwa Nala sections. Good collection of plant fossils and fertile forms was made alongwith an invertebrate fossil.

Suresh C. Srivastava & Anand-Prakash completed the palynological study of bore-hole TRDM-2 from Tatapani-Ramkola Coalfield. Since the bore-hole was affected by an intrusive, the recovery of palynomorphs was generally poor. However, some samples yielded good amount of palynofossils and on the basis of quantitative analysis, three palynozones have been identified :

- (a) *Striatopodocarpites-Densipollenites* Assemblage Zone (Barren Measures —43 m).



Typical marker plant megafossils from Early Triassic sediments of Ramkola-Tatapani area, Madhya Pradesh — 1. *Dicroidium* sp. (x 3), 2. *Lepidopteris* sp. (x 3).

(b) *Faunipollenites-Scheuringipollenites* Assemblage Zone (Upper Barakar—243.20 m).

(c) *Scheuringipollenites barakarensis* Assemblage Zone (Lower Barakar—320 m).

Samples collected from Deonae Nala and Suknaiya Nala from the southern part of the coalfield were macerated and slides prepared. Further work is in progress.

Archana Tripathi studied spores-pollen species distribution in the bore-holes TNA-7, TCP-39, TCP-41 and TP-8 from Talcher Coalfield, which revealed the presence of complete sequence from Talchir/Karharbari to Raniganj equivalent sediments. The composition of assemblage at 566-588 m depth in TP-8 and 157-166.25 m depth in TNA-7 correlates well with Barren Measures palynoflora—*Densipollenites indicus* Assemblage Zone. The composition of overlying assemblage at 557-524 m depth in bore-hole TP-8 and 21.90-132.25 m depth in bore-hole TNA-7 indicates a Raniganj-Late Permian affinity. The Early Triassic palynoassemblage is identified at 361-366.50 m depth in bore-hole TP-8. The identification of Barren Measures and Raniganj palynoflora helped in resolving the Upper Permian stratigraphy as Barren Measures and Raniganj Formations above the Barakar Formation in the Talcher Coalfield.

In Panagarh sub-basin, at the eastern most end of Raniganj Coalfield, Vijaya investigated the Mesozoic sediments represented by Rajmahal and Panchet Formations in bore-hole PGD-1A (between 288.00-423.51 m). Within this depth, 3 palynoassemblages are identified: the oldest one *Verrucosiporites-Lundbladispora* zone (373.50-372.50 m) at the closing end of Panchet Formation (Early Triassic). At 372.50 m, FAD of *Callialasporites turbatus* signals the onset of Jurassic sediments. In the subsequent Infratrappean bed (371.50 - 354.00 m), alongwith increased presentation of genus *Callialasporites*, other significant spore species, viz., *Murospora florida*, *Contignisporites cooksonii*, *Lycopodiacidites asperatus* and *Microcachrydites antarcticus* evidence the Upper Jurassic palynozone. The Intertrappeans of Rajmahal Formation (346.35-295.50 m) have yielded relatively much diversified assemblage containing *Cicatricosisporites australiensis*, *Crybelosporites stylosus*, *Aequitriradites spinulosus* and other fern spores. This composition is referred to *Cicatricosisporites australiensis* zone. On comparison within the Australian Mesozoic palynozones, it is derived that the Infra- and Inter-trappeans of Rajmahal Formation (372.50-395.50 m) represent the time span of their

deposition between Oxfordian-Berriasian. The Jurassic-Cretaceous transition is observed within 346.35-328.81 m depth.

Ram-Awatar analysed 70 samples of bore-hole SKM-6 drilled in south of Dhurwara Village, Sohagpur Coalfield (M.P.). Sediments at 77.90-116.75 m reveal the dominance of *Faunipollenites*, *Striatopodocarpites*, *Crescentipollenites*, *Densipollenites*, *Arcuatipollenites*, *Guttulapollenites* and *Trabeculosporites*, indicating Late Permian age (Middle Pali equivalent). Between 119.05-254.05 m *Scheuringipollenites* dominance palynoflora in association with *Barakarites*, *Rhizomaspora* and *Ibisporites* has been recorded encompassing Late Barakar sediments.

Palynological analyses of the outcrop samples along Lotna Nala Section, Sohagpur Coalfield indicate Late Barakar palynocomposition showing *Microfoveolatispora*, *Faunipollenites*, *Scheuringipollenites* in association with *Rhizomaspora*, *Microfoveolatispora* and *Striasulcites*. Samples at the junction of Murna/Lotna Nala Section reveal the dominance of *Faunipollenites*, *Striatopodocarpites*, *Crescentipollenites*, *Arcuatipollenites* and *Scheuringipollenites* indicating Late Permian age of the sediments.

Two palynoassemblages have been identified in the outcrop samples from Umrar Nala Section, Korar Coalfield, M.P. Assemblage-I reveals the dominance of *Parasaccites* over *Plicatipollenites* indicating Late Talchir miofloral affiliation. In Assemblage-II, monosaccates declined with dominance of *Callumisporea* and *Jayantisporites*, which suggests an Early Karharbari miofloral composition. Identification of Karharbari palynoassemblage from the sediments of Talchir Formation is the significant outcome of the study. Besides, record of *Balmeella*, *Tetraporina*, *Leiosphaeridia* and *Quadrisporites* in the assemblage indicates marine influence in the area.

Collected outcrop and bore core samples from Sohagpur, Navalpur, Giar, Parsora, Bandhogarh and Anuppur areas in Sahdol District of Madhya Pradesh.

K.L. Meena processed 30 samples collected from Chaturdhara Nala Section, Jharsuguda, Ib-Himgir Basin (Orissa) and prepared slides of yielded samples and scanned them for photography and quantitative analysis.

Processing of bore-hole TCS-6 samples collected from Talcher Coalfield, Orissa has been carried out. The study records good palynoassemblage of Barren Measures Formation in this bore-hole.

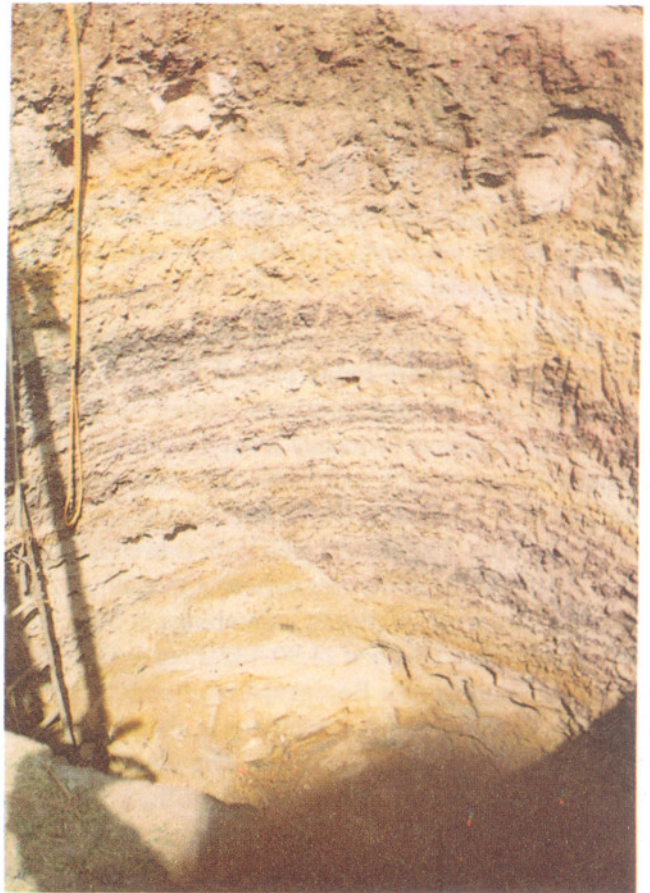
Component 2 : Morphotaxonomy, floristics, evolution, biostratigraphy and palaeoenvironmental studies of Satpura-Wardha-Godavari Basins

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

A.K. Srivastava is studying the flora and stratigraphic relationship of Motur and Bijori Formations of Satpura Gondwana Basin in relation to the floras of Barren Measures and Raniganj Formations of Damodar Valley coalfields. The plant fossils from Pench Valley coalfields were collected from open cast mines as well as underground mines. There are mainly four coal seams of Barakar Formation in the area. It has been observed that lower seams contain the specimens of *Gangamopteris*, *Noeggerathiopsis*, *Euryphyllum*, *Buriadia* and *Glossopteris*, whereas upper seams show the presence of *Glossopteris*, *Sphenophyllum*, *Benlightfootia* and a probable specimen of insect wing. The road cutting sections near Bijori and Delakhari villages have yielded fragmentary but identifiable plant fossils of Bijori Formation. Samples were also collected to recover the seeds, megaspores and cuticles from Barakar, Motur, Bijori and Jabalpur Formations. Shale samples collected from Kamptee Colliery and stone quarries situated near Satnauri and Bazargaon villages contain number of specimens of *Vertebraria*-axes and fragmentary plant remains of *Glossopteris*, *Noeggerathiopsis* and *Gangamopteris*.

Rajni Tewari prepared a comprehensive list of all the palaeobotanical records known from Satpura Gondwana Basin and analysed the plant fossil assemblages so far recovered from Barakar Formation of Lower Gondwana sequence. The morphotaxonomy and evolutionary lineages of the flora are under progress with the underlying and overlying floras of Karharbari, Barren Measures (Motur) and Raniganj Formations.

Pramod Kumar studied the palynology of Denwa Formation exposed south of Anhoni Village in Satpura Basin. Three palynoassemblages are quantitatively described: (A) contains dominance of *Falcisporites*, *Satsangisaccites*, (B) has the dominance of acritarcha + *Falcisporites*, *Satsangisaccites* and *Brachysaccus* as common to poor elements, whereas (C) shows the dominance of *Brachysaccus*, *Falcisporites* alongwith some significant forms of Late Triassic, viz., *Aratrisporites*, *Ashmoripollis*, *Corollina*, *Monolites*, *Harudisporites*, etc. These assemblages closely compare with the Late Triassic assemblages of 16-G basin, India



A section of Denwa Formation exposed in a well cutting at Anhoni Village, Chhindwara District, Madhya Pradesh.

and Opper zones, *S. speciosus* and *A. reducta* of Carnarvon Basin of north-western Australia. Some fungal remains have also been identified. Fungal fruiting bodies, vesicular or vesicular mycorrhizal fungus (VAM fungi), algal spores and some insect remains have also been investigated from the Denwa clays and matrix of Bagra conglomerates.

Visited MECL and GSI Central Region Offices at Nagpur and collected bore cores ((MKH-5, 6 and MTP-I) from drilling sites of MECL at Katal, Khamara and Tandsi. For outcrop samples and observations visited Tamia, Karrapani, Gaidubbra, Dukrikhera, Inder Nagar, Dabka, Choti Anhoni, Dhoopgarh, Chauragarh, Bara Mahadev, Beefall, Jata Shankar-Jambodip and Khairial Kesla areas in Satpura Basin.

Neerja Jha investigated the samples from bore core GC-17 (drilled in Godavari Basin). The recovered palynomorphs show presence of Early Permian (Talchir, Barakar) and Triassic assemblages. Photodocumentation of stratigraphically significant palynotaxa was done for poster presentation.

Comparison of the Permian palynoflora from India and Africa was done in relation to its phytogeographic

significance. Visited Geological Survey of India, Calcutta for scientific discussion, for procurement of samples and library consultation.

A.P. Bhattacharyya studied and correlated the palynofloras from bore-holes BR-21, 22 and 23 in Baranj Block, Wardha Valley Coalfield. Lower Karharbari mioflora has been described from BR-22 (50 m) and BR-21 (114-115 m). *Scheuringipollenites* dominance zone has been recovered from BR-21 at the depth of 93.10 m. *Faunipollenites* dominant assemblage has been recovered in BR-22 and BR-23 at the depth of 35-47 m and 59-63 m respectively.

Visited GSI, Calcutta and CMPDIL, MECL and DGM at Nagpur for consultation with geologists of concerned area at Wardha Valley Coalfield to collect bore-holes and future drilling programmes. Also visited Chandrapur District, Maharashtra for collection of bore-holes and surface samples from Kondha and Nanduri blocks. In this area four bore-holes were drilled through Kamthi, Motur and Barakar Formations. Talchir samples were also collected from surface exposures in Ghotambara Nala, Khandha Nala and a nala near Chiradevi. Contact between Talchir and Vindhyan was observed in Kondha Nala. From these sections varve, boulder bed matrix and shales were collected. Maceration of the collected samples is in progress.

Project 5 : **Floristics, biostratigraphy and palaeoenvironment of Mesozoic sediments**

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

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

Jayasri Banerji studied numerous chert specimens from Sonajori locality, Rajmahal Hills. Large number of well preserved seed remains have been examined and slides prepared for detail anatomical studies. Photodocumentation and preliminary identification show the presence of taxa *Pakurispermum*, *Sonajorispermum*, *Paradoxospermum*, *Triangulospermum* and a new genus. Large number of petrified chert blocks from Hiraniduba locality have been sectioned and examination of chert slice for the preparation of slides are being done for detail study.

Visited (with B.N. Jana) various localities, viz., Hiraniduba, Nipania, Sonajori, Gumapahar and Khatangi



Arauamyelon pakurensis Sharma & Suthar—cross section of a diarch root from Sonajori, Rajmahal Hills, Bihar x 2.

Hill in Rajmahal Basin and collected plant megafossils.

Archana Tripathi studied the palynology of infra- and intertrappean sediments in bore-hole RCH-151, Chuperbhita Coalfield (Rajmahal Basin). The palynoflora has dominance of *Podocarpidites* and the subdominant taxa *Araucariacites*, *Boseisporites indicus*, *Biformaesporites baculosus* impart a distinct character to the assemblage having affinity with the Jurassic-Early Cretaceous palynoflora. The poor diversity of trilete spores together with total absence of hilate and costate spores is noteworthy. It indicates older aspect than the *Callialasporites trilobatus* Assemblage Zone and is considered to represent the Jurassic palynoflora. The underlying coal-bearing sequence has shown the presence of *Scheuringipollenites barakarensis* Assemblage Zone, *Faunipollenites varius* Assemblage Zone, *Densipollenites indicus* Assemblage Zone and *Densipollenites magnicarpus* Assemblage Zone representing Early Permian-Barakar to Late Permian-Raniganj equivalent horizons.

The analysis of subsurface material from bore-hole RJP 49, Pachwara Coalfield shows presence of two assemblages in the thin cover of Dubrajpur sediments. Assemblage-I from coal-bearing upper strata (5.15-11.10 m depth) has affiliation with *Densipollenites magnicarpus* Assemblage Zone of Late Permian age, while Assemblage-

II (17.45-47.00 m depth) is assigned to *Kremipollenites indicus* Assemblage Zone of Early Triassic age.

A field excursion to Rajmahal Basin was undertaken. The outcrop and subsurface samples representing Dubrajpur Formation as well as coal-bearing sediments were collected for the palynological analysis from Pachwara and Mahuagarhi Coalfields. Also visited Geological Survey of India, Calcutta to discuss the palynodating of subsurface material.

B.N. Jana studied petrified megafossil assemblage from Kalkipara, Rajmahal Hills which shows the dominance of cycadophytic elements. The assemblage contains the genera like *Ptilophyllum*, *Otozamites*, *Bucklandia*, *Brachyphyllum*, etc. Several slides have been prepared for the study of anatomical details. In most cases lack of proper preservation is noticed.

Collection of megafossils of Gardeshwar Formation from Gardeshwar (Broach District); Dhrangadhra Formation from Than and Songad areas (Surendranagar District) and Wankaner-Morvi area (Rajkot District; and Himmatnagar Formation from nearby area of Himmatnagar (Sabar Kantha District) of Gujarat have been done. Studies on previous as well as fresh collections of megafossils from Than and Songad regions have revealed the presence of rich plant assemblage comprising the genera like *Cladophlebis*, *Sphenopteris*, *Gleichenia*, *Araucarites*, *Brachyphyllum*, etc. along with some bryophytic remains. The presence of bryophytic remains in the Mesozoic of Saurashtra region stands the first record.

A. Rajanikanth investigated plant megafossils assignable to the Early Cretaceous sediments of the Gangapur Formation, Pranhita-Godavari Graben represented by *Equisetites*, *Gleichenia*, *Cladophlebis*, *Taeniopteris*, *Torreyites*, *Elatocladus* and *Pagiophyllum*. Morphological variations in different taxa have been analysed. Predominance of small leaf forms indicates long distance transport from the source vegetation to the burial locale. Plant megafossil specimens assignable to conifers and taxa of uncertain affinity have been recovered from the Lameta Formation of Wardha Valley.

Field work was carried out on the different geological sections spread in the Pranhita-Godavari and Wardha valleys. Megafossil and sediment samples belonging to the Gangapur and Lameta Formations have been collected.

Neeru Prakash studied the morphotaxonomy of plant fossils of Athgarh Formation, belonging to Ghantikhal, Talbast and Naraj localities in Mahanadi Basin. The palaeofloral assemblage is dominated by pteridophytes

and conifers. Cycadophytes are comparatively less in number. The comparative assessment of the palaeoflora with other known palaeofloral assemblages of India suggests that this flora is coeval with the Bansa floral assemblage of Jabalpur Formation as in both the assemblages pteridophytes and conifers are dominant. An Early Cretaceous age has been suggested for the Athgarh floral assemblage.

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

Shyam C. Srivastava & Neeru Prakash

Amongst the enormous number of cones collected from the Triassic beds of Nidpur, South Rewa Basin two types have been identified to be of synangiate structure forming bell- and funnel-shaped organ. Of these bell-shaped organ, a morphotype has already been described as to be *Satsangia companulata*, revealed the additional features like the presence of microsporangia in multiseriate order radiating from basal or stalk region and diverging towards the distal end on the inner face of bell-shaped organ, whereas exterior surface depicts the sporangial markings in radiating fashion. The sporangial openings are interspersed all over inner surface in the form of circular depressions inside which pollen could be observed. These non-striate pollen indicate the affiliation of this taxon towards conifers.

The other cone which is composed of funnel-shaped microsporophylls is quite characteristic because these microsporophylls are spirally arranged forming cylindrical cone. The entire microsporophyll is constituted of uniseriate sporangia having nonstriate-bisaccate pollen arranged in seriate order. On the inner face microsporangia emerging from basal constricted region and thereafter diverging in uniseriate/multiseriate order and finally their sporangial tips coalesced with each other converging at the mouth of funnel somewhat giving a structure like that of glomerulus.

Studies on the population of *Dicroidium* leaves have been completed. Specific differentiation followed by different magnifications of stomatal-structure have been elucidated. In association with other plant taxa *Dicroidium* being dominant form of Nidpur vegetation, palaeoclimatic interpretations have also been made.

The in depth study of *in situ* spores-pollen from Mesozoic of India has been attempted, where the emphasis has been laid to systematise the dispersed palynotaxa as

evidenced by the data derived from *in situ* spores-pollen.

THRUST AREA 3: COAL BED METHANE (CBM) INVESTIGATION

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

Organic matter characterization of the samples collected earlier from the Upper Tertiary sediments of Mahuadanr area has been attempted. Fifteen samples were processed and a rich assemblage of palynodebris was recovered. The organic matter characterized by the amorphous, semi-amorphous, biodegraded, granular and

structured terrestrial types was observed. Fungal spores and hyphae are abundant along with few angiospermous pollen grains.

The organic petrological study shows dominance of vitrinite and a few associated fusinite grains. Two types of vitrinites were recognized based on reflectance and associated microconstituents, viz., (i) light grey vitrinite with R_o max. ranges between 0.3-0.4%, and (ii) dark grey vitrinite mainly associated with fusinite. The vitrinite grains seem to be gelified and may be termed gelocollinite.

Plant fossils, resinous matter and samples of organic sediments including lignite from Upper Tertiary sediments of Mahuadanr, Sindhudurg and coastal lignite deposits of Kerala were collected. The Ratnagiri beds/Sindhudurg Formation exposed in Devagarh area appears to be a lensoid deposit lying on the erroded surface of laterites. Apart from known outcrop sections, collection was also made from a new outcrop section near Parrowadi Village. The collection of Cenozoic sediments of Kerala Coast was done from cliff sections and working quarries located along the coast in Cannor and Kolam areas.



An *in situ* dicot fossil wood from Payangadi Clay Mines, Kannur District, Kerala.

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

- (A) *Organic petrological evaluation of Karanpura coal deposits (Damodar Basin) in relation to carbonization properties, genesis and depositional history*

B.K. Misra & B.D. Singh

Visited Central Mine Planning and Design Institute Limited and Central Coalfields Limited offices at Ranchi for discussions and consultation of reports related to coals of Karanpura Coalfield. Besides, collected samples of Barakar coal seams from KD-Haslong, Dakra and Karkata collieries and that of Karharbari seams (Lower and Upper Bachra) from Ray-Bachra and Churi mines of North Karanpura Coalfield. The coals are normally dull banded, laminated with thin impersistent bright bands, and non-coking type. Detail discussion about the spontaneous combustion susceptibility of the seams encountered there was also done.

- (B) *Biopetrology of Wardha-Godavari Valley coals*

O.S. Sarate

An excursion was undertaken to Nagpur for consultation and discussion with the authorities of DGM, CFRI, WCL, MECL and CMPDIL regarding collection of coal samples from various localities of the Wardha Valley. Also collected coal samples from Kondha and Nanduri blocks for biopetrographic evaluation.

A detailed biopetrographic study (39 pellets) from Sattupalli area has revealed that the coals have, in general, attained high volatile bituminous C to high volatile bituminous B stages of rank. They are comparable to the coals of Manuguru, Ramagundam and Mulug belt of Godavari Basin in their petrographic composition and rank.

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

Alpana Singh & B.D. Singh

Literature related to Palaeozoic and Mesozoic sediments, especially the coal-bearing sequences, of the

Satpura Gondwana Basin was consulted. About 134 coal samples were collected from different underground and some open cast mines of the Pench-Kanhan Coalfield. The channel samples representative of top, middle and bottom sections of the five coal seams belonging to Early Permian Barakar Formation were collected. Coals from Pench area are generally dull, laminated with fine and impersistent bright bands, whereas those from Kanhan area are of bright banded in nature. The coal seams of Kanhan area are expected to have potential for coal bed methane generation.

Visited Central Mine Planning and Design Institute Limited (Regional Institute-IV) and Western Coalfields Ltd. offices at Nagpur for discussions and consultation of reports related to coals of the region.

- (D) *Organic petrographic evaluation of coal seams from Talcher Coalfield*

Rakesh Saxena & Jyotsana Rai

An excursion to Talcher Coalfield and adjoining areas was carried out for the collection of coal samples. The characteristic occurrences of coals were recorded in Karharbari and Barakar Formations, and are being mined at different blocks. Kalinga Block was selected for collection of channel samples. Further, bore core coal samples were selected from Baitarni, Balbhadra, Chandipara, Kalinga, Ling Raj and Radhikapur blocks. In all, 36 coal core samples were collected.

Megascopic characterization of coals at New Kalinga open cast project suggests the seam thickness in the range of 18 to 20 m and the coals are of dull to semidull banded in nature. The enhancement of the thickness of coal seams indicates the merging tendencies of seams I to IV in the area. Bright band occurrences have also been recorded from I and II seams.

Component 3 : Sedimentary organic matter characterization of Indian lignites

Rakesh Saxena & Jyotsana Rai

Pertinent literature concerning the sedimentary organic matter characterization of Gujarat lignite was consulted and important sections were delineated for making the necessary collections of lignites and associated sediments. Samples from Panandhro, Rajpardi, Gogha and adjoining areas were collected. The study suggests the lensoid development of lignites at places.

Megascopic characteristics of lignites show dark brown to greyish-brown colour impregnated with varied

types of resins in the form of lenses and at times make persistent layer. The lignites exposed at Gogha and Matanomadh also show resin bodies in them. Burnt outcrop tendencies were also seen at places where the lignites are affected with post depositional faults. Frequent firing tendencies were also recorded at outcrop sites as well as at stack.

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

B.K. Misra

Visited Tikak Colliery of Makum Coalfield (District Tinsukia) and Dilli-Jeypore Coalfield (District Dibrugarh), Assam for the sample collection of coal and associated sediments from the Oligocene Tikak Parbat Formation, Barail Group. Also collected information about the susceptibility to spontaneous combustion and methane gassiness of the coal seams present there.

THRUST AREA 4: PETROLIFEROUS BASINS OF INDIA AND ABROAD

Project 7 : Morphotaxonomy, floristics, biostratigraphy, sedimentological studies of Tertiary sediments and search for Cretaceous-Tertiary Boundary in marine sequences of lesser Himalayas

Component 1 : Floristics and biostratigraphy of Pre-Siwalik sediments

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

J.S. Guleria explored Jammu, Nagrota, Udhampur and Kalakot regions in search of megafossils and collected some plant remains from the Subathu as well as Murree and Siwalik sediments of the areas. Some fossils were also collected from Dharmasala, Kasauli and Bilaspur areas of Himachal Pradesh.

J.S. Guleria, Rashmi Srivastava and Mahesh Prasad finalized a paper on some fossil leaves from Pre-Siwalik sediments of Himachal Pradesh. The paper reports the genera: *Dipterocarpus*, *Bauhinia*, *Cassia*, *Leguminophyllum*, *Amoora*, *Bambusa* and *Amesoneuron*.

Samir Sarkar and Vandana Prasad studied dinoflagellate cyst assemblages from the Subathu

Formation (Ypresian-Lutetian) of Koshalia Nala section, Shimla Hills for assessing the palaeoenvironmental significance. The stratigraphic distribution of assemblages has also been evaluated using selected species and their relative abundance. The vertical distribution of dinocysts indicates that the present succession is correlatable with the *Homotryblum* and *Cordosphaeridium* assemblage zone of Subathu Formation of other sections of Shimla Hills. Characteristic dinocyst assemblages have been described and interpreted in relation to water depth and salinity. The assemblages seem to have been deposited under shallow near shore marine environment.

Several dinoflagellate cyst associations have been studied from three measured stratigraphic sections of the Subathu succession in the Kalakot and its adjoining areas of Jammu. Characteristic dinocysts have been described. The palynological data have been interpreted throwing light on its dating potential and environment of deposition. The composition of dinocyst associations is highly variable through out the succession. The oldest horizon is dominated largely by species of *Apectodinium* and thin-walled peridinooid dinocysts. These are succeeded by more diverse assemblages dominated by species of *Homotryblum* and *Cordosphaeridium*. Dinoflagellates of *Thalassiphora* complex are significant constituents of the younger assemblages, which suggests that younger Subathu sediments were deposited under highly euxinic conditions.

A field trip was undertaken for systematic collection of palynological samples from the Subathu Formation of Shimla Hills (H.P.), Morni hills (Haryana) and Kalakot, Udhampur and its adjoining areas of Jammu. Altogether 320 samples were collected from 9 sections (7 from Jammu and one each from H.P. and Haryana). All the sections were measured and detailed geological observations were noted. Reconnaissance survey was also carried out at several localities to find out well exposed sections of the Subathu Formation and Murrees for further investigation.

Chemical processing of the Subathu samples from Kharag River Section of Morni Hills (Haryana) has been completed. A diversified dinocyst assemblage has been recorded. Some important taxa in this assemblage are : *Homotryblum*, *Hystrichosphaeridium*, *Spiniferites*, *Achomosphaera*, *Operculodinium*, *Leptodinium*, *Thalassiphora*, *Adnatosphaeridium* and *Glaphyrocysta*. Detailed morphotaxonomical study is in progress.

Chemical processing of the Subathu samples from Patlaadi, Moore and Sindhkatuti River sections were carried out. Samples are extremely poor in palynofossils.

However, several DOM rich horizons have been located in both the sections. Evaluation of DOM is now being carried out.

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

J.S. Antal, M.R. Rao, S.K.M. Tripathi, Anil Agarwal, Mahesh Prasad & G.K. Trivedi

J.S. Antal carried out the identification and photodocumentation of well preserved plant remains consisting of mainly leaf-impressions and some fruits and

fossil woods from Dudhia River, Ghish River, Sevoke Road cutting sections, Sevok Khola (Noonmati Khola), Kali Khola and Lethi River in the Himalayan foot-hills of Darjeeling District, West Bengal. Amongst them, the leaf-impressions were identified belonging to modern angiospermic families : Combretaceae, Ericaceae, Passifloraceae, Rubiaceae, Euphorbiaceae, Fabaceae, Anacardiaceae, Meliaceae, Dipterocarpaceae, Sterculiaceae, Malvaceae, Menispermaceae, Anonaceae, Flacourtiaceae, Clusiaceae, Dilleniaceae, Simarubaceae and Euphorbiaceae. The remains of fruits/seeds show close resemblance with *Millettia sericea* and *Aristolochia indica*. Out of several fossil woods collected, one has been



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Leaf-impressions resembling extant—1. *Eugenia curranii* Roxb, and 2. *Macaranga tanarius* from the Siwalik of Ghish and Lish Rivers, Darjeeling District, West Bengal.

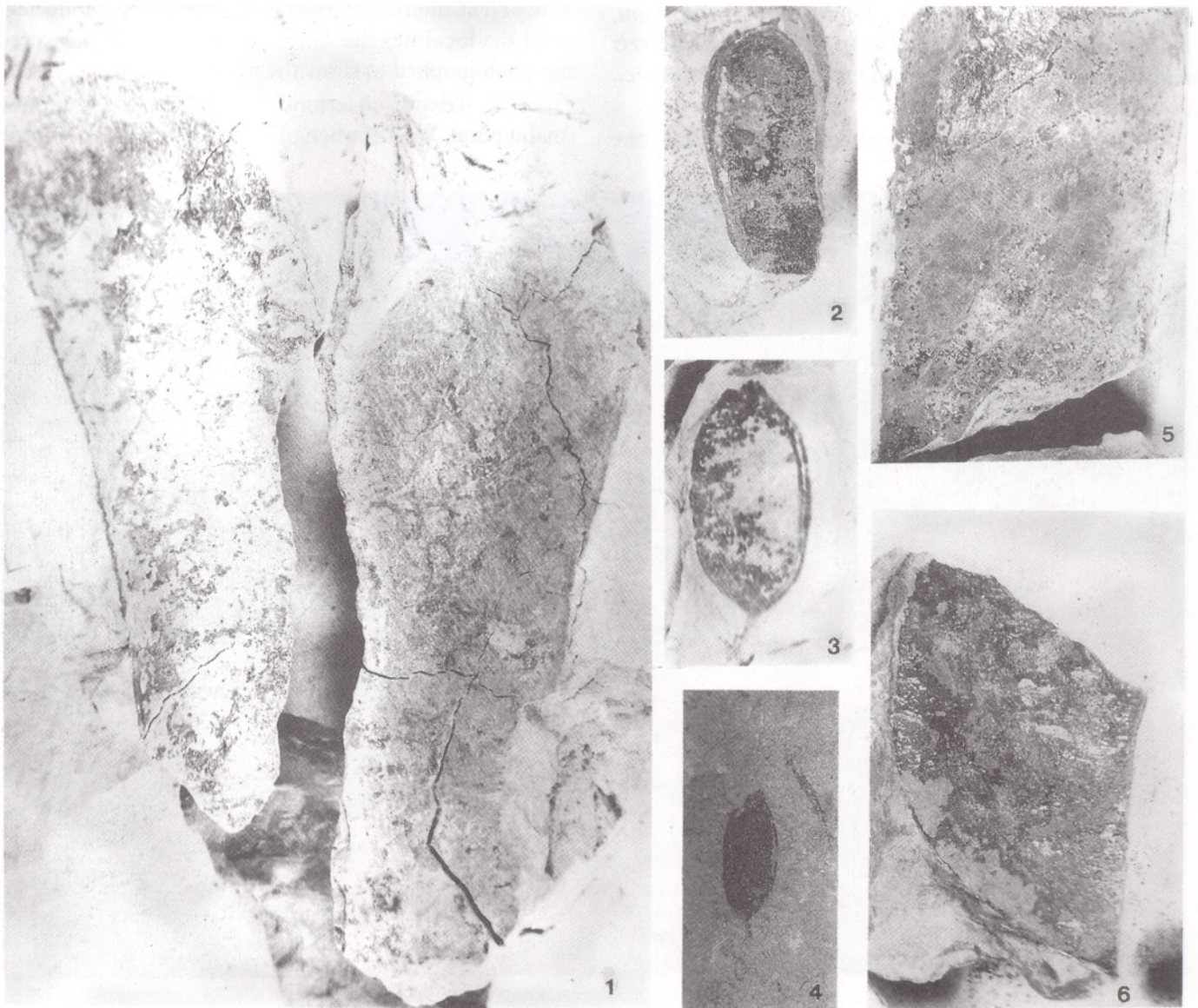
identified with extant wood of *Dipterocarpus*. It is interesting that the fossil leaves of *Dipterocarpus* have already been described from Ghish River, from where the present fossil wood was collected. The majority of identified taxa shows the prevalence of tropical climate with excessive rainfall during Siwalik sedimentation.

Visited the Siwalik foot-hills of Darjeeling District, West Bengal and a good number of well-preserved leaf-impressions, fruits/seeds and carbonised woods were collected from new localities. Also visited Central National Herbarium, Howrah to identify the fossil leaves and fruits/seeds collected from various localities of West

Bengal Siwaliks.

M.R. Rao processed the samples from Siwalik sediments exposed along Jassur-Nurpur road, Jwalamukhi-Kangra road and Kotla sections. Slides were prepared from the productive samples. Morphotaxonomy and identification of spores-pollen have been taken up.

S.K.M. Tripathi completed the morphotaxonomy of palynotaxa recovered from 35 rock samples collected from Middle Siwalik sediments exposed along Jammu-Srinagar Highway. Palynoflora is poor and is represented by angiospermic and gymnospermic pollen and pteridophytic spores.



Leguminous fossil fruits from the Siwalik sediments near Jamrani Village, Kathgodam, Uttar Pradesh (x Nat. size).

Anil Agarwal undertook a field excursion and surveyed several localities namely Tshanghu, Jorethang, Rangpo, Singtam, Indira bye-pass, Bordang, Bhotang mines, Ranipur and Phodong in Sikkim for the collection of plant megafossils. No Tertiary exposures were encountered and hence no megafossils from the area could be collected. This project was requested to be withdrawn.

Mahesh Prasad collected about 200 leaves and some fruit and seed impressions from the Lower Siwalik sediments of Tanakpur and Kathgodam area. These were cleared and photographed. The morphotaxonomic study of these fossils reveals additional taxa in the Himalayan foot-hills during Siwalik period. They are—*Clausena arisum*, *Gomphandra axillaris*, *Miliusa tomentosa*, *Orophica uniflora*, *Vatica lanceaefolia*, *Chrysophyllum viridifolium*, *Sarcosperma arporeum*, *Holorrhina antidysentrica*, *Diospyros eriantha*, *Derris trifoliatum*, *D. scandens*, *Sapindus attenuatus*, *Myristica crassa* and *Bec. le tetrandra*.

About 60 fossil woods collected for the first time

from the Lower Siwalik sediments of Tanakpur area in U.P. were studied. These woods resemble the extant taxa—*Dipterocarpus*, *Cynometra*, *Cassia*, *Bauhinia*, *Dalbergia*, *Diospyros*, *Bischofia* and a lauraceous wood. In this assemblage, the Legumes are found in abundance. These fossil woods are very similar to that described from the Siwalik sediments of Kalagarh (U.P.). The present day distribution of the comparable taxa indicates that evergreen to semi-evergreen forest was flourishing under warm humid climate in the Himalayan foot-hills of U.P. during Middle Miocene in contrast to mixed deciduous forest in this region at present.

Visited the Lower Siwalik localities of Nalagarh, Bilaspur, Jawalamukhi and Ranital in the foot-hills of Himachal Pradesh for the collection of plant megafossils. A lot of leaf-impressions and fossil woods were collected. In all the localities the outcrop sections were measured and photographed to show the nature of rocks.

G.K. Trivedi undertook a field tour in and around Bhalukpong, West Kameng District, Arunachal Pradesh



A view of Siwalik section in Nangal River near Nalagarh, Solan District, Himachal Pradesh from where petrified woods were collected.

and collected 122 samples from Dafla and Subansiri Formations and also from Gondwana sediments. Macerated 45 samples of Dafla Formation exposed along Bhalukpong-Bomdilla Road. Only 5 samples yielded pollen and spores, dominated by *Striatriletes* and *Palmaepollenites*.

Component 3 : *Search for K/T boundary in marine sequences of India with special reference to Lesser Himalayan terrain*

S.A. Jafar

Publications related to K/T boundary in general and with reference to Indian basins literature was compiled. Nannofossil yielding samples from Dharampur, Koshalia Nala and Kuthar Nala of Shimla Hills were re-examined under light microscope for further documentation of taxa. Difficulties in the procurement of bore-hole samples from GSI and ONGC, demanded withdrawal of this project, as per request made for a new project in January.

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

R.K. Saxena and Samir Sarkar undertook an excursion to study various Tertiary rock formations developed in Garo Hills, Meghalaya and to collect samples therefrom for palynological investigation. Altogether, 204 rock samples were collected from seven measured stratigraphic sections: Stratigraphic section at 10 km from Tura on Tura-Dalu Road, Adugiri-Purakhasia Road Section near Boldamgiri and Tura-Dalu Road Section from West Garo Hills District; Siju Cave Section, Simsang River Section and Siju-Baghmara Road Section from South Garo Hills District; and Nongwal-Bibra area from East Garo Hills District. Thickness, lithology and fossil contents of the Tura, Siju, Rewak, Kherapara, Boldamgiri/Baghmara and Angartoli Formations were studied and their contacts with the adjacent formations were located.

Rock samples from the Siju Formation (Middle Eocene) of two measured stratigraphic sections, viz., Simsang River Section and Siju Cave Section, were macerated. Slides of the productive samples were prepared and scanned for palynofossil studies. Rich palynofloral assemblages consisting of dinoflagellate cysts, spores-pollen and fungal remains were recorded. The assemblages

have predominance of dinoflagellate cysts, mainly *Operculodinium*, *Spiniferites* and *Achomosphaera*. Detailed morphotaxonomic study is being carried out.

R.C. Mehrotra visited various Tertiary localities of Assam and Meghalaya and collected many plant megafossil impressions, besides a large number of fossil woods. Ten fossil woods from the Tipam Sandstone of Mizoram were studied in detail. The woods are of five types belonging to families: Dipterocarpaceae, Anacardiaceae, Fabaceae, Lythraceae and Lauraceae. These plant megafossils are being reported from this State for the first time.

Twenty woods were studied from the Tipam Sandstone of Garo Hills, Meghalaya. Though most of them are duplicates of the already known species, one seems to be a new and its study is under progress. Besides, a few leaves were also investigated from the Barail sediments of Changlang District, Arunachal Pradesh.

Madhav Kumar visited Nagaon, Karbi-Anglong and Golaghat districts (Assam), Jaintia Hills (Jowai-Badarpur road), Meghalaya for the collection of rock samples for palynological studies. The Bokabil and Bhuban rocks (Miocene) of Nagaon District comprise microthyraceous fruiting bodies, pteridophytic spores, gymnosperm and angiosperm pollen, e.g., *Striatriletes* complex, *Microthyrites*, *Pluricellaesporites*, *Polypodiacea sporites*, *Pteridacidites*, *Pinuspollenites*, *Palmidites*, *Clavaperiporites*, *Polyadopollenites*, etc. Many Permian saccate grains are also recorded in the palynoassemblage. The qualitative analysis of palynoassemblage reveals that



An *in situ* petrified wood in Tipam Sandstone, Karbi Anglong District, Assam.

these sediments were deposited under fresh water condition with few inundation of brackish water mixed with recycled Upper Gondwana sediments from neighbouring areas.

B.D. Mandaokar investigated the samples from Oligocene sediments exposed along the Borjan Coalfield, Nagaland. Study of palynoflora recovered from Tikak Parbat Formation has been completed. The palynoassemblage is dominated by pteridophytic spores followed by angiospermic and gymnospermic pollen grains. Algal and fungal remains are also present. The presence of palynotaxa like *Striatriletes*, *Crassoretiriletes*, *Dictyophyllidites*, *Eximispora*, *Polypodiisporites*, *Dangripites*, *Lygodiumsporites*, *Phragmothyrites*, *Parmathyrites*, *Dyadosporonites*, *Cucurbitariaceites*, *Inapertisporites* indicates tropical to subtropical warm humid climate with high rain fall. Representation of dinoflagellate cysts (*Achomosphaera*, *Spiniferites*) and coastal plant element (*Spinizonocolpites*) suggests near shore environment of deposition.

Literature related to Surma sediments of Mizoram area was consulted. Visited Tertiary localities (Surma) around Aizawl, Rengtekawn, Kulikawn, Bangkawn, Tuirial, Kolasib, Bharobi and Champhai Road Section and collected 500 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, Anil Agarwal and R.S Singh

J.S. Guleria studied about 40 fossil woods from Rajasthan and Gujarat. Woods belonging to *Sterculia*, *Pterocarpus* and *Dipterocarpus* have been identified from the Jaisalmer area. *Ficus*, *Hopea*, *Duabanga* and gymnospermous woods have been identified from Gujarat. In addition, leaf remains showing affinities with *Terminalia* and palm have been identified from the Eocene deposits of Rajasthan. Explored various localities in Kachchh, south Gujarat and Rajasthan in search of fossil material. Carbonised woods were collected for the first time from Surat in Gujarat and Barmer in Rajasthan. Likewise, animal fossils were recovered for the first time from the Infratrappean shales near Dolatpar in Kachchh.

K. Ambwani undertook a field excursion to Tamil Nadu for collection of palynological samples. Maceration of lignite samples from Neyveli lignite mine-1 was done and recovered rich and varied palynomorphs comprising pteridophytic spores and angiospermic pollen assemblages. A number of fungal bodies especially

belonging to Microthyriaceae were also recorded in the assemblage. Based on the palynoassemblages two cenozones were established referable to *Ctenolophonidites* cenozoone (90-100 m) from the top and *Proteacidites triangulatus* (100-120 m) below. A histogram pertaining to above cenozones was plotted. SEM studies on *Trilatiporites* cf. (*Sclerosperma*) *erdtmannii* was completed and a manuscript has been finalized.

J.P. Mandal visited areas around Matanomadh, Harudi, Naredi, Maniyara Fort and Chasara of Kutch Basin to collect palynological samples. Palynostratigraphical study of Early Eocene sediments, collected from two measured sections in the adjoining areas of Matanomadh, has been completed. The palynoflora compares well with the assemblages of Panandhro and Wagopadar. However, *Retitratiporites kutchensis* dominates in the basal strata unlike other areas. Correlation between different Early Eocene sections is in progress.

M.R. Rao undertook a field trip to and adjoining areas of Ratnagiri (Maharashtra), Panaji (Goa) and Mangalore (Karnataka) to collect geological/palynological samples. Forty samples of carbonaceous clay and lignite were collected from the surface sections exposed at Amberiwadi and Kalwiwadi, Sindhu Durg District. Carbonaceous clay and lignite samples were also collected from the wells of Paruchuri and Vidyamandir, Ratnagiri District. A traverse was also made along the Maupsa-Panaji road and collected 10 samples of bluish clay. 25 samples were collected from Lithoferomine, Sangod, South Goa. In addition, lateritic clay samples were collected from Kavur-Kullur road, Mangalore District.

S.K.M. Tripathi undertook a field trip to western Rajasthan covering the areas near Barmer and Jaisalmer. Rock samples representing Palaeocene-Eocene sediments were collected for palynological investigations from adjoining areas of Kapurdi, Giral, Akli, Sanu, Khuiala and Bandha. Palynological studies on 17 samples representing the Thumbli Formation from Giral lignite mine (Barmer) were completed. About 3 m thick sequence of this formation consists interbedded claystones, shales and lignites. Two shale samples and one lignite sample yielded a diversified palynofloral assemblage dominated by angiospermic pollen. Dinocysts, fungal remains and pteridophytic spores are other constituents of the assemblage. Most of the palynotaxa present in the assemblage show affinity with plants presently confined to tropical to subtropical regions. Composition of the palynoflora indicates that the area of deposition was in close proximity to the shore-line. Pollen appearing to be

related to the family *Arecaceae* are registered in very high frequency. A similarity between the palynomorphs under investigation and those reported from Late Palaeocene sediments of north Rajasthan, Kutch, northeast India and most interestingly the Indus coal region, Pakistan was noticed.

R.S. Singh chemically processed the Tertiary rock samples from areas around Cannanore, Varkala and Quilon

Spores and pollen recovered were studied morphotaxonomically. Preliminary studies show that the assemblages recovered are dominated by angiospermic pollen grains followed by pteridophytic spores. Various taxa belong to heterogeneous complex representing diverse ecological groups ranging from Montane to back mangrove floral communities. The characteristic taxa of the assemblages are *Dictyophyllidites*, *Lycopodiumsporites*, *Crassoretitriletes*, *Intrapunctisporis*, *Polypodiisporites*, *Quilonipollenites*, *Margocolporites* and *Malvacearumpollis* indicating Miocene age. The study reveals that there are some marker Palaeocene-Eocene taxa in the assemblages, viz., *Lakiapollis*, *Meliapollis*, *Ctenolophonidites*, *Proxapertites*. It indicates that during Miocene the older Palaeocene-Eocene rocks were eroded and redeposited. The subsurface studies also corroborate the observation.

Anil Agarwal undertook a field excursion to Ratnagiri and its adjoining areas and Goa. The carbonised woods, dicot leaves and fruits were collected from the measured sections of Ambriwadi, Kaluiwadi (surface), Parchari and Vidya Mandir School and petrified woods from the wells of Boarding Road at Ratnagiri and Sindhu Durg District of Maharashtra, and at Maupsa-Panaji Road Section and Maovdui River of Goa. Thin sections of 8 petrified woods were cut and photography of dicot fossil leaves from Vidya Mandir School locality is in progress.

Component 3 : Palaeofloristics of sedimentary sequences associated with Deccan traps

R.S. Singh & Rashmi Srivastava

R.S. Singh processed the samples of Deccan Intertrappean sediments from the areas around Jabalpur and Nagpur. Jabalpur Intertrappeans of Padwar, Ranipur and Barela contain spores-pollen alongwith algal remains. Slides were scanned and studied. Preliminary observations show that the assemblages are characterized by the presence of *Cyathidites*, *Dictyophyllidites*, *Ariadnaesporites*, *Gabonisporites*, *Cicatricosisporites*, *Osmundacidites*, *Palmaepollinites*, *Neocouperipollis*, *Spinizonocolpites*, *Aquilapollenites* and

other tricolpate and tricolporate pollen grains. Presence of *Azolla cretacea*, *Ariadnaesporites intermedius* and *Aquilapollenites bengalensis* indicates Maastrichtian age.

Rashmi Srivastava examined the dicot woods from Ghughua, Deorikhurd, Umaria and other localities of Mandla District (M.P.) deposited in the Museum of the Institute. Some of the woods belong to different genera of the families Myrtaceae, Simaraubaceae, Sterculiaceae, Euphorbiaceae and Burseraceae. One specimen showing long uniseriate extensions in multiseriate xylem rays and end to end ray fusion represents a new record from the area. The anatomical features of wood are comparable with the family Flacourtiaceae or Elaeocarpaceae. Further work is being done to identify other specimens.

Plant megafossils were collected from Ghansaur Village (in deep Binori Reserve Forest), Seoni District. The locality is very rich with big logs of palm trunks, dicots woods, roots, leaves and fruits of coconut type. Besides, a number of dicot woods were collected from two hillocks near Mahurzari Village, Nagpur. Pieces of wood specimens from few very big logs and few palm woods were also collected from these hillocks. Also visited a Gitti Khadan Quarry, the type locality of Takli Formation and collected few wood pieces from old dump.

Intertrappean chert pieces were collected from Phutala area road cutting exposures near a pond known as Telankhedi. The bed probably represents the continuation of Takli Bed. Also surveyed the localities in and around Udadaun, Paladon, Jhilimili and Chaurai. A



A coconut type fossil palm fruit from Ghansaur near Binori Reserve Forest, Seoni District, Madhya Pradesh.

rich collection was made from around Mohgaon Kalan Village, Chhindwara District. Number of chert pieces having monocotyledonous leaf and stem impressions and molluscs, palm woods, dicotyledonous woods, fruits and seed were also collected. A survey was also made to the Intertrappean beds around Padwar, Barela and Ranipur up to Maneri area of Jabalpur District and collected carbonaceous shale samples. Plant fossils are not found in these strata.

Project 9 : Marine micropalaeontology of petroliferous basins

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

A.K. Ghosh

Morphotaxonomic study of calcareous algae including petrographic study of thin sections of rock samples from the Tertiary of Kutch were carried out. Preliminary study of algal taxa up to generic level has been done in some specific samples and photomicrographs have been taken. It has been observed that the Oligocene rocks of southwestern Kutch yielding fossil algae are dominated by members of Rhodophyta belonging to Corallinaceae. Identification of taxa and interpretation of data on the freshly collected samples are in progress.

Visited the Tertiary localities of southwestern Kutch, Gujarat for the study of calcareous algae. More than 100 samples were collected from the Eocene of Naredi, Harudi, Kali Nadi Section, Fulra Village Nala Section and Babia Hill Section; Oligocene of Maniara Fort, Ber

Nani and Ber Moti sections; Miocene of Chasara and Khari Nadi Section; and Pliocene of Vinjan and Sandhan localities. In all the localities, the outcrop sections were measured and lithocolumns were prepared. In addition, some Cretaceous localities in Dayapar, Umarsar and Lakhpat areas were also visited and samples were collected.

For the study of modern analogues, visited Botanical Survey of India and Indian Museum, Calcutta. In the Indian Museum, studied marine algae, a collection of K.S. Srinivasan from different parts of India (viz., Okha, Dwarka, Kanyakumari, Andaman and Nicobar Islands), and consulted literature. Dr A.K. Pal's slides on algae from Bagh Beds and other localities were also examined at the Botany Department, Calcutta University.

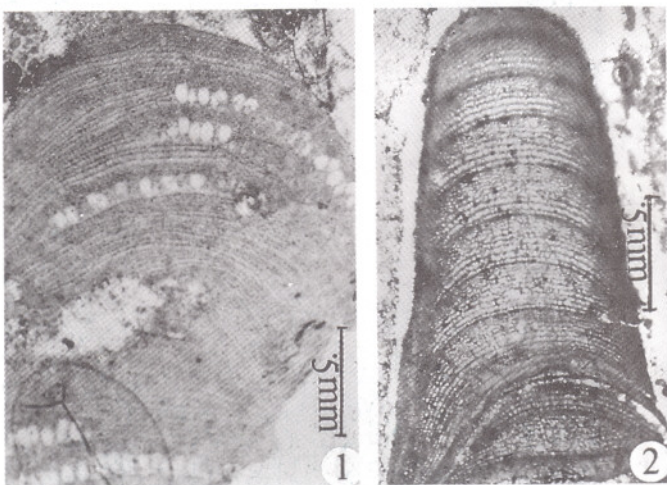
Component 2 : Integrated phytoplankton biozonation and palynofacies analysis of Cretaceous-Tertiary sequences of Meghalaya and Kutch with emphasis on bioevents, time boundaries and palaeoenvironment

Rahul Garg & Khawaja Ateequzaman

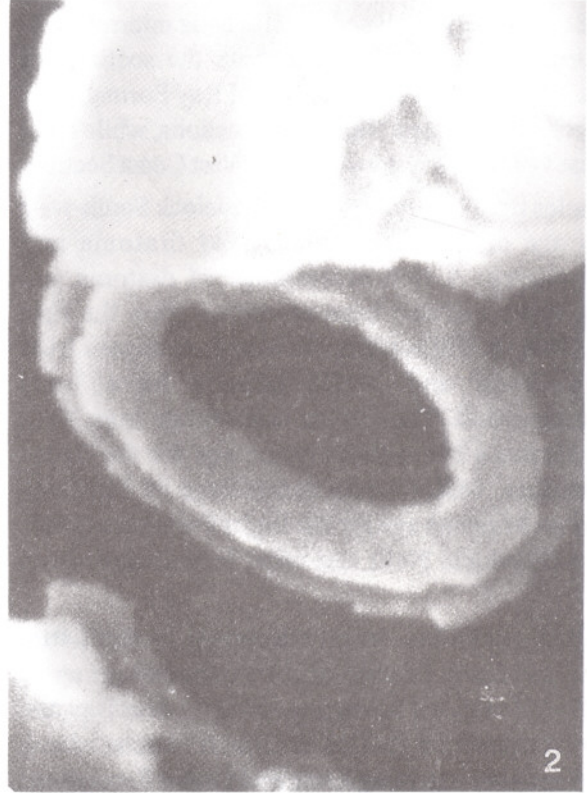
Documentation of Late Maastrichtian nannofossil assemblage recovered from the Mahadek Formation in Therriaghat area, Meghalaya was carried out. Significant species in the assemblage, underlying the *Micula murus* Zone, include *Lithraphidites quadratus*, *L. carneolense*, *Micula decussata*, *M. concava*, *Micula* sp. cf. *praemurus*, *Watzneuria barnesae*, *Cribracorona gallica*, *Prediscosphaera cretacea*, *P. spinosa*, *Microrhabdulus decoratus*, *M. attenuatus*, *Ceratolithoides aculeus*, *Ceratolithoides* sp., *Accuturris scotus*, *Placozygus* sp., *Effilithus turrisiefelli*, *E. gorkae* and *Cribrospheraella ehrenbergii*. Study of the nannofloral assemblage is in progress.

A manuscript highlighting stratigraphic and palaeoenvironmental significance of a diagnostic Late Palaeocene dinoflagellate cyst assemblage, almost exclusively dominated by *Apectodinium* species, recovered from Lakadong Sandstone exposed around Cherrapunji was prepared. Predominance of "P-Cysts" as possible indicator of short-lived Eutrophication Event in an Expanded Oligotrophic Cycle represented by Nummulitic carbonate buildups during deposition of the Early Palaeogene Sylhet Limestone sequence in the Cherrapunji area, Khasi Hills of Meghalaya is discussed.

In Mawsynram area, calcareous sandstone nodules from the lowermost "Great Bottom Sandstone", overlying



Calcareous algae in thin sections—1. *Sporolithon lugeoni* (Pfender) Ghosh & Maithy, a red alga from the Maastrichtian of Kallankurichchi Formation, Cauvery Basin; 2. *Mesophyllum* sp. from the Oligocene of Bare Moti Member, Maniyara Fort Formation, Kutch Basin.



Early Danian marker nannofossils from Um Sohryngkew K/T Boundary section, Meghalaya—1. *Cruciplacolithus primus* Perch-Nielsen 1977 (x 20000); 2. *Neobiscutum romeinii* (Perch-Nielsen) Varol 1989 (x 30000).

the Basal Conglomerate have yielded a scarce but datable dinoflagellate cyst assemblage along with few acritarchs. The assemblage provides the oldest marine phytoplankton evidence in this area. Detailed study of dinocysts is in progress.

In Therriaghat area, lower part of the Mahadek Formation has yielded a diagnostic dinoflagellate cyst assemblage. Occurrence of *Cannosphaeropsis utinensis*, *Senoniasphaera inornata* and *Diphyes colligerum* in the assemblage may prove significant in demarcating Lower/Upper Maastrichtian Boundary in the section. Documentation and morphological study of the dinocysts is in progress.

Samples collected across the lithological contact of Mahadek/Langpar Formations exposed in Mawsmi-Shella Road Section were studied for dinoflagellate cysts. The uppermost Mahadek Formation yielded a rich but low diversity assemblage characteristically dominated by *Areoligera* species. The recovered assemblage is indicative of Late Maastrichtian age. The overlying Langpar black shales yielded a scarce assemblage. Morphological study of dinocysts is being carried out.

Rich and well preserved dinoflagellate cyst assemblages are recovered from different levels within

the sequence underlying the *Asselina* limestone from the Type Section of Naredi Formation, Kutch Basin. The dinocysts provide the first ever definitive microplankton evidence for dating of the post-Trappean shale sequence which has been shrouded in controversy for a long time. Occurrence of *Muratodinium fimbriatum* together with *Ginginodinium* sp. is significant for precise age determination. Documentation and detailed study of dinocysts is in progress.

Khowaja Ateequzzaman undertook the field work in Kutch Basin for collection of rock samples for phytoplankton investigations of Palaeogene-Early Neogene sequences. Sections exposed at Babia Hill, nala cuttings around Baranda, Nareda, Ber Moti, Ber Nani and Kankawati River Section were studied for sampling from Naredi, Harudi, Fulra, Maniara Fort and Vinjhan Shale Formations.

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

Anil Chandra & R.K. Saxena

Rock samples from two sections, namely Lacum Point and Havelock South-west from Havelock Island and

three sections, namely East Coast, West Coast and Nipple Hill were chemically analysed for siliceous microfossils. Inglis Formation is developed in both the sections of Havelock Island. In Neill Island, Sawai Bay Formation is exposed in East Coast and Nipple Hill sections, while Neill West Coast Formation is developed in West Coast Section.

Samples from Lacum Point and Havelock South-west sections are productive in terms of diatoms and silicoflagellates. A rich assemblage of diatoms and silicoflagellates has also been recovered from the East Coast and Nipple Hill sections. Selected specimens from both Havelock and Neill Islands have been microphotographed. The diatom assemblage from Neill Island indicates a Miocene-Pliocene age for the Sawai Bay Formation, while diatom assemblage of Havelock Island shows Miocene age for the Inglis Formation. Field data from Havelock, Neill and other Islands have been compiled.

A field excursion was undertaken to the Little Andaman and Long Islands of the Andaman group of Islands. Seven sections belonging to Inglis, Hut Bay and Long Formations were studied in Little Andaman Island, while two sections exposing Long and Guitar Formations were studied in Long Island. Samples were collected from all these nine sections.

THRUST AREA 5: PALAEOCLIMATOLOGY AND PALAEO-MONSOON

Project 10 : Quaternary vegetation and palaeoenvironment

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

Chhaya Sharma, M.S. Chauhan and Asha Gupta

Chhaya Sharma finalized two manuscripts entitled "Modern pollen rain *vis-a-vis* reflected vegetation in Himalaya" and "Palynostratigraphy of Himalayan lacustrine sediments" based on investigations on eastern Himalaya.

Chhaya Sharma and M.S. Chauhan constructed a pollen diagram using "Tilia" Software Programme from Kupup (Sikkim) and finalized a manuscript entitled "Late-Quaternary pollen records of vegetation and climate from Kupup Lake, eastern Himalaya".

Chhaya Sharma and Asha Gupta visited Kumaun Himalaya to survey and collect samples from potential sites for palynological studies. Collected sedimentary profiles from extant lakes, namely Saria Tal, Sukha Tal and Malwa Tal from Nainital District and from



A view of Khurpa Tal in Kumaon Himalaya.



Coring operation for palynological samples at Jagmotha swamp, District Sidhi, Madhya Pradesh.

palaeolakes, such as Hawalbagh, Kakrighat and Mahatgaon from Almora District alongwith surface samples. Also collected moss cushions from Khurpa Tal and air catches from Saria Tal and Kumaun University.

Asha Gupta pollen analysed surface samples from 8 different localities in Nainital District, Kumaun Himalaya and constructed pollen spectra. The recent pollen spectra exhibit presence of mixed chirpine-oak forest with diversified AP/NAP ratio. Among arboreals, *Pinus* represents high values throughout and *Quercus* dominance at higher elevations. *Alnus*, *Carpinus*, *Ulmus*, *Betula*, *Juglans*, *Celtis*, *Engelhardtia*, *Corylus*, etc., encountered in low values, reflecting mixed nature of forests. Myrtaceae has abundance at certain places due to its recent plantation in the region. Non-arboreals show predominance of Poaceae followed by Cyperaceae. Aquatics are represented by *Typha*, *Potamogeton*, *Lemna*, etc. Bryophytic and pteridophytic spores are encountered in good number reflecting their local source. Pollen deposition broadly reflects the true floral composition in

the area. Consulted relevant literature and examined modern pollen/spore slides of the taxa from Kumaun Himalaya.

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

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

S.K. Bera studied 25 important tree pollen taxa of northeast India from reference pollen slides available in the Palynological Laboratory of Central National Herbarium, Howrah. Undertook a field excursion to Mikir Hills in the districts of Karbi, Anglong and Badarpur of Assam and Meghalaya respectively in order to survey and collect samples from potential sites for palaeoclimatic studies. Fifty modern surface samples (moss and soil) were procured from different forest stands with a view to understand the pattern of pollen dispersal and sedimentation in the region. Three sediment profiles comprising 40 soil samples were collected from Diphu and Manja area of Assam and Jowai-Badarpur area of

Meghalaya in order to reconstruct palaeovegetation and palaeoclimate in the area. In addition, 12 samples were procured for carbon dating.

Besides, macerated 8 moss samples collected from Karbi and Anglong districts and pollen analysis is in progress. Finalised the manuscript entitled "Mid-Holocene vegetational and climatic sequences from Palni Hills, south India".

M.S. Chauhan undertook field excursion to Sidhi District (M.P.) in order to survey and collect samples from potential sites for Quaternary palaeoclimatic studies. In all, four sediment profiles (measuring 1.5 m, 2.0 m, 1.0 m and 5.0 m depths respectively) were collected from Jagmotha, Kerha, Jarbokho and Jarbo Nala for pollen analysis. 12 samples were also collected for radiocarbon dating from these profiles. In addition, 36 surface samples (moss cushions and soil) were picked up from different forest stands to study modern pollen/vegetation relationship in the region.

Pollen analysis of 14 surface samples from Boodandol and Jagmotha reveals that *Shorea robusta* (Sal) together with other forest constituents, viz., *Madhuca indica*, *Emblica officinalis*, *Terminalia*, Sapotaceae, etc. is recorded in reduced frequencies as compared to its occurrence in the forest floristics. Certain other associates of Sal are also met with sporadically. The under representation of all these taxa could be attributed either to their low pollen production or poor preservation of pollen in the sediments. Among the non-arbores, Poaceae, Cyperaceae, Chen/Ams, Asteraceae, Ranunculaceae and *Justicia* are the major elements and their representation in the pollen spectra corresponds more or less to the composition in the ground flora. Fungal spores are encountered frequently in most of the samples.

Prepared reference slides of 72 tropical plant species belonging to 35 natural families. Also got acquainted with their pollen morphology in order to facilitate the precise identification of sub-fossil pollen grains in the sediments.

Anjum Farooqui consulted literature related to the work on mangrove ecosystem in India and abroad. Also studied and photographed mangrove palynomorphs through reference book and Herbarium specimens. Besides, the cuticular and epidermal features of important mangrove plants, viz., *Avicennia officinalis* and *Rhizophora apiculata* were studied. Maceration and slide preparation of pollen material procured from the Herbarium were carried out.

Undertook a field trip to Pichavaram coastal region and Pulicat Lake, Tamil Nadu and collected surface soil

samples and soil profiles. During the field study collected and prepared Herbarium specimens of plants. Comparative study of the Herbarium specimens with the specimens collected was done at the French Institute, Pondicherry. The samples of soil profile collected from Pichavaram were macerated and slides prepared. The study of pollen grains is in progress.

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

Chhaya Sharma & Chanchala Srivastava

A field trip was undertaken to Rajasthan to survey the potential lake sites and collected soil profiles, one each from Pachpadra (1.4 m deep), Bagundi (4.0 m deep) in Barmer District, and Degana (2.0 m deep) in Nagaur District alongwith surface samples and ¹⁴C dating samples. Three fresh water lakes situated at the outskirts of Ajmer city in Pushkar, Madhya Pushkar and Budha Pushkar were surveyed. Besides, plant specimens for Herbarium were also collected. Studied relevant modern pollen slides belonging to about 18 families.

Chemical processing of the surface samples and part of soil profile from Degana was carried out. The study of part of soil profile has revealed dominance of non-arboreal pollen, such as Poaceae, Cyperaceae, Caryophyllaceae, Chen/Ams, *Polygonum* sp., etc. Arboreals are few represented by the stray pollen of *Acacia/Albizia* species. The overall pollen assemblage shows the open nature of vegetation with arid climatic condition in the region.

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

K.S. Saraswat carried out study on carbonised botanical remains recovered from a wide range of cultural deposits at Kunal, Hissar District, Haryana. This demonstrates the development and gradual advancement of agricultural economy at this Harappan site, dated from Ca. 3,000 to 2,500 B.C. The earliest phase from 3,000 to 2,850 B.C. revealed the evidence of cultivation of *Hordeum vulgare* and *Lens culinaris*. In the subsequent phase dated from 2,850 to 2,600 B.C., cultivation of *Hordeum vulgare*, *Triticum sphaerococcum*, *Triticum dicoccum*, *Triticum aestivum*, *Lens culinaris*, *Oryza sativa*, *Pisum arvense* and *Linum usitatissimum* shows considerable advancement in the agricultural economy.

Fruit remains included *Zizyphus nummularia* and *Phoenix* sp. Associated weeds and wild taxa included the seed and fruit remains of *Capparis decidua*, *Vicia sativa*, *Rumex dentatus* and the species of *Phalaris*, *Datura*, *Aegilops*, *Melilotus*, *Indigofera* and *Cyperus*.

During the subsequent transitional phase between Early and mature Harappan cultures, dated 2600-2500 B.C., the new additions are : *Hordeum vulgare* var. *nudum*, *Triticum compactum*, *Lathyrus sativus*, *Trigonella foenum-graecum*, *Dolichos biflorus*, *Sorghum bicolor*, *Gossypium arboreum/herbaceum* and *Sesamum indicum*. The fruit and seed remains are of *Zizyphus nummularia*, *Phoenix* sp., *Embllica officinalis*, *Cucumis melo* cf. *momordica* and *Vitis vinifera*. Weeds and other wild taxa include the seeds and fruits of *Coccinia cordifolia*, *Vicia sativa*, *Lathyrus aphaca*, *Cenchrus* cf. *ciliaris*, *Cleome viscosa*, *Capparis decidua*, *Albizia* cf. *lebbeck* and the species of *Indigofera*, *Abutilon*, *Desmodium*, *Aerva*, *Melilotus*, *Cyperus*, *Medicago*, *Ephedra* and *Artemisia*.

Wood charcoals were found in poor state of preservation. Some of them have been found belonging to *Acacia* cf. *nilotica*, *Albizia* cf. *lebbeck*, *Ficus glomerata*, *Tamarix* sp. and *Bambusa* sp. Further study is in progress.

Finalized a manuscript (jointly with A.K.S. Pokharia) on "The botanical remains of fire-sacrifice at Sanghol, Punjab".

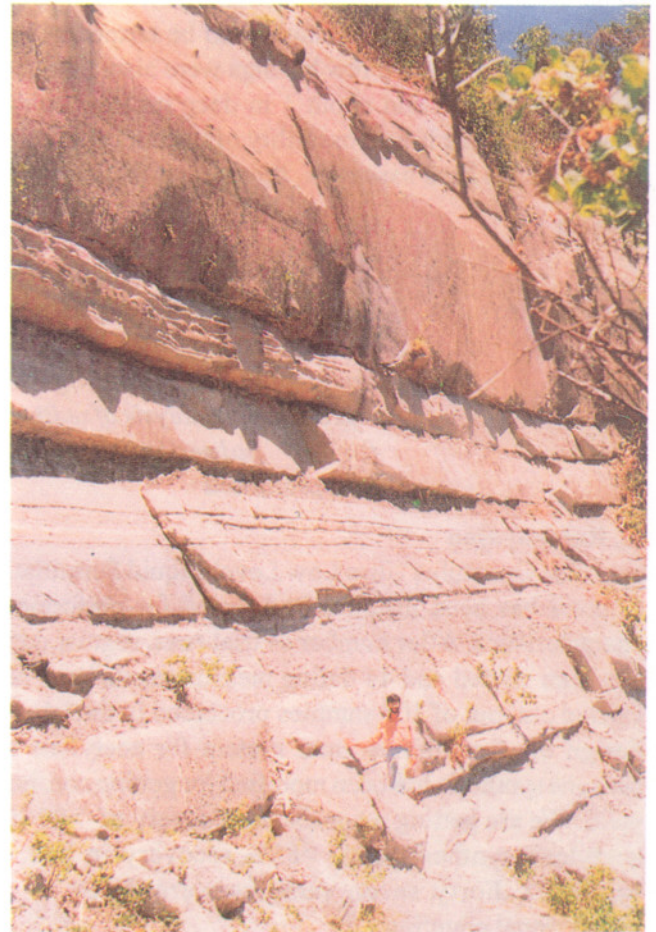
Chanchala Srivastava finalized a manuscript entitled "Seed and fruit remains from Manjhi, Saran District, Bihar (Ca. 250 B.C.-250 A.D.)". Another draft manuscript of a review paper on 'Diffusionary trends in the use of Indian timbers in space and time' was also prepared.

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

R.R. Yadav & A. Bhattacharyya

Tree-ring samples, collected from 90 deodar trees growing around Malari Glacier, have been processed for tree-ring analysis. For dating of growth ring sequences, cross dating technique was employed and each ring was dated to the calendar year of its formation. The dates range from 100 to 686 years. These dated samples will be analysed for further studies towards climate reconstruction in the area.

A field trip was undertaken to the semi-dry deciduous teak forest of Madhya Pradesh to collect tree-ring samples. Total 28 disc samples from the base of the trunks of 28 teak trees were collected for the dendroclimatic analysis. In this collection, 10 samples are from Dhekana under Timarani Forest Circle, Hoshangabad District and 18 samples from Chiraipatla, Betul District.



Eocene flysch sediments near Indira Point, Great Nicobar Island which yielded palynofossils and carbonised woods.

Project 12 : **Cenozoic palaeofloristics of Andaman Islands**

Component 1 : *Palaeofloristic studies of deep-sea flyschoid sedimentaries and its bearing on the evolution of Andaman Nicobar Basin*

S.A. Jafar & J.P. Mandal

Samples from sections in Middle Andaman and Baratang Islands were re-macerated to recover better yield of palynofossils, but owing to poor productivity of the samples, this project was requested to be withdrawn.

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

H.P. Gupta & Asha Khandelwal

Field excursion was undertaken to Andaman and Nicobar Island and collected Pleistocene samples from the exposed vertical scarpment in little Andaman. The

nature of the sediments is semi-consolidated pale yellow coloured mudstone which could also be termed as marl deposits. In addition, a few borings were also conducted in little Andaman and about 1 m deep profile could be procured as there is no possibility of boring further deep in view of the hard base rock, throughout the Island.

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

The Quantulus Ultra Low Level Liquid Scintillation Counter has been installed and tested for performance characteristics. After number of trial runs, regular dating has been started and 44 dating measurements have been carried out, out of 107 samples processed in the lab. The design of the high vacuum system for acetylene and benzene synthesis has been modified for getting consistent yield. We are getting a consistent recovery of >90 % in acetylene synthesis and >85% recovery in benzene synthesis. Forty seven samples were dated by gas proportional counting.

The microwave sample preparation system has been installed and regular sample preparation for chemical analysis is being carried out using the same. After a number of trial runs the sample preparation procedure for palynological analysis of shale, etc. has been standardised. The Varian Atomic Absorption Spectrometer has been installed. After a number of trial runs, regular measurement of elemental analysis at ppm levels are being carried out regularly for palaeoenvironmental studies. The flame photometer has been installed and analysis of alkali elements are being carried out at ppm levels regularly for environmental applications.

In order to understand the chronology of the climatic changes in Gangetic Plain during the Late Quaternary Period, kankar and shell samples from Yamuna River Section and in Kalpi and Nala Section in Sanger River were dated. Three phases of kankar deposits with ages ranging from 36200 to 22000 yrs were found. These samples are also being investigated for their ^{13}C , ^{18}O isotopic variations. Gastropod and bivalve samples from a tectonically disturbed sequence in Sanger Nala section near Kalpi gave ^{14}C age of 8800-8500 yrs B.P. indicating a Mid to Late Holocene tectonic event in the region.

The samples from a trench in the terrace on the southern bank of Giri River in Sirmuri Tal, Himachal Pradesh were ^{14}C dated. The age data indicate that the origin of the lake dates back to 1400 yrs B.P. The colluvial wedge containing charcoal pieces dated to 4900 yrs B.P. is older material brought down by landslide during 1400 to 1350 B.P. The palynological analysis has indicated different phases of vegetational changes. A manuscript is being prepared on the above aspects.

Sediments from palaeolakes in Karnataka (sent by Professor K.S. Valdiya) were dated to know the origin of these lakes and their relationship with neotectonic activity. Preliminary data showed that Manchanabela Lake was formed about 1900 yrs B.P. The samples from other lakes dated to 26500 to 25500 yrs B.P. A field trip was undertaken (with Prof. Valdiya) to collect samples from palaeolakes in Hassan and Mysore districts in Karnataka. The profile collected from Mosale Hosahalli, Hassan District dates to 1100 yrs B.P. Further samples are being dated.

On the interpretations of past climatic changes around Tsokar Lake (Ladakh), Didwana Lake (Rajasthan) and Paradip River Delta core on the basis of elemental analysis and authigenic phosphorus concentrations a manuscript was finalized. Chemical analysis of Berijam Lake sediments (Kodai Kanal) and Paradise Lake (Sela Pass, Arunachal Pradesh) is being carried out using the newly installed atomic absorption spectrometer and flame photometer. Interpretation of the results for the reconstruction of past environmental changes is in progress.

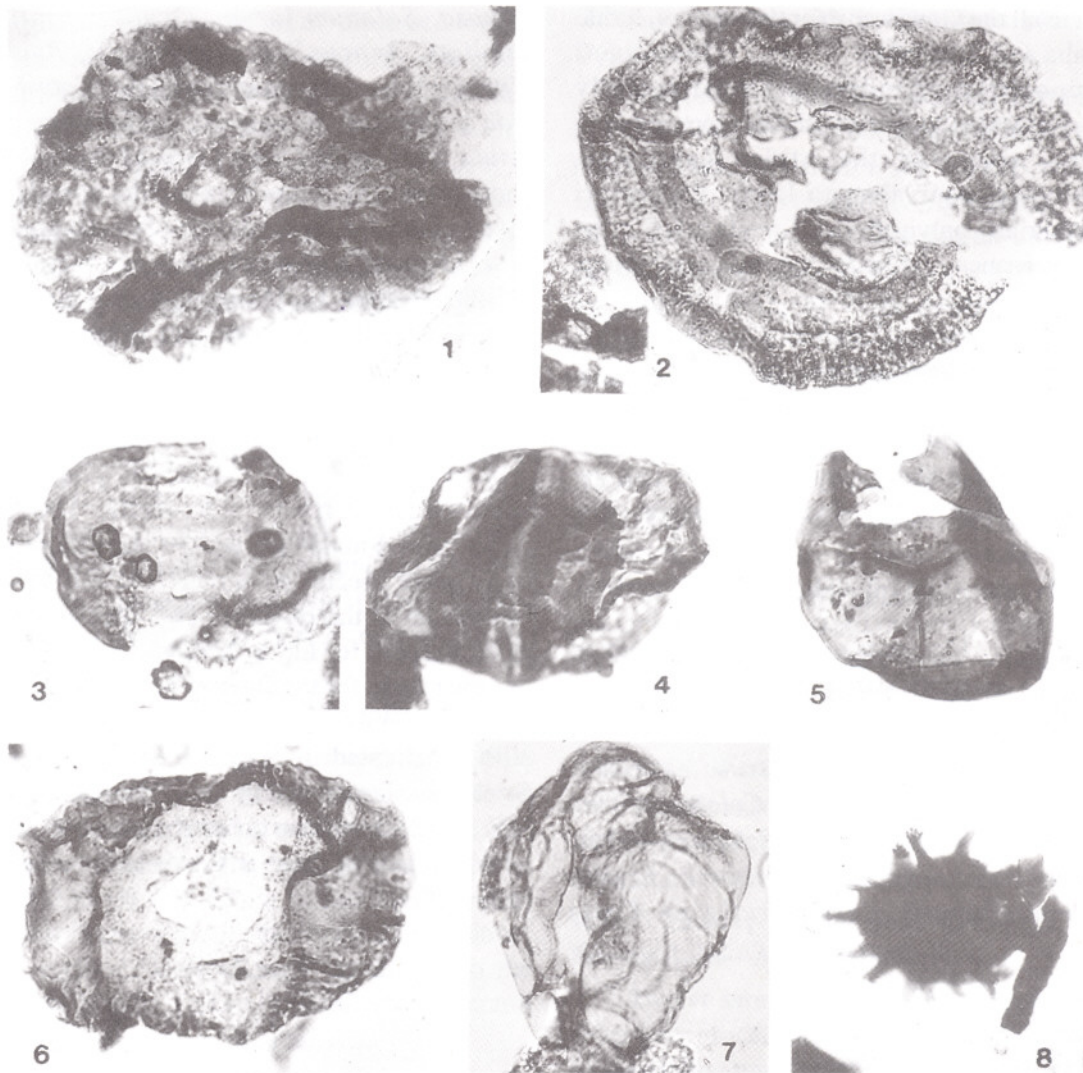
Component 2 : Fission track dating of minerals and fossil woods

G. Rajagopalan & C.M. Nautiyal

Project 14 : Accretionary evolution and tectonics of terranes in Ladakh-Karakoram sector

A.K. Sinha

Most of the present-day topographic elevation of Himalaya, Karakoram, Tibet and Central Asia is a direct result of collision of India with Asian Plate sometime over the interval 60-50 Ma. There are a number of accretionary and non-collision processes involved towards configuring the initial framework of the Himalaya and adjoining Karakoram mountains. Thus, following the above mentioned background this project has been formulated. The project would cover an area of most inaccessible and inhospitable regions of Nubra-Shyok Valley in Ladakh



Early Permian palynofossils from Karakoram area; 1. *Parasaccites* sp., 2. *Plicatipollenites* sp., 3. *Lunatisporites* sp., 4. *Crescentipollenites* sp., 5. *Callumispora* sp., 6. *Caheniasaccites* sp., 7. Foraminifera, and 8. Microplankton (Personal communication by Dr R.K. Kar and Dr (Mrs) Neerja Jha (all x 500).

and adjoining Karakoram terrane up to Karakoram Pass having average height from 3000-6000 m. The most important objectives of the present project is to work out the processes and mechanism of docking and accretion between Indus Suture Zone versus Shyok Suture Zone and Shyok Suture Zone versus Karakoram Terrane in turn subsequently. The studies of basic and acidic magmatism associated with the Shyok Suture Zone and Karakoram ranges would be an additional advantage to work out different crustal geochemical processes and timing of geochronological constraints on subduction, accretion and their emplacement history. Special attention would be given to the tectonics and sedimentation aspects of the flysch and molasse type sediments of the Shyok Suture Zone and rift related sedimentation in the Permian sequences of the Karakoram mountains. Additionally the

role of seamounts, if any, would be worked out for retardation of plate motion and possible palaeoseismicity involved with it. Further, it is very significant to mention here that the most important Karakoram strikeslip fault is passing through the Nubra-Shyok Valley. Therefore, the region would be of utmost significance to understand the Himalayan mountain building processes and the role of Karakoram active fault and its rate of movements in the region.

Shales containing megafossils from Karakoram area have yielded palynofossils. Though some of which are not well preserved, yet are identifiable up to generic level. The palynoassemblage is dominated by monosaccates (52%) and sub-dominated by disaccates (41%). The triletes are 4%, monocolpates 1% and taeniates 2%. Dominance of monosaccates has been recorded during

Early Permian in all the Gondwana continents, i.e., India, Africa, Australia and Antarctica.

The composition of palynoflora particularly dominance of monosaccates along with fair representation of disaccates suggests that this Karakoram palynoassemblage is equivalent to Upper Karharbari (Asselian-Sakmarian) palynoflora of peninsular India. Except for the presence of *Cordaitina*, this assemblage has typical Gondwana aspects. Occurrence of *Corisaccites*, *Crescentipollenites*, *Lunatisporites*, *Verticipollenites* have been noticed in rare amounts. Presence of acritarchs and microplanktons indicates marine influence during the deposition of these sediments. Some of the unidentified forms may throw more light on the interpretation or relationship of palynoflora with other regions.

Project 15 : Special activity

Component 1 : Floristics and phytogeography of tropical and subtropical forests

K. Ambwani & D.C. Saini

K. Ambwani collected the polleniferous material of the following taxa *Strobilanthus alba*, *Colchospermum religiosa*, *Jatropha angustifolia*, *Brownea ariza*, *Duabunga sonneratioides*, *Albizia lebbeck*, *Ligelia pinnata*, *Ochna squarosa*, *Kopsia fruticosa*, *Casia*

spinosa, *Solanum larum*, *Oxalis latifolia*, *Walsura trifoliata*, *Anacardium occidentale*, *Bauhinia vahli*, *Alpina speciosa*, *Rhyncosia wallichii*, *Catasbaea spinosa*, *Sida cordifolia*, *Sesuvium roxburghiana* and *Casia fistula* and prepared them for SEM studies. Out of these, photography of several taxa was completed. Further observations and characteristic of the taxa are in progress.

D.C. Saini undertook a floristic survey in the forest of Sidhi District (M.P.) and adjoining area (Robertsganj) in U.P. The climate of the area is hot and damp to dry with three distinct seasons. The forest of the tract is dry deciduous and mixed type. The main constituents of the forest are *Shorea robusta* Gaertn. (Sal) and *Tectona grandis* Thunb. (Teak). About 400 plant specimens, 50 specimens of fruits and seeds, 100 samples of polleniferous materials, and 30 samples of wood blocks of different species were collected and deposited in the Herbarium of the Institute. Two species were identified as new record for India. About 50 species were reported as new record for the flora of Madhya Pradesh.

An ethnobotanical survey of the area around Piprahi Village, situated in Majhauri forest range along Bijor Stream and dominated by Gond, Baiga, and Panica tribes was also done with an objective to know the various uses of wild plants by these tribals, and documented valuable information.

Work other than Components Work

H.K. Maheshwari & B.N. Jana

Draft manuscript of the chapter dealing with pollen and spores for 'Project Report on Mesozoic palynology of the Kutch Basin' was revised and updated.

S.M. Singh & H.K. Maheshwari

Checking of the draft manuscript of Ph.D. dissertation on 'Early Permian flora of Karanpura and Bokaro coalfields' was continued. Chapters dealing with Gondwana Supergroup, Geology of North Karanpura, South Karanpura and West Bokaro coalfields, and Materials and Methods were checked and revised. Systematic Description of taxa was partly checked and revised. Forty six plates of photographic illustrations (6 copies of each plate, 3 plates in colour), and four maps have been made.

Shaila Chandra

Compiled and finalized a paper on 'Species diversification, floristics and evolutionary trends in Indian basins over \pm 300 Ma from the Late Devonian to Early Cretaceous'.

Prepared a manuscript covering '50 years of palaeobotany in India: A reappraisal'.

Suresh C. Srivastava & Neerja Jha

Three samples from Karakoram area were processed and an Early Permian palynoassemblage has been recovered.

Suresh C. Srivastava & Ratan Kar

Palynological studies undertaken in the Tatapani-Ramkola Coalfield since last four years were compiled and 24 palynofloral assemblages were identified. Correlation among different palynological assemblages led to the demarcation of 13 palynological zones (Cenozones) and, thus, representing a complete palynofloral succession from Talchir to Panchet Formations. The work has been completed and submitted in the form of a Ph.D. Thesis.

Anand-Prakash & Shinjini Sarana

Petrological study of 95 coal samples from three bore-holes (TRM-3, TRS-16, TRS-15) and two outcrops from Tatapani-Ramkola Coalfield, Surguja District (M.P.) has been completed. It indicates that the coals have attained high-volatile bituminous C rank, while certain coals of Tatapani sub-basin have reached up to high-volatile bituminous B rank. In general, the coals are rich in durite microlithotype and contain considerable amount of

liptinite macerals. The study is being finalized to be submitted in the form of Ph.D. dissertation.

Rakesh Saxena

Petrographic data collected from Bokaro and Ramgarh Coalfields have been reprocessed and a manuscript is under preparation.

Alpana Singh & B.D. Singh

Gathered informations on methane gas obtained from coal beds ('coal bed methane') and sea floors ('hydrate') and prepared a state-of-the-art paper.

J.S. Guleria & R.C. Mehrotra

Finalized a paper entitled 'On some plant remains from the Deccan Intertrappean localities of Seoni and Mandla districts of Madhya Pradesh, India'.

Anil Agarwal

Finalized a manuscript entitled 'Contributions to the fossil leaf assemblage of Neyveli lignite deposits, Tamil Nadu, India'.

R.K. Saxena

Palynological study of the Sindhudurg Formation in type area was carried out and a manuscript entitled 'Palynological investigation of the Sindhudurg Formation in the type area, Sindhudurg District, Maharashtra, India' was prepared and submitted for publication.

A manuscript entitled 'Palynology of the Neogene sediments of North-western India' was prepared under IGCP Project 329 and submitted to the Co-convenor of the project.

Vandana Prasad, R.K. Saxena & S.K.M. Tripathi

Avicennia pollen in association with other mangrove pollen taxa were recorded from the Rewak Formation (Late Eocene) of Garo Hills, Maghalaya. Occurrence of *Avicennia* pollen from this region provides an important clue for its origin and possible migratory route in the Indian subcontinent during Palaeogene. The distribution and diversification of mangroves in this region has been critically assessed in the light of pollen records.

M.R. Rao

The Tertiary sediments of Kerala Basin have yielded a variety of pteridophytic spores and angiospermous pollen. Dinoflagellate cysts and fungal remains are also recorded. The palynostratigraphic zonation established in Arthungal bore-hole has been correlated with the Kalarakod bore-hole and surface samples of

Padappakkara, Varkala and Kundara clay mine. Palaeoassociations of montane, low-land, fresh-water swamp and water edge, sandy beach and mangrove and back-mangrove vegetation has been figured out. A manuscript describing the above aspects was prepared and finalized.

Samir Sarkar

Critical morphotaxonomical evaluation of the genus *Thalassiphora* was carried out. The study is based on the specimens recorded from different sections of the Subathu Formation in the north-western Himalayan regions.

G.K. Trivedi

Finalized a manuscript entitled 'Palynology of the Kopili Formation (Late Eocene) exposed at Umsohryngkew River Section, Therriaghat, Meghalaya, India'.

Rahul Garg & Khowaja-Ateequzzaman

Dinoflagellate cyst part of the Project Report on 'Mesozoic palynology of the Kutch Basin' dealing with their biostratigraphic significance has been updated.

Khowaja-Ateequzzaman & Rahul Garg

Updated the computer data base regarding stratigraphic distribution of dinoflagellate cysts reported from Jurassic-Miocene sedimentary sequences of India. Comparison is made with known global stratigraphic ranges to identify marker taxa useful for biostratigraphic studies.

S.A. Jafar & J.S. Guleria

Eucalyptus-like carbonised wood from the Eocene flyschoid sediments of Great Nicobar Island and the phytogeography of the same was discussed in a manuscript. This is the first record of any fossil wood from the Nicobar group of Islands.

S.A. Jafar & S.K.M. Tripathi

Revised version of a manuscript was finalized on Late Triassic palynomorphs of Andaman-Nicobar Basin.

H.P. Gupta & Asha Khandelwal

Ten samples from Bhowania profile on the northern flank of Chilka Lake, Orissa were pollen analysed. The pollen analytical results have revealed the preponderance of herbaceous taxa, such as Poaceae, Chenopodiaceae, Amaranthaceae, Cyperaceae, Brassicaceae, Urticaceae, Asteraceae, etc. However, typical mangrove taxa (*Heritiera*, *Sonneratia*, *Brownlowia*, *Avicennia*, *Cocos*) are encountered in low values. Thus, the pollen assemblage has envisaged the occurrence of hypohaline environmental zone with 5-10% salinity encouraging reedswamp to develop.

Asha Khandelwal

The air-borne pollen grains and fungal spores of Lucknow were monitored over a period of 12 months by employing Burkard volumetric air sampler in the Institute's campus with a view to record the changes in the incidence of aerobioparticles registered a decade back (i.e., during 1985-1986). The comparative study has generated information on changing pollination periods, and differences in the composition of airspora in relation to short term and long term changes.

The concentration of air-borne pollen varies considerably during different seasons of the year. Two 'pollen waves' are observed. The first and the greater one occurs in March-May and is mainly associated with trees. The second one is observed in September-November and is characterised by higher concentration of grasses and sedges. In general, the fungal spores do not show specific seasonality.

Asha Gupta

A manuscript entitled 'Spore types in Bryophytes' has been prepared, which provides accumulative idea of extant and extinct spore morphotypes.

A.K. Ghosh

Prepared and finalized two manuscripts entitled 'Sponges from the Ordovician of (Takche Formation) Spiti Valley, Himachal Pradesh' and 'Cyclocrinids from India'.

Collaborative Projects Work

Manoj Shukla [& R. Srinivasan]

Preliminary study was done on sample no. 14/4 from a bore-hole in Killari, Maharashtra. The assemblage is dominated by smooth walled sphaeromorphs and rare presence of *Baltisphaeridium* which indicate Neo-Proterozoic age for the bed.

Mukund Sharma

The samples collected from the Cuddapah, Kaladgi and Bhima Basins were targeted for stable isotope studies at the University of Wales, Cardiff. The studies in Department of Geology, UWC and NERC isotope Geoscience Laboratory, Nottingham incorporated the petrological studies, cathodoluminescence studies, X-Rays analysis, and stable isotopes studies components.

Shaila Chandra

Keynote address 'Colonization and subsequent speciation/diversification on Gondwana : Gondwana biodiversity' was prepared covering biodiversity trends in all the Gondwana continents. This study is jointly conducted by the South African and Australian scientists for Gondwana-10 International Symposium held at Cape Town, South Africa in June-July, 1998.

S.A. Jafar, A. Tripathi, J.P. Mandal & B.K. Misra

Late Cretaceous section (Chainpur) of Middle Andaman yielded poor palynomorphs. Few long ranging taxa—*Striatopodocarpites* and *Falcisporites* were recovered. Five sections from flyschoid sediments of Middle Andamans yielded poor palynomorphs of Eocene age with more common reworked elements of Palaeozoic/Mesozoic age. Photodocumentation of palynomorphs was completed. Logs and maps of Middle Andaman Island were prepared.

[A. Sahni, A. Khosla], S.A. Jafar [& M. Vianey-Liaud]

Ultrastructure of egg-shell fragments of a rare bird Megapod from Great Nicobar Island was described and the nesting habits compared with that of extinct dinosaurs. Manuscript on the aspect was finalised.

Rahul Garg [& Hartmut Mai (Universitaet Bremen, Germany)]

Detailed SEM investigation of calcareous nannofossils across K/T boundary from Um Sohryngkew Section, Meghalaya revealed considerable etching/dissolution effect. With relatively high terrigenous influx added to the preservation factor, a thorough search had to be made for documentation of the sub-zonal markers

of the Early Danian NP1 Zone. LM studies have, however, shown better preservation facilitating proper specific identification. In a closely-spaced sample set (5 cm interval), occurrence of *Micula prinsii*, *Neobiscutum romeinii*, *Biantholithus sparsus*, *Cyclagelosphaera alta*, *Markalius inversus*, *Cruciplacolithus primus*, besides *Chiastozygus ultimus*, *Placozygus sigmoides*, *Orthopithonella operculata*, *Brarudosphaera discula*, *B. biglowi* has been documented in a typical biostratigraphically complete Late Maastrichtian-Danian nannofloral succession. A draft manuscript on K/TB nannofossils is prepared.

J.S. Guleria [& N. Awasthi & J.H. Gregor]

Studied and identified a number of fossil woods belonging to the following genera from the Tertiary of Guatemala, central America. These are *Avicennia* (Avicenniaceae), *Crudia/Hymenostegia*, *Prioria*, *Zollernia* (Fabaceae), *Terminalia* (Combretaceae), *Mammea/Ochrocarpus* (Guttiferae), *Quercus* (Fagaceae) and a palm (Palmae).

J. Mandal, Madhav Kumar [S.K. Dutta—Dibrugarh, Bharti Kalita & B. Saikia—Duliajan]

One hundred thirty samples of Telani bore-cores have been chemically processed and prepared the slides of productive samples. The preliminary study of palynotaxa and palynodebris reveals that *Meyeripollis nahorkatensis*, *Striatriletes* complex and polypodiaceous spores represent from top to bottom of the sequence (1220-3800 m). The amorphous organic matters are abundant in basal sequence and gradually decrease toward upper sequence and consequently replaced by Biodegraded Terrestrial Organic matters.

S.K.M. Tripathi, Madhav Kumar [& M. Kedves, Hungary]

Pollen grains of 20 palm species were investigated to observe the effect of high temperature on morphology. Pollen grains were subjected to 200°C for 1, 25 and 100 hour(s). Due to high temperature the polar and equatorial diameter of pollen changed in most of the species. Alterations in exine thickness and ornamentation were also observed. It was noticed that most of the alterations appeared after 1 hour and the modified features got intensified after 25 and 100 hours. This study provides an idea to understand regional geothermal history and effect of level of energy on plant material since its lithification.

Madhav Kumar [& S.K. Dutta—Dibrugarh]

Ninety subsurface rock samples of core (nos 2, 4, 5 and 6) of Palaeocene-Eocene sedimentary sequences at Brahmaputra Basin were chemically processed. The recovered palynoassemblage were qualitatively analysed and marker taxa of the sequence were selected to differentiate Therria and Lakadong Sandstone (Palaeocene), and Nurpuh, Prang and Kopili (Eocene).

Samir Sarkar [& G.M. Bhat, Jammu]

Palynological analysis of the Upper Siwalik sediments exposed at Bantala on Bantala-Jammu Road, Jammu reveals a total of 18 genera and 30 species of gymnospermous and angiospermous pollen, pteridophytic spores, fungal spores and conidia. The palynoflora (Upper Siwalik) studied for the first time from this area indicates a swampy environment of deposition. A paper on the above aspect was finalized.

Samir Sarkar [& G. Corvinus—Nepal]

Finalization of work on Siwalik sediments (Mio-Plio-Pleistocene) from Surai Khola and its adjoining areas of west Nepal was done. *Debarya* (Zygnemataceae) zygospores have been recorded from Early Miocene rocks for the first time.

Mahesh Prasad, J.S. Antal [& V.D. Tiwari—Balrampur]

A number of well preserved leaf-impressions from a new fossil locality Seria Naka (at Indo-Nepal border in Gonda District of U.P. were investigated. Of them, 10 leaf-impressions have been identified with extant taxa belonging to families : Anonaceae, Sapindaceae, Flacourtiaceae, Polygalaceae, Anacardiaceae, Fabaceae and Ebenaceae. An analysis of the floral assemblage with respect to the distribution pattern of modern equivalent taxa reveals the prevalence of warm and humid climate



Leaf-impressions resembling extant—1. *Mangifera indica*, 2. *Mitrephora macrophylla*, 3. *Nephelium glabrum* from Lower Siwalik sediments exposed near Seria Naka Village, Gonda District, Uttar Pradesh (all x Nat. size).

in the region during the deposition of these sediments. The fossil flora also indicates that tropical evergreen forests with few moist deciduous plants were flourishing around Seria Naka in the Himalayan foot-hills during Middle Miocene in contrast to the mixed deciduous type of present day forests. Further, the presence of some Malayan elements like *Goniothalamus meboldii*, *Mitrephora macrophylla* and *Nephelium glabrum* is phytogeographically important supporting the view of migration of some taxa from South-east Asia to Indian subcontinent during Neogene.

Chhaya Sharma [& K.S. Valdiya]

Six samples from palaeolakes in Kumaun Himalaya, namely Gogil (2), Matela (2), Hawalbagh and Lower Katarmar (2) were palynologically investigated. Preliminary study has revealed the dominance of arboreals in the samples from Matela (top) and Gogil (base), whereas the sample from Hawalbagh is rich in non-arboreals. Further study is being done.

Chhaya Sharma [& B.S. Kotlia—Nainital]

The pollen analysis of a 13 m thick continuous sequence made up largely of carbonaceous mud from Wadda Lake in Pithoragarh and constructed Tilia Pollen Diagram revealed that the lake was formed between 36,000 and 35,000 yrs BP. Three humid and two arid phases have been observed during the course of deposition. A manuscript entitled 'Palaeoclimatic conditions in the Late-Pleistocene Wadda Lake (Pithoragarh), Kumaun Lesser Himalaya, India' has been finalized.

Visited Kumaun Himalaya and collected samples for pollen analysis and ^{14}C dating from a 6.5 m thick profile from Quaternary section from Phulera (Champavat) situated 76 km from Pithoragarh on road to Tanakpur. Pollen analysis of partly investigated section has revealed dominance of non-arboreals over arboreals. Among the arboreals *Pinus roxburghii* is the chief constituent, followed by *Cedrus*, *Larix*, *Abies*, *Picea*, etc. Broad-leaved taxa, viz., *Quercus*, *Juglans*, *Rhus* are sporadically represented. The ground vegetation is dominated by high frequencies of Poaceae followed by Chen/Ams, Cyperaceae, Asteraceae, Primulaceae, *Polygonum*, Ranunculaceae, Urticaceae, etc. Fern too are represented in high values.

G. Rajagopalan, M.S. Chauhan [& M.P. Shah—Dehradun]

Visited Sirmuri Tal, district Sirmur (H.P.) and collected two sets of 40 samples each for pollen and chemical analyses from a 4.9 m deep trench profile. In addition, 10 radio carbon dating samples were collected from the same trench. The pollen analysis study has envisaged that around 1500 yrs BP the open-mixed vegetation chiefly comprising grasses, sedges, Chenopodiaceae/Amaranthaceae, Ranunculaceae, *Artemisia*, Asteraceae, together with scattered trees of *Shorea robusta*, *Emblica*, *Mallotus*, *Holoptelea*, *Grewia*, Sapotaceae, grew in the region under dry climatic regime. Around 1350 yrs BP the mixed tropical deciduous forests got established as a consequence of improvement in *Emblica*, *Mallotus*, *Grewia* as well as invasion of *Terminalia*, *Adina*, *Acacia*, *Syzygium*, *Viburnum*, etc. in the region. The increased diversity in the forest floristics signifies the onset of moist climatic condition in the region. This is also corroborated by better representation of aquatic taxa such as *Potamogeton* and *Typha* with frequent recovery of dinoflagellates.

The erroneous date of 4820 ± 300 yrs BP for the colluvial wedge at 3.9 m depth could be due to re-deposition of the older sediments in the lake basin.

R.R. Yadav, K.S. Saraswat [& Rajagopal, Somayajulu—Ahmedabad]

Twelve samples of a profile collected from Godavari delta were processed for pollen analysis to assess changes in vegetation and its relationship to climatic change. In general, these samples are found rich in herbaceous taxa over the tree elements. Detailed study is in progress.

A. Bhattacharyya (& J.T Gergan—Dehradun]

Tree ring samples of *Abies pindrow* collected from sites around Dokriani Bamak Glacier have been dated and the measurements of ring widths from these samples are in progress. Eight samples from the 9.0 m section of lacustrine deposits near the snout of glacier have also been macerated and pollen counts are in progress.

B.D. Mandaokar [& R.P. Tiwari]

Palynofloral and animal succession through Tura, Boldamgiri and Dihing sediments in Garo Hills, Meghalaya are being worked out.

Sponsored Projects

Project : Aeroallergens and human health : An aerobiological study (Ministry of Environment and Forest No. 42/14/94- RE)

Asha Khandelwal, Rashmi Tewari & Lily Misra

The aerobiological studies carried out during four years (April 1994-March 1998) have been finalized.

Photodocumentation and statistical analyses of airborne pollen and fungal spores on weekly, monthly and annual basis with the help of various tables and graphs were carried out. Correlation of aerobiological data of the period from September, 1996 to March, 1998 with the prevailing meteorological factors (Temperature, R.H., Rainfall, Wind Velocity and Direction) was also done. Bulk collection of 42 types of pollen and 18 types of fungal spores has been used in preparing allergenic extracts for allergy test on patients suffering from allergic disorders at various medical units of AICP.

Suggestion to minimise the pollen/spore loads in various sites and usage of data by user agencies for meaningful purposes was given.

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

Vijaya & Sanjay Kumar (JRF)

The literature on palynological and geological data about the Upper Gondwanas in Indian peninsula was consulted. One review article is being finalized to evidence the existence of Upper Jurassic deposits in the subsurface Mesozoic succession in Panagarh area of West Bengal as derived from palynological findings.

Besides, search has been made for the spore-pollen species—*Murospora florida*, *Contignisporites cooksonae*, *Callialasporites turbatus*, *C. dampieri*, to explore the Jurassic sediments in the Mesozoic sequences of B.H. DPD-15, Birbhum area, West Bengal. These species in association are of stratigraphic value to support the Upper jurassic sedimentation in Dubrajpur Formation.

Sanjay Kumar visited many localities of Upper Gondwana in Kachchh area and collected the samples of Mesozoic succession for palynological investigation.

Project : Deccan Intertrappean palynoflora and its implication for the demarcation of K/T

boundary (DST)

K. Ambwani [& R.K. Kar, A. Sahni, P. Sharma]

The volcano-sedimentary sequence at Anjar, Kutch District, Gujarat has several Intertrappean beds. In the 3rd Intertrappean bed connecting IV and III flow (by Prof. N. Bhandari, P.R.L., Ahmedabad) samples from BG. 1, BG 2 and BG 3 yielded blue-green algae (*Nostoc*), *Nypa* pollen (*Spinizonocolpites*) and other palm pollen.

Twenty five samples from Mohgaonkalan Village, Chhindwara District (M.P.) were processed. The topmost layer (0.25 m thick), 7 samples yielded the pollen grains. Unisexual flowers described for the first time from these Deccan Intertrappean (Maastrichtian) beds. The male flower (*Flosvirulis deccanensis*) has perianth and six pairs of anther lobes with tricolporate, anguloaperturate laevigate pollen. Whereas, the female flower (*Flosfemina intertrappea*) is a sessile flower with perianth and unilocular superior ovary with many ovules.

A new fossiliferous Intertrappean locality at Amarjiri, Chhindwara District was reported for the first time. It contains fossil woods both of monocots and dicots. Out of them, *Palmoxyton* Schenk and *Aeschynomenoxyton* Muller, Stoll & Mädal have been identified.

From Podwar near Jabalpur 17 palynological samples were positive and yielded pollen. This assemblage is very important in demarcating K-T transition as it consists of two intertrappean beds.

The palynological investigation suggests that Podwar, Mohgaonkalan and Naskal can be correlated on the basis of the marker genera and species. *Ariadnaesporites*, *Gabonisporites* and *Aquilapollenites* are present in all the assemblages. The assemblage at lower part is dominated by water ferns mostly represented by *Azolla*, *Salvinia* and *Marsilea*. It is succeeded in the middle part by angiospermic pollen, while in the Upper Intertrappean beds the pollen considerably reduce.

Project : Palynology and geochemical studies of lake sediments (CSIR/9/528(1)/97 EMR-I-BKR)

Chhaya Sharma [& D.N. Yadav (RA)]

Eight samples from Kumaun Himalaya were pollen analysed and the pollen grains of *Pinus*, Poaceae, Cyperaceae, Chenop/Ams, Asteraceae and fern spores were identified. Burnt charcoal pieces were also recorded frequently.

The reference pollen slides of the plant species, namely *Artemisia amygdalina*, *Polygonum plebejum*, *Plantago major*, *Pinus roxburghii*, etc. were also studied. Besides, the literature on Quaternary palaeoclimate work carried out in India and abroad based on chemical, isotopic and palynological approaches was consulted.

Visited parts of Rajasthan to collect sediment profiles from fresh water and saline lakes for Quaternary climate study and collected 3 sediment profiles from Pachpadra, Bagundi and Degana lakes with their respective depths 1.4 m, 4 m and 2 m. The first two profiles belong to saline lake basin, whereas the third one

represents that of fresh water lake. Two sample sets were collected, one for palynological and geochemical, and other for geochronological (radiocarbon) analyses. To explore some more potential sites for such studies three fresh water lakes situated at the outskirts of Ajmer city—the Budha Pushkar, Madhya Pushkar and the Main Pushkar Lake were visited. From the field observations it appeared that sediment from Budha Pushkar would be best suited for palynological/geochemical analyses, the samples of which is feasible only during extreme summer months (just before the onset of summer monsoon).

Organisational Structure

Governing Body

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Geological Survey of India
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Professor V.N. Raja Rao
Centre of Advanced Study in Botany
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Chennai 600 025

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Dy Director General
Geological Survey of India
Northern Region, Sector 'E'
Aliganj, Lucknow 226 020

Non-Member Secretary (Ex-officio)

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Lucknow 226 007

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Professor C.V. Subramanian
Chairman, Governing Body, BSIP
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Sri S.P. Elhence
Chief Engineer (Retd), UPPWD
B-87, Indira Nagar
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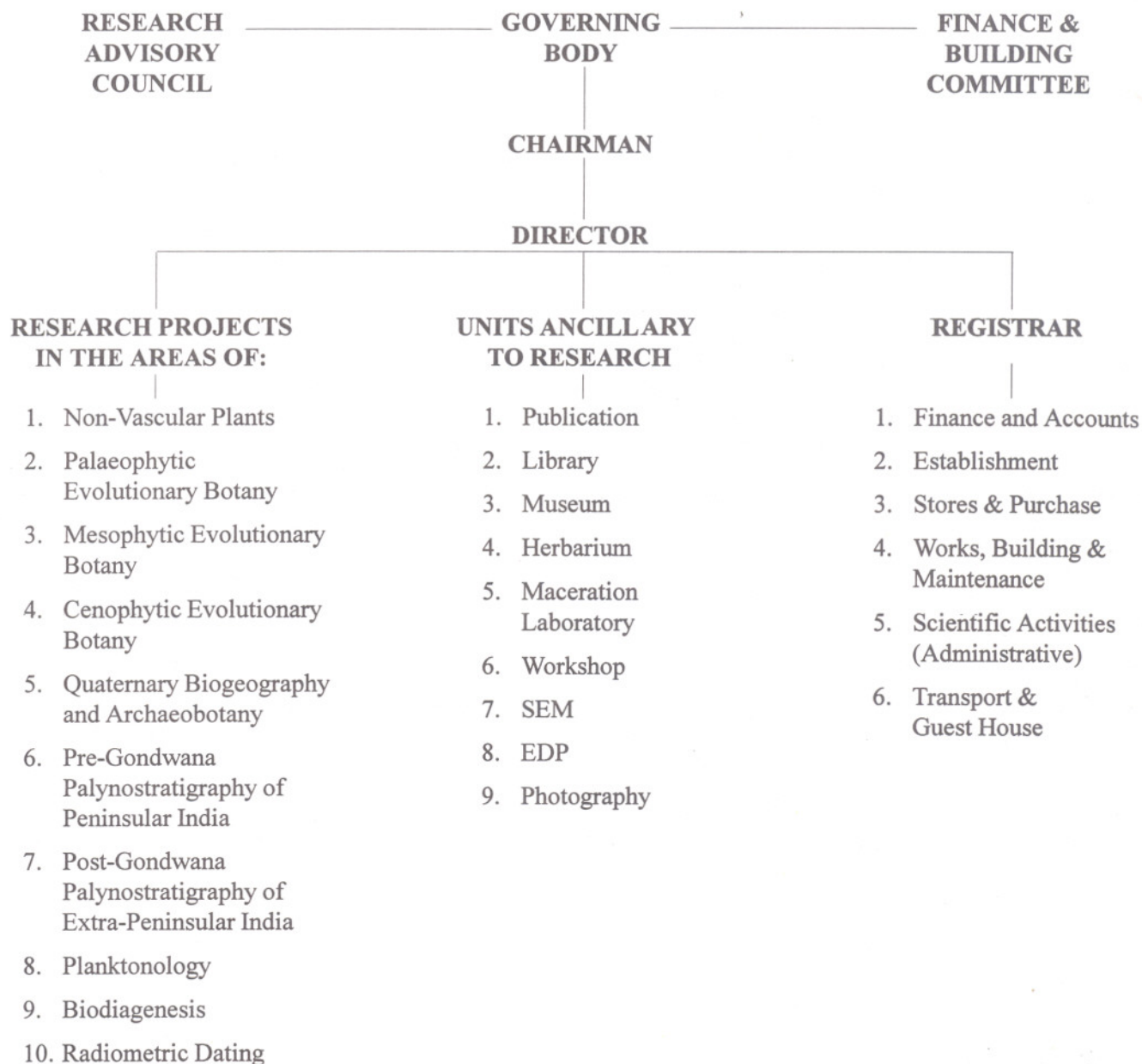
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Non-Member Secretary (Ex-officio)

Sri Suresh C. Bajpai
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Lucknow 226 007

Institute's Organisational Set-up



Recognition

- A.K. Sinha** —Recipient of “Brain Storming Session Memento”, presented by Indian Geological Congress, Roorkee.
- H.K. Maheshwari** —Session Chairman, *National Symposium on Biodiversity, Conservation and Evolution of Plants*, Allahabad.
- Session Chairman, *XVI Indian Colloquium on Micropalaeontology and Stratigraphy*, Dona Paula, Goa.
- P.K. Maithy** —Session Chairman, *XVI Indian Colloquium on Micropalaeontology and Stratigraphy*, Dona Paula, Goa.
- Shaila Chandra** —Co-ordinator, International Project “Gondwana Alive”.
- Awarded the “Sahni-Iyengar Prize” for the best paper published in three consecutive volumes of *The Palaeobotanist*.
- A.K. Srivastava** —Member, Organizing Committee, *International Conference on Dichotomy and Homology in Natural Sciences*, Tyumen, Russia.
- J.S. Guleria** —Session Co-Chairman, *Workshop on Himalayan Foreland Basin with special reference to pre-Siwalik Tertiaries*, Jammu.
- Asha Khandelwal** —Session Chairman, *9th National Conference on Aerobiology*, Hyderabad.
- C.M. Nautiyal** —Session Chairman, *Workshop on Script writing for Science and Technology Audio Visual Programmes*, NCSTC (DST), Lucknow.
- Shyam C. Srivastava** —Recipient of Hungarian Award “Commemorative Medal”, Cell Biology Evolutionary Micropalaeontology, Szeged, Hungary.
- Session Chairman, *International Palynologie Africaine*, Johannesburg, South Africa.
- Vijaya** —Awarded the “Dr P.N. Srivastava Prize” (a Medal and Citation) for the best piece of research work done during last two years.
- Ratan Kar** —Awarded the “Dr P.C. Bhandari Medal” (a Medal and Citation) for 1997 for the best piece of research work by him as Birbal Sahni Research Scholar.

Representation in Committees/Boards

- A.K. Sinha** —Co-ordinator, National Earth Science in Indo-Russian Projects under DST.
- Chief Editor, *Proceeding "Geodynamic Domains in Alpine-Himalayan Tethys,"* IGCP Project 276.
- Chief Editor, *'The Palaeobotanist'*.
- Guest Editor, *"Tethys of the Himalaya and its adjoining Regions."*
- Patron, Organising Committee, Brain Storming Session on 'Quantification of Financial and Manpower Resources devoted to R&D in Science and Technology - An approach for academic sector', Lucknow.
- Chairperson, 5th State Level Meet and District Meet of the National Children's Science Congress, Lucknow.
- G. Rajagopalan** —Member, National Organising Committee, Nuclear track Society of India, Calcutta.
- Member, Academic Committee of School of Archaeological Dating, Jadavpur University, Calcutta.
- Member, Organising Committee, Brain Storming Session on 'Quantification of Financial and Manpower Resources devoted to R&D in Science and Technology - An approach for academic sector', Lucknow.
- H.K. Maheshwari** —Member, Committee for Fossil Plants, International Association for Plant Taxonomy.
- Editor, *"The Palaeobotanist."*
- Editor, Indian Association of Palynostratigraphers.
- Member, Organising Committee, Brain Storming Session on 'Quantification of Financial and Manpower Resources devoted to R&D in Science and Technology - An approach for academic sector', Lucknow.
- P.K. Maithy** —Editor, *"Proceedings of Physical and biological changes across the major geological boundaries"-The Palaeobotanist.*
- Shaila Chandra** —President, The Palaeobotanical Society, Lucknow.
- Vice-President, Indian Society of Geoscientists.
- H.P. Gupta** —Secretary, The Palaeobotanical Society, Lucknow.
- Business Manager, Indian Association of Palynostratigraphers.
- Anand Prakash** —Member, Executive Council, The Palaeobotanical Society.
- Treasurer, Indian Association of Palynostratigraphers.
- S.A. Jafar** —Member, Bureau of Indian Standards, Solid Mineral Fuels Sectional Committee- PCD - 7.
- Anil Chandra** —Member, Executive Council, Palaeontological Society of India.
- Member, International Professional Planning : "Architekten Über Grenzen - Initiativkreis".
- Chhaya Sharma** —Vice-President, International Council for Biodeterioration of Cultural Property.
- Member, Advisory Committee, *"Journal of Bengal Natural History."*
- Member, Executive Council, The Palaeobotanical Society.
- Suresh C. Srivastava** —Chief Editor, *"Geophytology"*.
- Member, Organising Committee, Brain storming session on 'Quantification of Financial and Man-

- power Resources devoted to R & D in Science and Technology-An approach for academic sector,' Lucknow.
- J.S. Antal** —Joint Editor, "*The Palaeobotanist*".
- A.K. Srivastava** —Editor, "*Geophytology*" (up to December, 1997).
—Member, Advisory Board, '*Neobotanica*'.
—Treasurer and Member, Editorial Board, Indian Society of Geoscientists.
- Usha Bajpai** —Member, Managing Council, Indian Association of Palynostratigraphers.
- Rahul Garg** —Member, Editorial Board, '*Palaeontological Society of India*'.
- J.S. Guleria** —Joint Secretary, The Palaeobotanical Society (up to December 1997).
- B.K. Misra** —Member, Bureau of Indian Standard, Solid Mineral Fuels Sectional Committee-PCD-7.
—Joint Secretary, Indian Society of Geoscientists.
—Founder Member, South Asian Association of Economic Geologists.
- C.M. Nautiyal** —General Secretary, National Science Congress, U.P.
—Member, Organising Committee, Seminar on Ozone Depletion and Conservation of Endangered Species (under MOE & F Scheme).
- R.K. Saxena** —Secretary, Indian Society of Geoscientists.
—Member, Editorial Board, "*ISG Bulletin*".
- G.P. Srivastava** —Treasurer, The Palaeobotanical Society.
- Shyam C. Srivastava** —Convener-Secretary, Birbal-Savitri Sahni Foundation, Lucknow.
—Convener, Birbal Sahni IOP Medical Committee Honorary Affiliate Member, Botanical Society of America.
- Archana Tripathi** —Member, Jurassic Microfossil Group, International Subcommittee on Jurassic Stratigraphy.
—Editor, "*Quarterly Journal of Geological Association and Research Centre*".
- Vijaya** —Corresponding Member, Committee for Quantitative Stratigraphy.
—Voting Member, International Commission on Triassic Stratigraphy.
- Asha Gupta** —Member, Board of Editors, "*Flora & Fauna*".
- Madhav Kumar** —Joint Secretary, The Palaeobotanical Society.
—Member, Executive Council, The Palaeobotanical Society (up to December, 1997).
- O.S. Sarate** —Member, Executive Council, The Palaeobotanical Society.
- Rakesh Saxena** —Associate Member, International Committee for Coal and Organic Petrology.
—Member, Latin American Association of Organic Geochemistry.
- B.D. Singh** —Founder Member, South Asian Association of Economic Geologists.
—Member, Organising Committee, Brain Storming Session on 'Quantification of Financial and Manpower Resources devoted to R&D in Science and Technology - An approach for academic sector', Lucknow.
- Anjum Farooqui** —Member, Executive Council, International Society of Environmental Botanists.
- S.C. Bajpai** —Member, Organising Committee, Brain storming session on 'Quantification of Financial and Manpower Resources devoted to R & D in Science and Technology' - An approach for academic sector', Lucknow.

Lectures Delivered

By Institute's Scientists

- G. Rajagopalan** — “Radiocarbon and Fission track dating methods: Application to palaeobotany”, Nuclear Science Centre, New Delhi.
- Chhaya Sharma** — “Past climate from pollen data”, Discussion meeting on “Monsoons : Past, Present and Future”, sponsored and organised by Indian Academy of Science, Bangalore.
- “Reconstruction of the Quaternary climate from pollen data”, at XVI Colloquium on Micropaleontology and Stratigraphy, Goa.
- Shyam C. Srivastava** — “Commemorative Award Lecture”, Botany Department, J.A. University, Hungary.
- A. Rajanikanth** — “Creation and continuum of green life”, Schumacher College, Devon, UK.
- “Gondwana Palaeobotany in India”, University of Wales, Cardiff, UK.

By outside scientists in the Institute

- Professor C.M. Bhandari** — Department of Physics, University of Allahabad, Allahabad- “The complex nature of physical reality”, April 25, 1997.
- Professor M.C. Boulter** — Palaeobiology Research Unit, University of East London, UK and Secretary, IOP- “Palaeobotany in the internet shows patterns of evolution”, November 12, 1997.
- Professor David L. Dilcher** — Florida Museum of Natural History, University of Florida, USA- “Angiosperm leaf anatomy and morphology: Relationships to palaeoclimate and predictors of future climate”, January 21, 1998.
- Dr Jagdish Pandey** — Ex. Group General Manager (Exploration), ONGC Ltd., Bombay- “Consciousness, evolution and future of man”, March 10, 1998.
- Professor Sun Weiguo** — Nanjing Institute of Geology and Palaeontology, Nanjing, China- “Evolution of multicellular life towards the Cambrian explosion”, March 18, 1998.

Deputation/Training/Study/Visit Abroad/in Country

G. Rajagopalan

Spent a month as a Visiting Fellow to the Geodynamics Unit of the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore at the invitation of Professor K.S. Valdiya during January, 1998.

Usha Bajpai

Visited Leica Factory at Vienna, Austria from June 24-26, 1997 for training on use and maintenance of Ultracut-S ultramicrotome and Knife-maker.

Rahul Garg

Visited Fachbereich 5- Geowissenschaften, Universitaet Bremen and GEOMAR der Universitaet Kiel, Germany from November 21, 1997 to February 15, 1998 under the Exchange of Scientists Programme between Indian National Science Academy and Deutsche Forschungsgemeinschaft.

Asha Khandelwal

Attended annual review meeting of AICP on "Aeroallergens and human health - An aerobiological study" from August 7-8, 1997.

Shyam C. Srivastava

Visited Hungary to receive the Commemorative Award at CBEM, Botany Department, J.A. University, Szeged.

Archana Tripathi & Neerja Jha

Attended the "3rd Symposium of African Palynology" and then visited the Archaeological Sites,

the Sterk Fortein and Maka Pansgal caves, South Africa. Traversed Karoo Sequence in Orange Free State and Graafwater and Peninsula Formations in Cape Province, Early Palaeozoic, Permian and Triassic sediments of South Africa. Also visited council of Geoscience and Botanical Research Institute, Botanical Garden Pretoria and University of Cape Town, South African Museum and Botanical Garden at Cape Town.

A. Rajanikanth

Visited Schumacher College, Devon, UK and attended a "Course on Living Science Creatively" held during May 4-24, 1997. Also visited University of Wales, Cardiff.

Mukund Sharma

Visited University of Wales, Cardiff, UK and Natural Environment Research Council (NERC), British Geological Survey, Nottingham, under BOYSCAST Scheme. The study was carried to record the changes occurred in the depositional palaeoenvironment of the Cuddapah, Kaladgi and Bhima Basins of Palaeoproterozoic, Mesoproterozoic and Neoproterozoic age respectively which represent the time span of Precambrian Eons. Also obtained expertise in working.

R.S. Singh

Attended International Field Meeting and Group Discussion on "Cretaceous environmental change in East and South Asia", under IGCP-350, held during December 9-15, 1997 and visited various Cretaceous localities of Madhya Pradesh and Gujarat.

Deputation to Conferences/Symposia/Seminars/Workshops

- Archana Tripathi** — “*Third Symposium of African Palynology*” held at University of Witwatersrand, Johannesburg, South Africa from September 15-19, 1997.
- Neerja Jha**
- Chanchala Srivastava** — “*Joint Session of 'XXXI Annual Conference of Indian Archaeological Society' and 'XXV Annual Conference of Indian Society for Prehistoric and Quaternary Studies'*” held at H.N.B. University, Srinagar, Garhwal from October 16-18, 1997.
- R.K. Saxena** — “*Rashtriya Vaigyanik Sangoshthi Arthi Udarikaran Neetiyon ke Paripekchhya mein Swadeshi Prodyodiki ki Prasangikta*” held at CDRI and CIMAP, Lucknow from November 6-7, 1997.
- Neerja Jha**
- A. Rajanikanth**
- Rajni Tewari**
- Chhaya Sharma** — “*Discussion Meeting on Monsoons: Past, Present and Future*” held at Orange Country, Coorg, Karnataka from November 20-22, 1997.
- “*Group Discussion on Drainage Evolution of North-western India with particular reference to the lost Saraswati*” held at M. S. University, Baroda from December 6-8, 1997.
- H.K. Maheshwari** — “*National Symposium on Biodiversity, Conservation and Evolution of Plants*” held at University of Allahabad, Allahabad from November 27-29, 1997.
- Jayasri Banerji**
- A.K. Srivastava**
- B.N. Jana**
- Rashmi Srivastava**
- Asha Khandelwal** — “*9th National Conference on Aerobiology*” held at Hyderabad from November 27-30, 1997.
- Anand-Prakash** — “*National Seminar on Recent Advances in Geology of Coal and Lignite Basins of India*” held at GSI, Calcutta from December
- Ram Awatar** 5-7, 1997.
- O.S. Sarate**
- Alpana Singh**
- A.P. Bhattacharyya**
- Ratan Kar**
- Shinjini Sarana**
- A.K. Ghosh** — “*XIV Convention of Indian Association of Sedimentologists*” held at University of Madras, Chennai from December 17-19, 1997.
- G.P. Srivastava** — “*Indian Science Congress and Swarnabharati Science Exhibition*” held at Osmania University, Hyderabad during January 3-7, 1998.
- M.R. Rao**
- Vijaya** — “*International Seminar on Recent Advances in the study of Cretaceous Sections*” held at Chennai from January 6-12, 1998.
- H.K. Maheshwari** — “*XVI Indian Colloquium on Micropalaentology and Stratigraphy*” held at National Institute of Oceanography, Dona Paula, Goa from January 22-24, 1998.
- P.K. Maithy**
- Chhaya Sharma**
- Vijaya**
- S.A. Jafar** — “*7th International Nannoplankton Association Conference*” held at La Parguera, Puerto Rico, U.S.A. from February 10-14, 1998.
- S.C. Bajpai** — “*Financial Management Programe*”, Indian Institute of Management, Lucknow from February 16-18, 1998.
- J.C. Singh**
- A. Bhattacharyya** — “*International Tree Ring Conference Sea Dendro -98'*, 1st International Workshop on Southeast Asian Dendrochronology” held at Chiang Mai, Thailand from February 16-20, 1998.
- Vandana Chaudhary**
- Shaila Chandra** — “*National Symposium on 50 years of Botany in India : An assessment*” held at Banaras
- A.K. Srivastava**
- S.K. Bera**

- J.S. Guleria**
Samir Sarkar
- Hindu University, Varanasi from February 26-27, 1998.
- “*Workshop on Himalayan Foreland Basin with special reference to pre-Siwalik Tertiaries*” held at University of Jammu (J & K) from March 16-19, 1998.
- A.K. Sinha**
- “*Brain Storming Session on*
- G. Rajagopalan**
H.K. Maheshwari
Suresh C. Srivastava
Vijaya
Usha Bajpai
Rakesh Saxena
B.D. Singh
S.C. Bajpai
- Quantification of the Financial & Manpower Resources devoted to R & D in Science and Technology: An approach for Academic Sector*” sponsored by DST and organised by IGC at BSIP, Lucknow from March 23-24, 1998.

Papers presented at Conferences/Symposia/Meetings

- Anand-Prakash, Sarana S & Kar R**—Effect of intrusive on organic microconstituents, Dhamni Block, Meghuli area, Tatapani-Ramkola Basin, M.P. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India*, Calcutta, December 1997.
- Banerji J**—Significant occurrence of angiospermous remains in the Early Cretaceous flora of Sonajori, Rajmahal Basin, Bihar. *Nat. Symp. Biodiversity, Conservation and Evolution of Plants*, Allahabad, November 1997.
- Bera SK, Farooqui A & Gupta HP**—Mid-Holocene vegetational and climatic sequences from Palni Hills, South India. *Nat. Symp. 50 years of Botany in India: An assessment*, Varanasi, February 1998.
- Bhattacharyya A & Yadav RR**—Climatic reconstructions using tree ring data from tropical and temperate regions of India. *Sea Dendro '98 Conf., Changmai*, Thailand, February 1998.
- Chandra S**—Fifty years of Palaeobotany in India: An assessment. *Nat. Symp. 50 years of Botany in India: An assessment*, Varanasi, February 1997.
- Chaudhary Vandana**—Tree ring studies in the eastern Himalayan region: Prospects and problem. *Sea Dendro '98 Conf., Changmai*, Thailand, February 1998.
- Ghosh AK & Maithy PK**—Fossil algae from the Maastrichtian of Kallankurichchi Formation, Ariyalur Group. *XIV Conv. Indian Assoc. Sedimentol.*, Chennai, December 1997.
- Guleria JS, Srivastava R & Prasad M**—Some fossil leaves from pre-Siwalik sediments of Himachal Pradesh. *Workshops : Himalayan Foreland Basin with special reference to pre-Siwalik Tertiaries*, Jammu, March 1998.
- Jafar SA** - Architecture of *Braarudosphaera bigelowii* (Coccolithophorid) : A marine planktonic alga holding clues to quasicrystalline symmetry. *7th INA Conf. Puerto Rico*, February 1998.
- Jana BN**—The palynoflora of Athgarh Formation and its implication in age determination. *Nat. Symp. on Biodiversity, Conservation and Evolution of Plants*, Allahabad, November 1997.
- Jha N**—Koyla dharak sanstaro ka ayu nirdharan evam puraparaganuvigyan (in Hindi). *Rashtrya Vagyanik Sangoshthi*, Lucknow, November 1997.
- Khandelwal A**—Grass pollen spectra at Lucknow. *9th Nat. Conf. Aerobiol.*, Hyderabad, November 1997.
- Khandelwal A & Misra L**—Pollen production, incidence and preservation of some pollen grains in Lucknow. *9th Nat. Conf. Aerobiol.*, Hyderabad, November 1997.
- Maithy PK**—Sponges from the Ordovician (Takche Formation) of Spiti Valley, Himachal Pradesh. *Indian Colloq. Micropalaeont. Stratigr.*, Goa, January 1998.
- Rajanikanth A**—Emotional intelligence. *Sem. Role of Emotional Quotient in Management*, Lucknow, September 1997.
- Rajanikanth A**—Birbal Sahni Institute of Palaeobotany: An abode of plant fossils. *Sem. Contribution of Lucknow to Science*, Lucknow, December 1997.
- Ram-Awatar & Datta A**—Palynodating of "Dhanda Pahar" sediments and its stratigraphic status in South Rewa Basin, M.P., India. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India*, Calcutta, December 1997.
- Sarate OS**—Biopetrological study of the coals from Khairagura area, Belampalli Sector, Godavari Valley Coalfield, A.P. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India*, Calcutta, December 1997.
- Sarkar S & Bhat GM**—An Upper Siwalik palynoflora from Bantalao area of Jammu and its palaeoenvironmental significance. *Workshop on Himalayan Foreland Basin with special reference to pre-Siwalik Tertiaries*, Jammu, March 1998.
- Sarkar S & Prasad V**—Palaeoenvironmental significance of dinoflagellate cyst assemblages from the Subathu Formation (Ypresian to Lutetian) of Koshalia Nala Section, Shimla Hills, India. *Workshop on Himalayan Foreland Basin with special reference to pre-Siwalik Tertiaries*, Jammu, March 1998.
- Saxena RK**—Pashchimi Bharat ke Upari Shiwalik avasadon ka puravanaspatik adhdhyayan. *Rashtriya Vagyanik Sangoshthi*, Lucknow, November 1997.
- Sharma C**—Palaeovegetation and climate during Late-Quaternary in north-west Himalaya and western

Indian plains. *Workshop on Drainage Evolution of NW India with particular reference to the lost Saraswati*, Vadodara, December 1997.

Sharma C & Chauhan MS—Late-Quaternary pollen record of vegetation and climate from Himalaya. *XVI Indian Colloq. Micropaleont. Stratigr.*, Goa, January 1998.

Singh A—Probability of a new leptinitic maceral from Indian lignites. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India*, Calcutta, December 1997.

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Srivastava AK—Significance of morphotaxonomy in evolution of Glossopterid. *Nat. Symp. Biodiversity, Conservation and Evolution of Plants*, Allahabad, November 1997.

Srivastava AK—Recent development in palaeobotanical researches. *Nat. Symp. 50 years of Botany in India: An assessment*, Varanasi, February 1998.

Srivastava AK & Tewari R—Lower Gondwana plant fossils from Barren Measures Formation of India. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India*, Calcutta, December 1997.

Srivastava C—Diffusionary trends in the use of Indian timbers in space and time. *XXV Annual Conf. on Indian Soc. Prehistoric and Quaternary Studies*, Srinagar, October 1997.

Srivastava R—Fossil wood of *Artocarpus* from Warkalli Formation of Kerala Coast, India. *Nat. Symp. on*

Biodiversity, Conservation and Evolution of Plants, Allahabad, November 1997.

Srivastava Suresh C & Bhattacharyya AP—Palynodating of subsurface sediments around Baranj Village near Warora, Maharashtra. *Nat. Sem. on Recent Advances in Geology of Coal and Lignite Basins of India*, Calcutta, December 1997.

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Srivastava Suresh C & Jha N—Permian palynology from India and Africa: Phytogeographic paradigm. *3rd Symp. on African Palynol.*, Johannesburg, September 1997.

Tripathi SKM, Singh UK & Sisodia MS—Palynological investigation and environmental interpretation of Late Palaeocene sediments from Barmer Basin, western Rajasthan, India. *XVI Indian Colloq. Micropalaeont. Stratigr.*, Goa, January 1998.

Vijaya—Early Cretaceous palynoflora within the Intertrappeans of Rajmahal Formation, Panagarh area, West Bengal, India. *Int. Sem. on Recent Advances in the Study of Cretaceous Sections*, Chennai, January 1998.

Vijaya—Search for Jurassic in subsurface Mesozoic sediments, Birbhum District, West Bengal, India. *XVI Indian Colloq. Micropalaeont. Stratigr.*, Goa, January 1998.

Vijaya & Sinha S—Late Permian palynoflora in southeastern Korba Coalfield, M.P., India. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India*, Calcutta, December 1997.

Doctoral Degree awarded

Name	Supervisor	Title of the thesis	University
B. Sekar	G.Rajagopalan	Chemical analysis and ¹⁴ C dating of lake sediments and their implications on environmental reconstruction	Lucknow University, Lucknow

Consultancy/Technical assistance rendered

The consultancy in scanning electron microscope was provided (by Dr K. Ambwani) to the following :

- Department of Central National Herbarium, Botanical Survey of India (No. of samples processed—65)
- Professor Dinesh Kumar, Department of Botany, Lucknow University (No. of samples processed—22)

Fifty nine samples have been dated in the Radiocarbon Dating Lab as a part of consultancy services offered by the Institute.

Training in Quaternary palynological technique was imparted (by Dr Chhaya Sharma) to Mr Vinod Prasad

Khanduri and Mr Naresh Chamola of Department of Forestry, H.N.B. Garhwal Univesity, Srinagar and also to Ms. Sunita Tewari, Kumaun University, Nainital.

Training in chemical processing of rock samples and microscopy has been rendered (by Dr J.P. Mandal) to Mr S. Saha, Research Scholar, Chandigarh University for 4 weeks. Training was imparted (by Dr S.K.M. Tripathi) to Mr Uttam K. Singh, Research Scholar, Geology Department, Jodhpur University, Jodhpur for palynological studies.

The Institute generated revenue of Rs. 2,69,650.00 from consultancy/contract research/contract training services during 1997-98.

Research Projects at the Institute (Leaders)

- PROJECT 1** — Palaeobiology and biostratigraphy of Precambrian Basins (Dr P.K. Maithy)
- PROJECT 2** — Floristics and biostratigraphy of Palaeozoic and Mesozoic of Himalayas (Dr Suresh C. Srivastava)
- PROJECT 3** — Ultrastructural studies of fossil cuticles and megaspores, data processing of Gondwana fossils (Dr H.K. Maheshwari)
- PROJECT 4** — Floristics, biostratigraphy and palaeoenvironment of Gondwana sediments (Dr Shaila Chandra)
- PROJECT 5** — Floristics, biostratigraphy and palaeoenvironment of Mesozoic sediments (Dr Jayasri Banerji)
- PROJECT 6** — Coalification processes and depositional environment of coal and associated sediments (Dr Anand Prakash)
- PROJECT 7** — Morphotaxonomy, floristics, biostratigraphy, sedimentological studies of Tertiary sediments and search for Cretaceous-Tertiary boundary in marine sequences of Lesser Himalayas (Dr S.A. Jafar)
- PROJECT 8** — Tertiary floristics of Peninsular India (Director)
- PROJECT 9** — Marine micropalaeontology of petroliferous basins (Dr Anil Chandra)
- PROJECT 10** — Quaternary vegetation and palaeoenvironment (Dr Chhaya Sharma)
- PROJECT 11** — Archaeobotany and Dendrochronology (Dr K.S. Saraswat)
- PROJECT 12** — Cenozoic palaeofloristics of Andaman Islands (Dr H.P. Gupta)
- PROJECT 13** — Geochronometry and Isotope studies (Dr G. Rajagopalan)
- PROJECT 14** — Accretionary evolution and tectonics of terranes in Ladakh-Karakoram Sector (Professor A.K. Sinha, Director)
- PROJECT 15** — Special Activities (The Director)

Status of official language

In pursuance of the Government of India official language policy, further steps were taken to promote the usage of Hindi in official work. The Institute continued to be the incharge of the unit in the city's Implementation Committee of official language, Unit 11. The meetings of the committee were held regularly during 1997-98.

'Hindi Pakhwara' was organised in the Institute from 14 September to 28 September 1997. The main function was held on September 22, 1997 with noted scientist and

Hindi writer Dr Bhumitra Deo as the Chief Guest. In this function many programmes regarding Hindi were organised, in which scientific, technical and administrative staff of the Institute actively participated. A Hindi type writing contest was also organised during the 'Hindi Pakhwara'.

The use of Hindi in Electronic Data Processing work in the institute is on gradual progress. A large number of Hindi Books were also subscribed in the library of the Institute.

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 per directives of the Government of India, Department of Personnel 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.

Units Publication

Journal- The Palaeobotanist

Numbers 1, 2 and 3 of Volume 46 of the Journal were published, in which Number 1 and 2 were brought out as a special joint issue comprising the Proceedings of the Conference on “*Physical and biological changes across the major geological boundaries*” held at the Institute from November 15-17, 1996. This issue, consisting of 33 contributions, has about 264 printed pages and was released on the Foundation Day of the Institute, i.e., September 11, 1997.

24th Birbal Sahni Memorial Lecture

The 24th Birbal Sahni Memorial Lecture entitled “History and progress of plant tissue culture and

biotechnology” delivered by Professor B.M. Johri was published.

Annual Report

The Annual Reports for the year 1996-97, both in Hindi and English, were published in which major achievements and events of the Institute along with other activities were highlighted with coloured and black and white pictures. These reports comprise about 152 printed pages each. The printed copies of the Reports were sent to DST, New Delhi and other organisations.

Sale of the Institute Publications

This year the publications of the Institute netted an income of Rs.1,17,203.00.



BSIP Golden Jubilee Year celebrations—Dr R. Aiyagari, DST, New Delhi releasing a Proceeding Volume of The Palaeobotanist.

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पुस्तकालय
परिग्रहण सं. 59947

Library

Library is the backbone of researchers with motto to serve its users efficiently whether of own Institute or the scientists/teachers/students of other organisations and universities, both in India and abroad.

The present holdings of BSIP Library are as under:

Particulars	Additions during 1997-98	Total
Books	91	5,148
Journals	558	10,818
Reprints	272	35,510
Reference Books	2	256
Hindi Books	9	143
Reports	—	46
Maps & Atlases	—	61
Microfilms/Fisches	—	294
Ph.D. Thesis	3	86

Library is subscribing 100 journals and has 200 registered Card holders.

Exchange Unit

Journals received on exchange basis 72

Reprints of research papers purchased	46
Reprints sent out in exchange	1,650
Institutions on exchange list	59
Individuals on exchange list	377

The addresses on the Library's Exchange List of about 377 individuals and institutions were revised.

The following institutions availed the Library facilities during the year :

Lucknow University, Lucknow
 J.N.V. University, Jodhpur
 Burdwan University, Burdwan
 B.N.S.D. College, Kanpur
 H.N.B.Garhwal University, Srinagar, Garhwal
 Annamalai University, Hyderabad
 Barkatullah University, Bhopal
 Institute of Technology, Hauz Khas, New Delhi
 National Museum, Bhutan
 Bangalore University, Bangalore
 Kumaun University, Nainital
 Banaras Hindu University, Varanasi
 Cochin University of Science & Technology, Cochin
 Oil & Natural Gas Corporation, Sibsagar, Assam

Museum

Museum being the nodal centre of dissemination and popularization of palaeobotanical knowledge, organized a week long activity to celebrate the National Science Day (28th February) on the theme— "*Fifty Years of Independence*". Some of our activities were jointly held with Regional Science Centre, Lucknow. These include an Open House, film and slide shows on scientific topics, screening of educational video films, debate competition (in Hindi & English) on the topic "*Development of Science and Technology during Fifty Years of Independent India*". An Art competition and photo exhibition were also organised. The prize distribution ceremony was held at the Institute and at Regional Science Centre.

The Institute participated in the DST's Science and Technology Exhibition from January 3-8, 1998 at Osmania University, Hyderabad during the Indian Science Congress session. Lakhs of visitors visited our exhibits and were fascinated to see plant fossils. A bilingual

Brochure about the Institute and its activities was also distributed to the visitors.

Citizens of Belgium, Hungary, China, France, Finland and USA, besides persons of our country and teachers of refresher courses organised by the Lucknow University, also visited the Institute's Museum.

Type and Figured Specimens/Slides/Negatives

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

Particulars	Addition during 1997-1998	Total
Type & Figured specimens	63	5,556
Type & Figured slides	196	11,464
Negatives of above	360	15,089



Professor V.S. Ramamurthy, Secretary, D.S.T. showing deep interest in plant fossils at the exhibition at Hyderabad.



National Science Day—Children sketching the drawings.

New Collection

Specimens/samples were collected by the scientists from 255 localities of the country and were deposited to the Museum for investigations.

	Specimens	Samples
	70	
Project 1	28	185
Project 2	479	989
Project 3	-	427
Project 4	363	63
Project 5	384	231
Project 6	3	296
Project 7	-	600
Project 8	277	561

Presentation of fossil specimens

The Museum under its special programme entitled 'Palaeobotany for education' sends fossil specimens, information and photographs to other educational institutes to help them teach Palaeobotany. This year we have sent relevant information and fossil specimens to 14 educational institutions in the country and one abroad:

- Department of Environmental Science, Guwahati University, Guwahati
- P.G. College, Khatima, Udham Singh Nagar, U.P.
- Department of Botany, Punjab University, Patiala, Punjab
- Govt. Museum, Salem, Tamil Nadu
- Ghali College, Gandhiganj, Kolhapur, Maharashtra
- Department of Botany, DSM College, Palghat,

Maharashtra

- Asansol Girls College, Asansol, West Bengal
- Department of Botany, HNB Garhwal University, Srinagar, U.P.
- Kids Corner School, Faizabad, U.P.
- Kurnool Public School, Kurnool, A.P.
- Department of Botany, SPM College, Bihar Sharif, Bihar
- Department of Geology, Vinoba Bhave University, Hazaribagh, Bihar
- Sasibrata Kobriraja, Teacher, Barjora, Bankura, West Bengal
- Geology Department, Dhaka University, Dhaka, Bangladesh

Institutional Visitors

- K.S. Saket Degree College, Faizabad, U.P.
- H.N.B. Garhwal University, Srinagar, U.P.
- D.A.V. College, Kanpur, U.P.
- A.V. College, Guwahati
- Cotton College, Guwahati
- Ranchi University, Ranchi, Bihar
- Gauhati University, Guwahati, Assam
- City Montessori School, Lucknow
- Rani Laxmi Bai Memorial School, Lucknow
- Colvin Taluqdar's College, Lucknow
- Army Public School, Cantt, Lucknow
- Lucknow University, Lucknow
- Assembly of Church School, Lucknow
- I.T. College, Lucknow

Herbarium

Herbarium is a repository of reference collection of extant plant material and their preparations which are useful for comparative morphological study of fossil specimens. About 600 plant specimens, 30 samples of wood blocks, 50 fruits and seeds and 100 samples of polleniferous material were collected from different parts of the country. About 550 plant specimens were identified, mounted on herbarium sheets, registered and systematically incorporated. About 52 wood slides, 40 pollen slides, 10 laminated mounts of leaf venation patterns and leaf prints of 30 specimens were also added to herbarium. Preparation of paintings depicting different forest types in India and feeding of data in computer for preparation of inventory of carpothek, sporothek and xylarium are being done.

Herbarium Holdings

The modern plant materials collected by herbarium and other staff of the Institute during the year are as under :

Particulars	Addition during 1997-1998	Total
Herbarium		
Herbarium sheets of plant specimens	550	15,825
Herbarium sheets of leaf specimens	35	470
Laminated mounts of venation pattern	10	4
Xylarium		
Woods blocks	30	4,034
Woods disks	28	60
Wood core samples	30	470
Wood slides	52	3,990
Sporothek		
Pollen slides	40	11,639
Carpothek		
Fruits & seeds	50	2,566

Material received

A gift of about 15 various kinds of seeds was received from Dr Veena Chandra, Seed Laboratory, Forest Research Institute, Dehradun.

Herbarium facilities provided to :

Dr R.S. Kanaujia, Botany Department, K.S.S.P.G. College, Ayodhya (Faizabad), U.P.

Dr P. Ramchandra, Botany Department, Osmania University, Hyderabad

Dr A.S. Reddy, Department of Life Sciences, Sardar Ballabh University, Gujarat

Dr P.K. Singh, Botany Department, Gorakhpur University, Gorakhpur

Dr N.K. Dubey, Botany Department, Banaras Hindu University, Varanasi

Dr M.P. Singh and Dr A.K. Singh, Botany Department, U.P.P.G. College, Varanasi

Dr H.C. Singh, Harish Chand College, Varanasi

Dr David Dilcher, Florida Museum of Natural History, University of Florida, U.S.A.

Institutional Visitors

Teachers attending Refresher Course, organised by Academic Staff College, Lucknow University, Lucknow

Botany Department, Government P.G. College, Pithoragarh

Botany Department, Sagar University, Sagar, M.P.

Botany Department, K.S.S.P.G. College, Faizabad, U.P.

Electronic Data Processing

The following significant activities were carried out in this unit.

- Planning and up-keep of the unit,
- Updation of library information management system,
- Software development for scientists, administration and accounts section,
- Providing technical support to staff,
- Rendering basic maintenance of the systems, and
- Hardware and Software acquisition

In addition, the V Pay Commission's arrears were processed for the Accounts Section for the working staff

as well as retired employees. Pay rolls have been modified according to the recommendations of the commission. Invitation addresses were printed by Laser printer for all the invitees in India and abroad for various functions held at the Institute. Display and presentations were also prepared and manuscripts were printed by Laser printer for the scientists participating in Conferences.

Pentium based advance systems were procured to carry out the scientific and technical work. These include one Wipro Acer Note Book Computer, two Wipro Acer Aspire MULTIMEDIA and 21 Wipro Acer Entra 500 Computers. All the new systems have been distributed amongst the staff members.

Besides, a CANON Inkjet colour printer was also procured along with 21 Dot Matrix Printers.

Foundation Day and Founder's Day Celebrations

10 September, 1997 was observed as the Foundation Day. On this occasion Dr N.S. Murali, Professor of

Surgery, Ragas Dental College, Chennai delivered First Golden Jubilee Commemoration Lecture.



On the eve of releasing four Postal Stamps on fossil plants (from left to right : Dr G. Rajagopalan addressing, Shri S.P. Ojha—Post Master General, Uttar Pradesh, Professor C.V. Subramanian, Shri Beni Prasad Verma—the then Minister of Communications, Government of India, Dr Rao Aiyagari and Dr H.K. Maheshwari).



This year on 11th September 1997 four Postal Stamps on fossil plants and reconstructions along with first day cover were released by Sri Beni Prasad Verma, the then Minister of Communications, Government of India. A philatelic exhibition was also arranged to mark this memorable event.

On 14 November, 1997 the Institute staff and members from other organisations offered *Pushpanjali* on the *Samadhi* of Professor Birbal Sahni. Same day Dr P.D. Dogra, FNA, INSA Senior Scientist delivered 27th Birbal Sahni Memorial Lecture on “*Endangered tree genetic resources of forests of India-High subspecific variation : its conservation and utilization in tree breeding*”

Dr P.D. Dogra delivering the 27th Birbal Sahni Memorial Lecture.



Founder's Day Celebrations (from left to right : Dr P.K. Maithy, Dr G. Rajagopalan, Dr P.K. Das—ex-Director General, Indian Meteorological Department, Professor C.V. Subramanian, Dr P.D. Dogra—INSA Senior Scientist, Professor A.K. Sinha and Dr H.K. Maheshwari).



Dr P.K. Das delivering the 43rd Sir Albert Charles Seward Memorial Lecture.

and silviculture". Dr P.K. Das, FNA, Retired Director-General, Indian Meteorological Department delivered 43rd Sir Albert Charles Seward Memorial Lecture entitled "*Vagaries of the summer monsoon rains*".

Distinguished Visitors

Sri Beni Prasad Verma, Minister of Communications, Government of India, New Delhi

Professor V.S. Ramamurthy, Secretary, DST, Government of India, New Delhi

Professor V.K. Gaur, Distinguished Scientist, National Aerospace Centre, Bangalore

Professor G.S. Paliwal, H.N.B. Garhwal University, Srinagar, U.P.

Ms Anna Thompson, University of California at Burkley, San Francisco, USA

Dr G.J. Samathanam, Scientific Officer, DST, New Delhi

Dr T.K. Seshadri, Director, Department of Electronics, New Delhi

Professor V.K.S. Dave, Secretary, Indian Geological Congress, Roorkee

Dr K.D. Singh, FAO, Rome, Italy

Ms Carolene Stromberg, Palaeontology Lab, Burkley, California, USA

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

Dr N.S. Murali, Hon. Surgeon & Hon. Secretary, Voluntary Health Services, Chennai

Dr P.D. Dogra, INSA Senior Scientist, Dehradun

Dr P.K. Das, Ex-Director General, Indian Meteorology Department, New Delhi

Dr Krukki Kuranniemi, Heoneaa, Finland

Professor Sun Weiguo, Nanjing Institute of Geology and Palaeontology, Academia Sinica, Nanjing, China

Dr S.K. Saraswat, Director, National Museum of Natural History, New Delhi

Dr P.K. Bhaumik, Director, National Science Centre, New Delhi

The Staff

Scientists

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

Director

Professor Anshu K. Sinha (w.e.f. 14.11.1997)

Scientist 'F'

Dr (Mrs) Shaila Chandra
 Dr Hari P. Gupta
 Dr Hari K. Maheshwari
 Dr Prabhat K. Maithy
 Dr Govindraja Rajagopalan (Acting Director up to 13.11.1997)

Scientist 'E'

Dr Anand-Prakash
 Dr Jaswant S. Antal
 Dr (Ms) Jayasri Banerji
 Dr Anil Chandra
 Dr Syed A. Jafar
 Dr Kripa S. Saraswat
 Dr (Mrs) Chhaya Sharma
 Dr Ashwini K. Srivastava
 Dr Suresh C. 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 Gajendra P. Srivastava
 Dr Shyam C. Srivastava
 Dr (Mrs) Archana Tripathi
 Dr (Ms) Vijaya
 Dr Ram R. Yadav

Scientist 'C'

Dr Anil Agarwal
 Dr Ram Awatar
 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 Rakesh C. Mehrotra
 Dr Mahesh Prasad
 Dr (Mrs) Jyotsana Rai
 Dr Annamraju Rajanikanth
 Dr Dinesh C. Saini
 Dr Omprakash S. Sarate
 Dr Mukund Sharma
 Dr (Mrs) Alpana Singh
 Dr Bhagwan D. Singh
 Dr Kamal J. Singh
 Dr Rama S. Singh
 Dr (Mrs) Chanchala Srivastava
 Dr (Mrs) Rashmi Srivastava
 Dr (Mrs) Rajni Tewari
 Dr Surya K.M. Tripathi

Scientist 'A'

Dr (Mrs) Anjum Farooqui
 Dr Amit K. Ghosh
 Dr Bhagwan D. Mandaokar
 Dr Kindu L. Meena
 Dr (Mrs) Neeru Prakash
 Dr (Mrs) Vandana Prasad
 Dr Gyanendra K. Trivedi

Birbal Sahni Research Scholar

Mr Ratan Kar (till 17.10.1997)
 Mr Anil K.S. Pokharia (till 17.10.1997)
 Mrs Shinjini Sarana
 Mr Shiv M. Singh (till 31.10.1997)

Sponsored Project (DST/Ministry of Environment)

Dr (Miss) Rashmi Tewari (RA)
 Miss Vandana Chowdhary (PA)
 Miss Alka Srivastava (JRF) (till 2.5.1997)
 Miss Poonam Sharma (JRF, w.e.f. 6.5.1997)
 Miss Reema Singh (JRF, w.e.f. 6.5.1997; resigned w.e.f. 9.5.97)
 Miss Alka Srivastava (JRF, w.e.f. 14.5.1997; resigned w.e.f. 1.9.1997)
 Mr Sanjay Singh (JRF, w.e.f. 20.02.1998)
 Mr Jagdish Prasad (Field/Lab Attendant, w.e.f. 6.5.1997)

Technical and Administrative Personnel

Technical**Publication**

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

Library

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

Museum

Mr P.K. Bajpai (Technical Officer 'B')
 Mrs Kamla M. Chhabra (Technical Officer 'B')
 Mr Prem Prakash (Technical Officer '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) Madhavi Chakraborty (Technical Officer 'B')
 Mrs Asha Guleria (Technical Officer 'B')
 Mr T.K. Mandal (Technical Officer 'B')
 Mr E.G. Khare (Technical Officer 'A')
 Mr V.K. Singh (Technical Officer 'A')
 Mrs Sunita Khanna (Technical Officer 'A')
 Mrs Reeta Banerji (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 'D')

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 Chhotey Lal (Technical Assistant 'B')
 Mr M.S. Rana (Technical Assistant 'A')
 Mr S.C. Singh (Technical Assistant 'A')
 Mr A.K. Srivastava (Technical Assistant 'A')

Administration**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

Drivers

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 Mahanti
 Mr Satruhan
 Mr Ram Kishan
 Mr Ram Singh

Attendants 'II'

Mr Sri Ram
 Mrs Munni
 Mr Bam Singh
 Mr Kedar Nath 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 Mahadev Prasad
 Mr S.C. Misra
 Mr V.S. Gaikwad
 Mr Ramesh Kumar
 Mr R.K. Awasthi

Mali

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

Appointments and Promotions

Appointments

Professor Anshu K. Sinha, Director, w.e.f. 14.11.1997
 Miss Poonam Sharma, Junior Research Fellow (DST Sponsored Project) w.e.f. 6.5.1997
 Miss Reema Singh, Junior Research Fellow (DST Sponsored Project) w.e.f. 6.5.1997
 Miss Alka Srivastava, Junior Research Fellow (DST Sponsored Project) w.e.f. 20.2.1998.
 Mr Sanjay Singh, Junior Research Fellow (DST Sponsored Project) w.e.f. 20.2.1998.
 Mr Jagdish Prasad, Field/Lab Attendant (DST Sponsored Project) w.e.f. 6.5.1997.
 Mr Pawan Kumar, Technical Assistant "A" w.e.f. 13.11.1997.
 Mr Om Prakash, Technical Assistant "A" w.e.f. 13.11.1997.
 Miss Chitra Chatterjee, Lower Division Clerk w.e.f. 15.12.1997.
 Mr Inder Kumar, Attendant "I" w.e.f. 30.7.1997.
 Mr Deepak Kumar, Attendant "I" w.e.f. 30.7.1997.

Promotions

Dr H.P. Gupta, Scientist "F" w.e.f. 1.4.1996.
 Dr (Mrs) Shaila Chandra, Scientist "F" w.e.f. 1.4.1996.
 Dr J.S. Antal, Scientist "E" w.e.f. 1.4.1996.
 Dr Ashwini K. Srivastava, Scientist "E" w.e.f. 1.4.1997.
 Dr Pramod Kumar, Scientist "D" w.e.f. 1.4.1996.
 Dr J.P. Mandal, Scientist "D" w.e.f. 1.4.1996.
 Dr B.K. Misra, Scientist "D" w.e.f. 1.4.1997.
 Dr M.R. Rao, Scientist "D" w.e.f. 1.4.1997.
 Dr Samir Sarkar, Scientist "D" w.e.f. 1.4.1997.
 Dr (Mrs) Neerja Jha, Scientist "D" w.e.f. 1.4.1997.
 Dr R.R. Yadav, Scientist "D" w.e.f. 1.4.1997.
 Dr (Mrs) Asha Khandelwal, Scientist "D" w.e.f. 1.4.1997.
 Dr (Mrs) Usha Bajpai, Scientist "D" w.e.f. 1.4.1997.
 Dr A. Bhattacharyya, Scientist "C" w.e.f. 1.4.1996.
 Dr A. Rajanikanth, Scientist "C" w.e.f. 1.4.1996.
 Dr R.C. Mehrotra, Scientist "C" w.e.f. 1.4.1996.
 Dr S.K. Bera, Scientist "C" w.e.f. 1.4.1996.
 Dr Khowaja Ateequzzaman, Scientist "C" w.e.f. 1.4.1996.

Dr Mukund Sharma, Scientist "C" w.e.f. 1.4.1996.
 Dr D.C. Saini, Scientist "C" w.e.f. 1.4.1996.
 Dr Madhav Kumar, Scientist "C" w.e.f. 1.4.1996.
 Dr K.J. Singh, Scientist "C" w.e.f. 1.4.1996.
 Dr O.S. Sarate, Scientist "C" w.e.f. 1.4.1996.
 Dr Mahesh Prasad, Scientist "C" w.e.f. 1.4.1996.
 Dr (Mrs) Rashmi Srivastava, Scientist "C" w.e.f. 1.4.1997.
 Dr (Mrs) Rajni Tewari, Scientist "C" w.e.f. 1.4.1997.
 Dr Rupendra Babu, Scientist "C" w.e.f. 1.4.1997.
 Dr (Mrs) Alpana Singh Scientist "C" w.e.f. 1.4.1997.
 Dr B.D. Singh, Scientist "C" w.e.f. 1.4.1997.
 Dr M.S. Chauhan, Scientist "C" w.e.f. 1.4.1997.
 Dr (Mrs) Jyotsana Rai, Scientist "C" w.e.f. 1.4.1997.
 Dr (Miss) Asha Gupta, Scientist "C" w.e.f. 1.4.1997.
 Dr A.P. Bhattacharyya, Scientist "C" w.e.f. 1.4.1997.
 Mrs Indra Goel, Technical Officer "B" w.e.f. 1.4.1996.
 Mrs Madhavi Chakraborty, Technical Officer "B" w.e.f. 1.4.1997.
 Mrs Kamla Manik Chhabra, Technical Officer "B" w.e.f. 1.4.1997.
 Mrs Asha Guleria, Technical Officer "B" w.e.f. 1.4.1997.
 Mr T.K. Mandal, Technical Officer "B" w.e.f. 1.4.1997.
 Mr Prem Prakash, Technical Officer "A" w.e.f. 1.4.1996.
 Mrs Sunita Khanna, Technical Officer "A" w.e.f. 1.4.1997.
 Mr Madhukar Arvind, Technical Assistant "E" w.e.f. 1.4.1996.
 Mr Rattan Lal Mehra, Technical Assistant "E" w.e.f. 1.4.1997.
 Mr Chandra Bali, Technical Assistant "C" w.e.f. 1.4.1997.
 Sri Ramesh Chandra, Section Officer w.e.f. 29.10.1997.
 Sri N.N. Joshi, Section Officer w.e.f. 14.11.1997.
 Sri I.J.S. Bedi, Accountant w.e.f. 14.11.1997.
 Sri Dhoom Singh, Assistant w.e.f. 14.11.1997.
 Mrs Ruchita Bose, Assistant w.e.f. 14.11.1997.
 Mrs Usha Chandra, Assistant w.e.f. 14.11.1997.
 Mrs P. Thomas, Assistant w.e.f. 14.11.1997.
 Sri Hari Lal, Upper Division Clerk w.e.f. 18.11.1997.
 Sri Koshy Thomas, Upper Division Clerk w.e.f. 18.11.1997.

Mrs Swapna Mazumdar, Upper Division Clerk w.e.f. 18.11.1997.

Sri K.P. Singh, Upper Division Clerk, w.e.f. 18.11.1997.

Sri Gopal Singh, Upper Division Clerk w.e.f. 18.11.1997.

Sri M. Pillai, Upper Division Clerk w.e.f. 10.12.1997.

Sri N. Unnikannan, Upper Division Clerk w.e.f. 10.12.1997.

Sri Nafis Ahmed, Driver "II" w.e.f. 22.10.1997.

Sri Sri Ram, Attendant "II" w.e.f. 22.10.1997.

Mrs Munni, Attendant "II" w.e.f. 22.10.1997.

Sri Bam Singh, Attendant "II" w.e.f. 22.10.1997.

Sri Kedar Nath Yadav, Attendant "II" w.e.f. 22.10.1997.

Mrs Maya Devi, Attendant "II" w.e.f. 22.10.1997.

Sri Kailash Nath, Attendant "II" w.e.f. 22.10.1997.

Sri Mohammad Shaqil, Attendant "II" w.e.f. 22.10.1997.

Sri Mani Lal Pal, Attendant "II" w.e.f. 22.10.1997.

Retirements

Sri Bhagwan Singh, Section Officer, retired on 31.10.1997.

Dr H.A. Khan, Scientist "C", retired on 31.12.1997.

Sri P.C. Roy, Technical Officer "A", retired on 31.3.1998

Papers/Reviews/Articles submitted

- Ambwani K**—Further observations on the agavaceous axis from the Neyveli lignite, Tamil Nadu, India. *Palaeobotanist*.
- Anand-Prakash, Sarana S & Kar R**—Effect of intrusive on organic microconstituents, Dhamni Block, Meghuli area, Tatapani-Ramkola Basin, M.P. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India*, Calcutta.
- Antal JS & Prasad M**—Angiospermous leaves from the Siwalik sediments (Middle Miocene) of Darjeeling District, West Bengal. *Palaeobotanist*.
- Banerji J**—Significant occurrence of angiospermous remains in the Early Cretaceous flora of Rajmahal Basin, Bihar. *Palaeobotanist*.
- Bera SK & Gupta HP**—Vegetation and environment since Middle Holocene in Silent Valley as evidenced by palynostratigraphy. *J. Palynol.*
- Dutta SK, Bhuyan D & Kumar M**—Record of palynodebris from the Upper Disang-Lower Barail Group around Kohima District, Nagaland, India. *Geophytology*.
- Ghosh AK & Maithy PK**—Fossil algae from the Maastrichtian of Kallankurichchi Formation, Ariyalur Group. *Indian J. Petrol. Geol.*
- Guleria JS & Mehrotra RC**—On some plant remains from Deccan Intertrappean localities of Seoni and Mandla districts of Madhya Pradesh, India. *Palaeobotanist*.
- Guleria JS, Srivastava R & Prasad M**—Some fossil leaves from pre-Siwalik sediments of Himachal Pradesh. *Him. Geol.*
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- Maheshwari HK**—Permian-Triassic boundary: A tyro's view. *Palaeobotanist*.
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- Maithy PK, Kumar G & Ghosh AK**—Sponges from the Ordovician of (Takche Formation) Spiti Valley, Himachal Pradesh. *Curr. Sci.*
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- Meena KL**—Palynodating of subsurface of B.H. IBH-6 in Ib-River Coalfield, Orissa, India. *Geophytology*.
- Meena KL**—Palynodating of subsurface Late Permian sediments in bore-hole RPA-2, Palasban area, Raniganj Coalfield, West Bengal, India. *Geophytology*.
- Prakash N**—The genus *Phlebopteris* in the Indian Gondwana. *Indian Fern Journal*.
- Prakash N & Sukh-Dev**—New records of plant fossils from new sites of Jabalpur Formation with remarks on its age. *Plant Cell Biol. Devel.*
- Prasad M, Antal JS & Tiwari VD**—Investigation on plant fossils from Seria Naka in the Himalayan foot-hills of Uttar Pradesh, India. *Palaeobotanist*.
- Rai V, Shukla M & Gautam R**—Discovery of carbonaceous megafossils (*Chuarina-Tawuia* assemblage) from the Neoproterozoic Vindhyan succession (Rewa Group), Allahabad-Rewa area, India. *Curr. Sci.*
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- Ram-Awatar & Datta A**—Palynodating of "Dhanda Pahar" sediments and its stratigraphic status in South Rewa Basin, Madhya Pradesh, India. *Indian Mineral*.
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- India : Cyanobacterial or other bacterial microfossils? *Precambrian Res.*
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- Sharma M & Shukla M**—Palaeo-Mesoproterozoic stromatolites from the Vempalle and Tadpatri Formations, Cuddapah Supergroup, India and their characteristics. *Precambrian Res.*
- Singh A**—Probability of a new liptinitic maceral from Indian lignites. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India,* Calcutta.
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- Srivastava AK**—Fossil records of insect and insect-related plant damage in India. *Zoo's, Print.*
- Srivastava AK**—The morphological and evolutionary aspects of Glossopteris flora. *Vasundhara.*
- Srivastava AK & Tewari R**—Lower Gondwana plant fossils from Barren Measures Formation of Jharia Coalfield, Bihar, India. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India,* Calcutta.
- Srivastava R**—Angiospermous fossil wood from lignite beds of Warkalli Formation, Kerala Coast, India. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India,* Calcutta.
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- Srivastava, Suresh C & Bhattacharyya AP**—Palynodating of subsurface sediments around Baranj Village near Waora, Maharashtra. *Nat. Sem. Recent Advances in Geology of Coal and Lignite Basins of India,* Calcutta.
- Sun Keqin & Chandra S**—Evolution and ecology of Cathaysian Flora. *Palaeobotanist.*
- Trivedi GK**—Palynoflora of Kopili Formation from Jowai-Badarpur Road, Meghalaya, India : Palaeoecologic and palaeogeographic implications. *Geophytology.*

Trivedi GK—Palynology of Upper Tertiary sediments in Meghalaya, India : A discussion. *Geophytology*.

Upadhyay R & Sinha AK—Tectonic evolution of Himalayan Tethys and subsequent Indian Plate subduction along Indus Suture Zone. *Proc. Indian Nat. Sci. Acad.*

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Papers/Reviews/Articles published

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- Bhattacharyya A & Chaudhary V 1997.** Is it possible to demarcate floristically transition of Pleistocene/Holocene in India? *Palaeobotanist* 46(1, 2) : 186-190.
- Bhattacharyya A, Yadav RR & Chaudhary V 1997.** Himalayan conifers and their perspective in dendroclimatic studies. *Him. Geol.* 18 : 169-176.
- Bhattacharyya AP 1997.** Palynological recognition of the Karharbari-Barakar Formation in the subsurface sediments of Wardha Coalfield, Maharashtra, India. *Palaeobotanist* 46(1, 2) : 217-219.
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- Chandra S & Sun Keqin 1997.** Evolution and comparison of the Gondwana Flora and Cathaysian Flora. *Palaeobotanist* 46(3) : 35-46.
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Research Coordination and Planning Cell		Sri Pradeep Mohan	Convener
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Audit Report to the Governing Body of the Birbal Sahni Institute of Palaeobotany, Lucknow

We have audited the attached Balance Sheet of the Birbal Sahni Institute of Palaeobotany, Lucknow as at 31st March, 1998 and the Income and Expenditure and 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, 1998,
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.

Place : Lucknow

Dated : 31 July, 1998

For R.N. Khanna & Company

Chartered Accountants

Sd/-

(R.N. Khanna)

**Audit Report of the Birbal Sahni Institute of Palaeobotany,
Lucknow for the year ended 31st March, 1998
Comments on Accounts for the year ended on 31st March, 1998**

Annexure 'A'

ACCOUNTS

1. Accounts have been maintained on cash basis except a grant of Rs. 38 lacs for the year 1997-1998 from the Department of Science & Technology, Government of India which is accounted on the basis of sanction.
2. Various advances were found pending recovery for unduly long period. Efforts are to be made for speedy settlement of the same.

PUBLICATION

3. On scrutiny of record of the priced publications of the Institute, it has been observed that during the last several years, the Institute has brought out publications on different subjects to sell out in the market. Stock position of these priced publications as on 31.03.1998 is about Rs. 23.76 lacs apart from which Rs. 3.88 lacs is reserve stock, totaling stock of Rs. 27.64 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.

STORES

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 and explanations furnished before us, no physical verification of fixed assets has been made.
No identification marks on the fixed assets have been made for efficient and proper verification thereof.
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.
8. During the year appropriation for Reserve fund and Pension fund of Rs. 65,00,000/- and 10,00,000/- respectively are made out of Institute fund.

Dated : 31 July, 1998

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

Serialwise replies to the comments of the Chartered Accountant on the Annual Accounts of the Institute for the year 1997-98

Comments of the Chartered Accountant

Reply of the Institute

ACCOUNTS :

1. Accounts have been maintained on cash basis except Government of India Grant of Rs. 38 lacs for the year 1997-98 from the Department of Science & Technology are accounted on the basis of sanction.
2. Various advances were found pending recovery for unduly long period. Efforts are to be made for speedy settlement of the same.

No Comments.

Efforts are being made to settle the outstanding advances. The outstanding advances which stood at Rs.46.44 lacs on March 31,1998 have been brought down to Rs. 33.46 lacs on August 31, 1998.

PUBLICATION :

3. On scrutiny of record of the priced publication of the Institute, it has been observed that during last several years, the Institute has brought out publications on different subjects to sell out in the market. Stock position of these priced publications as on 31.03.1998 is about Rs. 23.76 lacs apart from which Rs. 3.88 lacs is reserve stock, totalling stock of Rs. 27.64 lacs.

Efforts are being made on continuous basis to reduce the old stock of publications. As on August 31, 1998, the total stock of old publications is Rs. 27.42 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.

The last physical verification of Library was completed in June 1997.

STORES :

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.

Noted for compliance.

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

No identification marks on the fixed assets have been made for efficient and proper verification thereof.

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.

No comments.

Noted for compliance.

8. During the year appropriation for Reserve Fund and Pension Fund of Rs.65,00,000/- and Rs.10,00,000/- respectively are made out of Institute fund.

Appropriation for Reserve Fund and Pension Fund have been made as per the provisions of the Bye-laws of the Institute and the approval of the Finance & Building Committee and Governing Body of the Institute.

For R.N. Khanna & Company

Chartered Accountants

Sd/-

(R.N. Khanna)

Sd/-

J.C. Singh

(Accounts Officer)

Sd/-

Suresh C. Bajpai

(Registrar)

Sd/-

Anshu K. Sinha

(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow

Balance Sheet as at March 31, 1998 (Figures in Rupees)

PREVIOUS YEAR 1996-97	(LIABILITIES) Sources of Funds	CURRENT YEAR 1997-98
8,06,29,495	1. A) Capital Fund	9,26,15,315
29,96,538	B) Income & Expenditure	-34,04,142
30,00,000	2. Reserve Fund	76,50,889
9,00,000	3. Pension Fund	39,42,816
4,95,091	4. Donated Fund	8,53,417
50,675	5. Deposit Account	53,034
34,632	6. Current Liabilities	60
1,67,75,433	7. General Provident Fund	1,94,24,206
10,48,81,864	TOTAL	12,11,35,595

PREVIOUS YEAR 1996-97	(ASSETS) Application of Fund	CURRENT YEAR 1997-98
5,93,05,670	1. Fixed Assets	
3,25,424	i) Owned Assets	6,35,54,107
39,89,000	ii) Donated Assets	6,71,075
1,55,90,767	2. Investments	1,16,82,705
88,95,570	3. Current Assets	67,52,029
1,67,75,433	4. Loans And Advances/Deposits	1,90,51,473
	5. General Provident Fund	1,94,24,206
10,48,81,864	TOTAL	12,11,35,595

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

Sd/-
(R.N. Khanna)

CERTIFICATE

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

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

Sd/-
Suresh C. Bajpai
(Registrar)

Sd/-
Anshu K. Sinha
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow

Income and Expenditure Account for the year ending March, 1998

(Figures in Rupees)

Previous Year			Schedule	Current Year		
Plan	Non-Plan	Total		Plan	Non-Plan	Total
			Income :			
1,10,00,000.00	1,70,00,000.00	2,80,00,000.00	1. Grants	1,68,00,000.00	1,68,62,000.00	3,36,62,000.00
0.00	3,65,921.00	3,65,921.00	2. R &D Receipts	0.00	4,54,307.00	4,54,307.00
683.00	1,16,169.00	1,16,852.00	3. Misc. Income & Recoveries	0.00	81,506.00	81,506.00
0.00	6,55,107.00	6,55,107.00	4. Interest	0.00	8,95,185.00	8,95,185.00
1,10,00,683.00	1,81,37,197.00	2,91,37,880.00	Total	1,68,00,000.00	1,82,92,998.00	3,50,92,998.00
			Expenditure :			
12,25,896.00	1,69,95,342.00	1,82,21,238.00	1. Pay & Allowances	12,77,281.00	2,40,64,133.00	2,53,41,414.00
20,24,298.00	2,000.00	20,26,298.00	2. Academic Expenses	16,91,669.00	22,500.00	17,14,169.00
6,44,745.00	2,30,344.00	8,75,089.00	3. Expenses on Units/Services Ancillary to Research	8,55,558.00	15,420.00	8,70,978.00
3,45,542.00	50,598.00	3,96,140.00	4. Travelling Expenses	6,91,969.00	-4,317.00	6,87,652.00
1,92,926.00	1,96,679.00	3,89,605.00	5. Publication Expenses	86,046.00	1,53,492.00	2,39,538.00
16,70,974.00	6,89,053.00	23,60,027.00	6. Contingencies	28,06,754.00	4,44,396.00	32,51,150.00
11,94,305.00	22,616.00	12,16,921.00	7. Maintenance & Repairs	18,88,777.00	0.00	18,88,777.00
37,01,997.00	-49,435.00	36,52,562.00	Balance carried down	75,01,946.00	-64,02,626.00	10,99,320.00
1,10,00,683.00	1,81,37,197.00	2,91,37,880.00	Total	1,68,00,000.00	1,82,92,998.00	3,50,92,998.00
37,01,997.00	-49,435.00	36,52,562.00	Balance of Income & Expenditure	75,01,946.00	-64,02,626.00	10,99,320.00
-30,00,000.00	0.00	-30,00,000.00	Less appropriation during the year			
0.00	-9,00,000.00	-9,00,000.00	Reserve Fund	-65,00,000.00	0.00	-65,00,000.00
			Pension Fund	0.00	-10,00,000.00	-10,00,000.00
			Balance transferred to Capital Fund			
7,01,997.00	1,78,49,996.00	-2,47,438.00	Net Excess of Expend. over Income	10,01,946.00	-74,02,626.00	-64,00,680.00

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

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

Sd/-
Suresh C. Bajpai
(Registrar)

Sd/-
Anshu K. Sinha
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow
Receipts and Payment Account for the year ending 31st March, 1998

Receipts	Plan	Non-Plan	Total	Payments	Plan	Non-Plan	Total
To Opening Balance							
Bank Current Account				By Fixed Assets	1,46,65,294.00	0.00	1,46,65,294.00
Revenue	2,03,754.00	60,905.00	2,64,659.00	By Pay and Allowances	12,77,281.00	2,06,15,542.00	2,18,92,823.00
Capital	1,36,88,386.00	0.00	1,36,88,386.00	By Retiring Expenses	0.00	34,48,591.00	34,48,591.00
Savings Bank A/c	15,05,000.00	0.00	15,05,000.00	By Academic Expenses	16,91,669.00	22,500.00	17,14,169.00
Deposit A/c				By Expen. Services/Units	8,55,558.00	15,420.00	8,70,978.00
Capital	27,268.00	0.00	27,268.00	Ancillary to Research			
Revenue	18,407.00	5,000.00	23,407.00	By Travelling Expenses	6,91,969.00	-4,317.00	6,87,652.00
Cash in Hand	564.00	567.00	1,131.00	By Publication Expenses	86,046.00	1,53,492.00	2,39,538.00
Group Insurance Scheme	0.00	250.00	250.00	By Maintenance & Repairs	18,88,777.00	0.00	18,88,777.00
C.D.P. Account	0.00	3,054.00	3,054.00	By Contingencies	28,06,754.00	4,44,396.00	325,1,150.00
Donation Accounts	0.00	77,612.00	77,612.00	By Advances	10,52,150.00	60,300.00	11,12,450.00
To Project Accounts				By General Provident Fund	1,95,667.00	49,06,296.00	51,01,963.00
Opening Balance	4,72,099.00	0.00	4,72,099.00	By Payment of Misc.	2,10,517.00	19,89,227.00	21,99,744.00
Grants	3,21,720.00	0.00	3,21,720.00	Recoveries/GPF			
To Grants :	2,88,00,000.00	1,68,62,000.00	4,56,62,000.00	By Investment	66,50,889.00	10,428,16.00	76,93,705.00
To Donation and Endowment				By Deposit Account	1,407.00	0.00	1,407.00
Maturity				By Project Account	6,10,531.00	0.00	6,10,531.00
Interest	0.00	12,675.00	12,675.00	By Donation Account	0.00	0.00	0.00
To R & D Receipts	0.00	4,54,307.00	4,54,307.00	By Closing Cash & Bank Balances			
To Admn. Receipts	2,80,573.00	77,02,192.00	79,82,765.00	Deposit Account (C.N.R.)	26,034.00	0.00	26,034.00
To Deposit Account	5,000.00	0.00	5,000.00	Current Account (Capital)	1,31,55,540.00	0.00	1,31,55,540.00
To Interest	9,02,714.00	8,29,023.00	17,31,737.00	Deposit Account (Revenue)	22,000.00	5,000.00	27,000.00
To Misc. Income & Recovery	0.00	81,019.00	81,019.00	Group Insurance Scheme	0.00	0.00	0.00
To Other Receipts				Savings Bank Account CNR	0.00	0.00	0.00
				Current Account (Revenue)	15,40,83.00	-67,04,497.00	-65,50,414.00
				Cash in Hand	31.00	497.00	528.00
				Donation Account	0.00	93,341.00	93,341.00
				Project Accounts	1,83,288.00	0.00	1,83,288.00
Total :	4,62,25,485.00	2,60,88,604.00	7,23,14,089.00	Total :	4,62,25,485.00	2,60,88,604.00	7,23,14,089.00

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

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

Sd/-
 Suresh C. Bajpai
 (Registrar)

Sd/-
 Anshu K. Sinha
 (Director)

