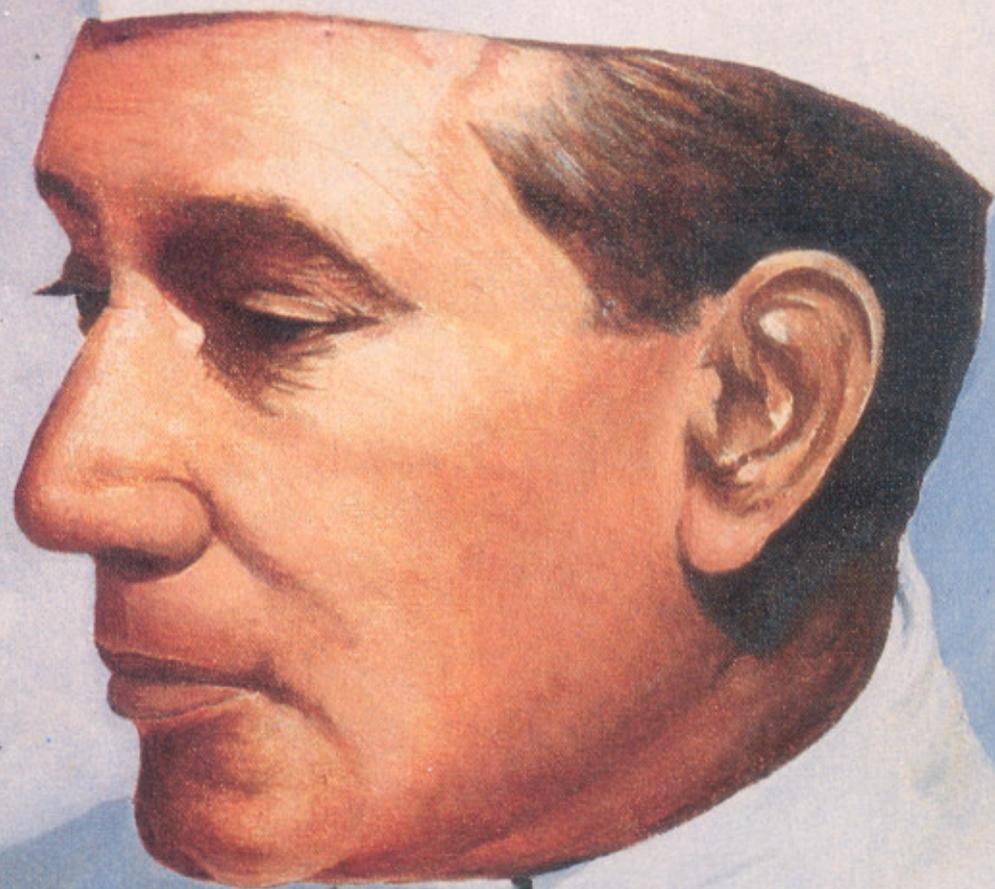


*Annual Report*

1990-91



BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY

Lucknow *V. Chala*



# ANNUAL REPORT 1990-91



**Cover portrait :** Professor Birbal Sahni (1891-1949)

**Back cover photo :** Entrance Hall of the Institute showing restoration model of *Williamsonia  
sewardiana*

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*Published by :* Birbal Sahni Institute of Palaeobotany, Lucknow

*Produced by :* J. S. Antal

*Printed at :* Kapoor Art Press, New Delhi.

## **Acknowledgement**

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

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## Foreword

THE Birbal Sahni Institute of Palaeobotany is committed to generate and disseminate data on plant fossils, both macro- and micro-fossils, and their application to solve problems of evolutionary biology and stratigraphical geology. The research activities are directed to achieve desired levels of accuracy in interpretation through pluridisciplinary approaches. In the year of Professor Birbal Sahni's Birth Centenary the Institute rededicates itself to give a concrete shape to his vision for this Institute as an international centre of excellence in palaeobotany and allied branches. The research achievements during the year 1990-1991 are summarized below.

Study of organic-walled microfossils *Bavlinella*, *Halocyrrillium*, *Anguloplana* and *Archaeobystriobosphaeridium* indicates a Vendian age for the Bhandar Group. A Leiosphaerid-Vendotaenid assemblage associated with colonial and tubular Cyanophyceae was studied from the shale bands of section of Ganurgarh Fort, Madhya Pradesh. Morphology, microfabric and microstructure of stromatolites in the sediments south-west part of Cuddapah indicate upper subtidal to middle intertidal environment of deposition. An association of digitate stromatolites with phosphorites has also been observed in these beds.

SEM studies of the irregular spots on leaf surface of certain *Noeggerathiopsis* and *Glossopteris* from Auranga Coalfield have revealed branched non-septate hyphae and fruiting bodies of fungi. Two new fructifications, a gynoclad and an androclad, have been reported from the shales associated with the Lalmatia coal-seam in the Hura Coalfield, Bihar and named as *Veekaysinghia durgavataiae* and *Birbalsabnia divyadarshanii*, respectively. A possible pteridospermous affinity has been suggested. Two new taxa of microsporangiata structures *Rotbwelleatbeca* and *Kimuratbeca* have been described from the Nidhpuri plant beds. Floristics of Gilamari locality has been detailed out. The plant beds at Gilamari in Rajmahal Hills are equated with the third intertrappean bed at Dhokuti and Chunakal localities on the basis of contained plant megafossils.

Evolutionary trends of saccate pollen and their radiation in time through Gondwana Sequence in India has been studied. The high percentage of Leiosphaeridia observed in the Talcher Formation, Godavari Graben has been taken to indicate marine influence. Additional reticulate monocolpate and colpoidate angiosperm pollen are reported from the first intertrappean bed of Rajmahal Formation.

Study of coal samples of Ramagundam area indicated the presence of both anthroxylous and attrital material constituents. Organic petrographic evolution of coals of Chuperbhita Coalfield suggests that the coals were formed under lagoonal and lower delta plain environments.

Woods from Deccan Intertrappean of Gujarat have been studied and attributed to Flacourtiaceae (*Hydnocarpus*, *Homalium*), Icacinaceae (*Gomphandra*), Euphorbiaceae and Arecaceae. Study of dicotyledonous woods from Bikaner

suggests prevalence of mesophytic conditions during the time of deposition of Late Tertiary sediments. The Makum Coalfield flora suggests the existence of a tropical evergreen forest. Fruits of *Dipterocarpus* and *Terminalia tomentosa* have been identified from the Lower-Middle Siwalik sediments exposed along Arjun Khola-Gharai Road section, Nepal.

The Neyveli Lignite sediments encountered in Jayamkondacholapuram area have been dated as Upper Palaeocene-Middle Eocene on the basis of palynofossils and a tropical climate and mangrove environment has been deduced.

Palynological investigations of profiles 2 and 3 of Siwalik sediments near Arjun Khola, Nepal indicate the presence of fresh water swampy elements, viz., *Botryococcus*, *Azolla* and *Ceratopteris*. Palynological studies on bore hole Pemba 5, Tanzania have enabled an assignment of a Miocene age to the samples studied. Palynological investigations on the bore hole CM 5 Senegal helped to identify Cretaceous-Tertiary transition sequence. Palynological data from intertrappean sequences at Padwar (near Jabalpur) on the north and at the Naskal (near Hyderabad) in the south have helped to document the latest stratigraphic record of the Indian dinosaurs and the near synchronicity of the basal basaltic flows in the central, eastern and southern sectors of the Deccan province. Palynological studies of Subathu Formation confirms a shallow marine environment of deposition.

A Late Maestrichtian calcareous nannoplankton zone (cc 26) has been recognized by the occurrence of stratigraphically significant species of *Micula*, *Archangelskiella*, *Litbrapdidites* and *Eiffellithus* which coincides well with the disappearance of marker Maestrichtian dinoflagellate cyst species *Dinogymnium accuminatum* below the clay layer in Therriaghat, Meghalaya. Basal Danian was also marked above the clay layer on the first appearance of dinoflagellate cysts species *Danaea californica*, *Carpatella cornuta* and *Kenleyia* spp. A rich diatom assemblage has been studied from south coast cliff section, Kamorta Island and two marker forms *Coscinodiscus lewisianus* and *Actinocyclus moronensis* are reported.

A biopetrological synthesis on Tertiary coals and lignites has revealed that majority of Tertiary coal and lignite seams originated from autochthonous vegetal source accumulating in rheotrophic swamps. Intermittent volcanic activity at Narcondam is indicated by the presence of fragments of fusinite in a core material representing a time span of 18,000 years to 20,000 years B.P.

Palynological investigations of modern surface samples from the Bombay Shola in Palni Hills indicated relatively higher value for arboreals. Similar investigation on the two meter deep Gola Tappar-3 profile, Dehradun indicated existence of open-grassland in the region. Pollen analysis of a profile from Khichipiri lake suggested dominance of *Quercus-Alnus-Betula*, *Pinus-Betula-Carpinus* association depicting warm temperate climate in the region around 3000 years B.P. Palynological investigations of Rambha Profile have shown that the southern flank of Chilka Lake was more under fresh water influence with periodical intermixing of sea water.

Seeds and fruits of crops, weeds and other wild taxa collected from Senuwar (Circa 2000-600 B.C.), district Rohtas, Bihar have been studied. Investigations on wood charcoal samples, Harappan site, Shikarpur, Rann of Kutch suggest prevalence of arid conditions during Harappan times.

Shells in coastal deposits at Idythra, Karnataka were dated by radiocarbon method to 6,400 years. Radiocarbon dating of archaeobotanical samples from different cultural horizons at Senuwar, Rohtas have firmly established chronology of the settlement (2,000 BC to 60 BC). F-T dating of glauconitic sandstone samples from three areas around Sidhi, Madhya Pradesh suggested  $1110 \pm 190$  Ma,  $1100 \pm 235$  Ma (Koludih area),  $1135 \pm 230$  Ma,  $1145 \pm 205$  Ma (Hatwa area) and  $1140 \pm 225$  Ma (Garua area) ages and it indicates that these belong to the same bed.

The Research Programming and Planning Group consisting of Drs H. P. Singh, K. P. Jain, H. K. Maheshwari and R. S. Tiwari helped to prepare this document. Dr A. Rajanikanth rendered considerable help in bringing out this report. The printing of the report has been looked after by Dr J. S. Antal.



B. S. VENKATACHALA  
*Director*



## Research

### Projects and Programmes

PROJECT 1 : ANTIQUITY, RADIATION AND EVOLUTIONARY PATTERNS OF EARLY LIFE

**Programme 1.1 : Palaeobiology of Vindhyan Basin**

- Objective*
- : To identify metaphyte and metazoan body fossils, ichnofossils and their relics from the Proterozoic succession and their evolution and diversification
  - : To identify organo-sedimentary structures found in association of metaphytes and metazoans and to decipher environmental conditions
  - : To determine the significance of metaphytes and metazoans in biostratigraphy

Studied thin-sections of Dholpura Shale, Balwan Limestone, Sirbu Shale and Lakheri Limestone formations. Recorded *Archaeotrichion*, the simple non-septate twisted thread-like filaments and *Orygmato-sphaeridium* in the chert samples of Nagod Limestone; *Baulinella*, an endosporulating cyanobacteria indicating adverse climatic conditions and *Halocyrrillium* in Sirbu Shale, *Anguloplanina* and *Melanocyrrillium* in the Balwan Limestone and *Archaeobystrichosphaeridium* in the Dholpura Shale. The presence of Vendian marker OWM, viz., *Baulinella*, *Halocyrrillium*, *Anguloplanina* and *Archaeobystrichosphaeridium* support Vendian age for the Bhandar Group.

P. K. Maithy

Leiosphaeridia-Vendotaenid assemblage in association with colonial and tubularcyanophyceae have been recovered from the shale bands exposed in the section of Ganurgarh Fort, Madhya Pradesh. Acritarchs are characterised by their large size. The marker forms are *Trachysphaeridium*, *Lophosphaeridium*, *Nucellosphaeridium* and *Cymatosphaeridium*. Besides, the Vendian marker *Polytrichoides* is found which shows several tubes entangled together in cylindrical mass.

Stromatolites exposed around Balwan were studied. *Jurusania* is recognised.

P. K. Maithy and Rupendra Babu

Prepared samples of Suket Shale to study the evidences of metaphytes and metazoans.

K. L. Meena

**Programme 1.2 : Palaeobiology of the Proterozoic sediments in Cuddapah, Kaladgi and Bhima-basins**



Columnar stromatolite from Vempalle Formation, Cuddapah Supergroup exposed near Velpula, Andhra Pradesh.

*Objective* : To record distribution of Precambrian microfossils in Proterozoic succession of Cuddapah, Kaladgi and Bhima basins

Field work in the south western part of Cuddapah Basin was undertaken. Traverses to the Kadiri, Pulivendla, Karnapapayapalli, Kottalu, Rangapur, Iptala, Vempalle and Velpula hillocks have been completed. Varied types of columnar, branching, domal and digitate stromatolitic bioherms have been noticed. Associated sedimentary structures coupled with the microfabric and texture study of stromatolites revealed their growth in upper subtidal to middle intertidal zone. Digitate stromatolites are characteristically found in those beds which are known for their high phosphorite content. The fossiliferous cherts are invariably associated with stromatolites. The cherts associated with Cuddapah stromatolites show presence of solitary spheroidal microfossils ranging in size from 5-50  $\mu\text{m}$  with an average of 11  $\mu\text{m}$ . Detailed study after serial sectioning, reconstruction and photography are under progress.

Manoj Shukla and Mukund Sharma

PROJECT 2 : GONDWANA COAL AND ASSOCIATED SEDIMENTS : GENESIS, FLORAL EVOLUTION AND BIOSTRATIGRAPHY

**Programme 2.1 : Morphotaxonomy, floristics, evolution and stratigraphic significance of plant fossils in Koel Valley and Jharia Coalfields**

- Objective* :
- : To collect plant fossils from different localities
  - : To study morphotaxonomy, evolution, stratigraphical distribution of the flora and its significance
  - : To decipher ecological and climatological regimes

Investigation of plant fossils from the Jagaldagga and Murup areas of Aûranga Coalfield was carried out. The assemblage comprising 5 species of *Glossopteris*, 2 species of *Gangamopteris* and 1 species of *Noeggerathiopsis* shows affinity with the known flora of the Lower Barakar Formation.

Some specimens of *Noeggerathiopsis* and *Glossopteris* show small, rounded to oval spots, distributed irregularly over the leaf surface. Under the scanning electron microscope, these spots show branched, non-septate hyphae and fruiting bodies of fungi.

A. K. Srivastava

Investigation of plant fossils from the Raniganj Formation of Jharia Coalfield was partly completed. Following taxa have been identified—*Schizoneura*, *Trizygia*, *Glossopteris angustifolia*, *G. formosa*, *G. sbailae*, *G. retusa*, *G. browniana*, *G. communis*, *G. gondwanensis*, *G. conspicua*, *G. intermedia* and *Plumsteadia* sp.

Rajni Tewari

**Programme 2.2 : Comparative morphology, floristics, biostratigraphy and palaeoecology of Permian Gondwana plants in Son-Mahanadi Graben**

- Objective* :
- : To study morphotaxonomy, floristics, biostratigraphy and palaeoclimate of the Permian Gondwana formations in the area
  - : To study fructifications in order to understand the evolutionary aspect of pteridophytes and gymnosperms
  - : To establish palaeobotanical succession in the Singrauli Coalfield area

Study of Talchir plant fossils exposed in a section of Brahmani River near Soranga Village, Dhenkanal District, Orissa was completed. Insect wings and annelid/worm remains have also been discovered in the oldest Gondwana sequence.

Shaila Chandra and K. J. Singh

Elongated trails with a median ridge and transversely striated furrows are recorded from the lowermost sequence of Indian Gondwana.



Trace fossil, *Talchirichnus gondwanensis* ( $\times 4$ ) from Talcher Coalfield, Orissa.

Traces probably representing the crawling or locomotion behaviour of animals have been assigned to a new ichnogenus—*Talchirichnus*. The findings support fluvio-lacustrine mode of deposition.

A. K. Srivastava, Shaila Chandra and K. J. Singh

**Programme 2.3 : Evolutionary perspective of megafloreal diversification in the Nidpur plant bed**

*Objective*

- : To carry out fine resolution, morphotaxonomical investigations and decipher affinities and inter-relation of different plant organs
- : To attempt whole plant reconstructions

Two taxa of microsporangiate organ, namely *Rothwelleatbeca* and the basis of *Kimuratbeca* have been identified on their microspore contents.

*Rothwelleatbeca* bears monolete spores which are somewhat identical to *Laevigatosporites* type of spores. These spores have medullosan characters. Such type

of microspores are known as prepollen. In bearing prepollen, *Rothwellatbeca* comes closer to pollen organ *Dolerotbeca*.

*Kimuratbeca* bearing nonstriate-bisaccate pollen have shown the various stages of development as evidenced by mature and immature pollen grains in a single sporangium. The pollen contents have closer resemblance with that of *Alisporites* complex recovered from Nidpur Shale. This further depicts that the fertile organ possessing *Kimuratbeca* type sporangia must have had affiliation with conifers.

Shyam C. Srivastava and S. R. Manik

#### Programme 2.4 : Palynostratigraphy of Gondwana Sequence in Son-Mahanadi Graben

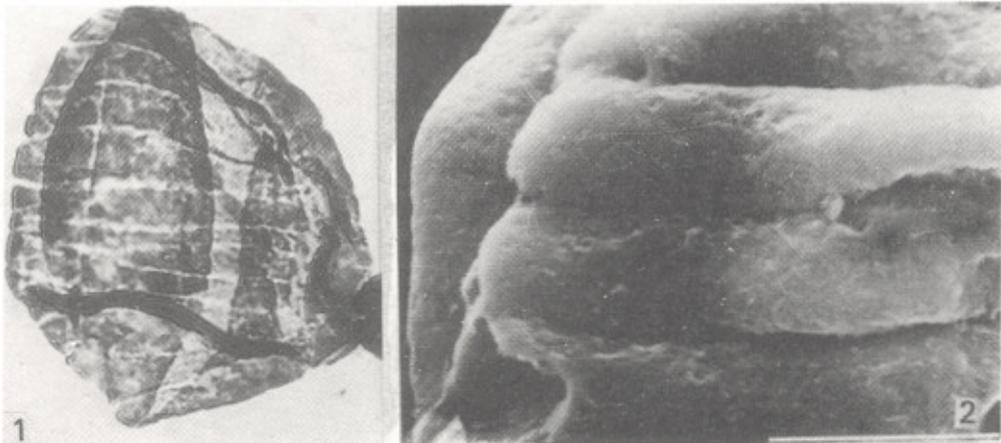
##### Objective

- : To systematically collect samples and to analyse palynoassemblages with a view to interpret floral changes, boundary transitions and age determination at a finer level in the intraformational succession of Jobilla Coalfield
- : To identify Talchir/Atbgarh relationship in the Talcher Coalfield and Atbgarh Basin

Palynological study of Middle Pali sediments in Bore-hole SPB-17 in Sohagpur Coalfield shows a closer relationship with palyno-assemblages of the Raniganj Formation. Palynofossils recovered from Bore-hole SKNB-3, Sohagpur Coalfield show a succession of Talchir, Karharbari, Barakar and Barren Measures (Lower Pali) palynozones.

R. Ram-Awatar

Palynological investigation of a section in Madalia River section near Patrapara Village, has revealed a striate-disaccate rich palynoflora. A Late Permian Raniganj



A striate pollen of *Trabculosporites* showing transitional stage of striation, simulating taeniate pattern; 1, pollen under light microscope,  $\times 750$ ; 2, a portion magnified under SEM (scale = 10  $\mu\text{m}$ ).

level is thus established. This indicates a probable presence of Raniganj sequence in the subsurface which could be promising for coal deposits.

R. S. Tiwari, Archana Tripathi and B. N. Jana

For palynodating of the subsurface strata in the area of western Talcher Coalfield, Bore-hole TCW-24 has been undertaken for analysis. The presence of Upper Permian palynoflora is indicated in the upper reaches of the bore core; this reveals the presence of strata which equates to the Raniganj Formation of Damodar Valley. No such horizon was known in the area of study earlier.

B. N. Jana



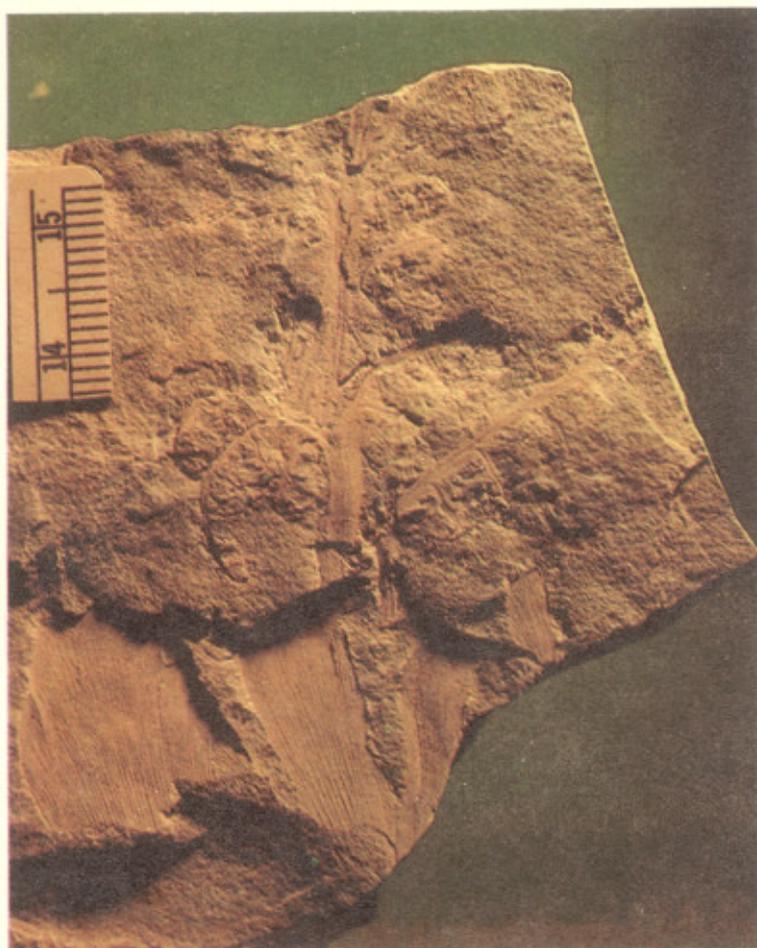
*Veekaysingbia durgavataiae*, a gynoclad from the Permian Gondwana of the Hura Coalfield, Rajmahal Hills.

A new area in Mand-Raigarh Coalfield is being explored for coal deposits by G.S.I. In order to build the palynological succession for dating of various horizons, bore-hole RGP-7 has been taken up for analysis. Upper Permian palynofossils have been recorded in the samples studied so far.

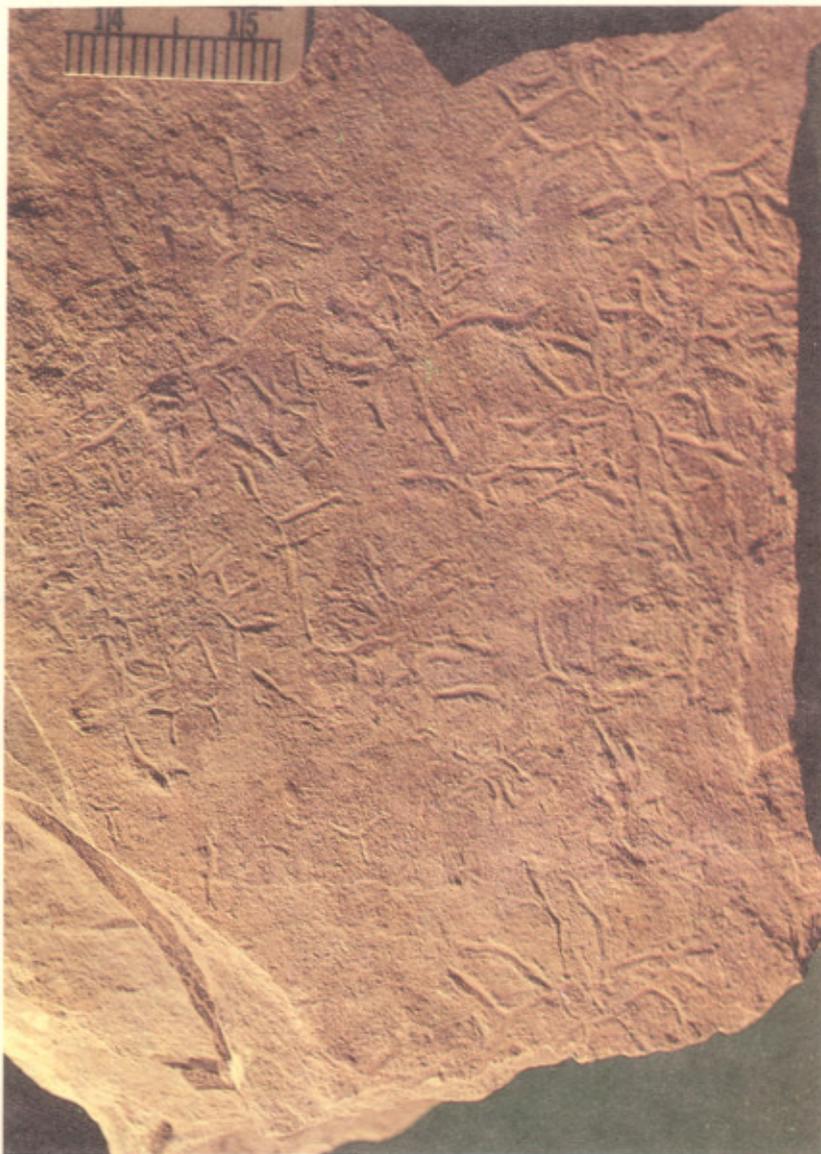
Kindu L. Meena

**Programme 2.5 : Morphology of Gondwana plants and ultrastructure of megaspores, seeds and *in-situ* pollen/spores**

*Objective : To make extensive and exhaustive collections of leaf specimens of Gondwana gymnosperms, study their morphology, make cuticular preparations, establish relationship between morphology and epidermal features. Objectively identify each species, based*



*Birbalsabnia divyadarshanii*, an androclad from the Permian Gondwana of the Hura Coalfield, Rajmahal Hills.



Trace fossil from the Permian Gondwana of the Hura Coalfield, Rajmahal Hills.

*on cuticles of extant gymnosperms, ultrastructure of in-situ pollen/spores for fine resolution taxonomy and affinities*

Two new fructifications, a gynoclad and an androclad have been investigated from shales associated with the Lalmatia coal-seam in the Hura Coalfield, Bihar. The seed-bearing axes, placed under a new taxon *Veekaysinghia durgavatiiae* gen. et sp. nov., are dichotomously branched a few times and bear compactly arranged orthotropous ovules/seeds on alternate branches in a very characteristic manner, i.e.,

the ovules/seeds are apparently only on one side of the axis. The pollen-sac-bearing axis, *Birbalsabnia divyadarshanii* gen. et sp. nov., is also partly built on similar pattern except that the branches seem to be foliose. These fructifications do not compare with any of the known glossopterid fructifications; pteridospermous affinities are suspected.

Usha Bajpai and H. K. Maheshwari

**Programme 2.6 : Pattern of evolving palynofloras through Gondwana Sequence in Damodar Graben**

*Objective* : To search for characters in dispersed spores and pollen useful for determining major changes in patterns of morphologies

In order to search evolutionary trends of saccate pollen and their radiation in time through Gondwana Sequence of India, intensive analysis of pollen morphoforms has been carried out. Radial monosaccate pollen constitute the primary stock in the pre-Permian of Australia and South America. Nested diagrams based on parsimonically derived characters establish the relationship among closely affiliated groups. The derivation and diversification of organizations have been established which indicate a course of evolution in body-saccus relationship.

Compilation of palynological data from the bore-hole samples RD-1, NCRD-6, RAD-2, RAD-4, RAD-5, RAD-11, RNM-2, RNM-3, RNM-4 has been completed. A composite diagram has been attempted to illustrate the inter-relationship among different palynoassemblages. A continuity in Raniganj-Panchet palynological sequence is seen.

Vijaya

**Programme 2.7 : Composition, relationship and age of the mega-fossil flora of Rajmahal Formation**

*Objective* : To study morphotaxonomy of fossils collected from various intertrappean beds

: To work out composition of flora in order to arrange different plant beds in a chronological sequence and to correlate with other coeval floras

: To reconstruct whole plants based on comparative studies of different plant organs

Following taxa have been recorded from Gilamari locality: *Equisetites* sp., *Cladophlebis denticulata*, *Ptilophyllum cutchense*, *P. acutifolium*, *?Dictyozamites* sp., *Williamsonia* sp., *Taeniopteris* sp., *Brachyphyllum rhombicum*, *Elatocladus* sp. and *Araucarites* sp. In the assemblage, similarity and dominance of cycadophytes have been observed. This bed may be equated with the 3rd intertrappean bed of Dhaukuti and Chunakhal localities of Rajmahal Hills, Bihar.

On the basis of earlier record of branched stem of *Bucklandia* by Bose (1953) and Sharma (1967), it is suggested that probably the *Bucklandia* stem had a branching habit rather than columnar stem as proposed by Sahni (1932) Moreover,

the laterally attached *Williamsonia* flower to a narrow branch further suggests that perhaps these plants were arborescent and profusely branched.

Jayasri Banerji

Fossil plants belonging to *Gleichenites*, *Ptilophyllum*, *Pterophyllum* and *Elatocladus* from Dhokuti locality have been identified. Detailed morphotaxonomic study of *Gleichenites gleichenoides* and *Ptilophyllum cutchense* has been done.

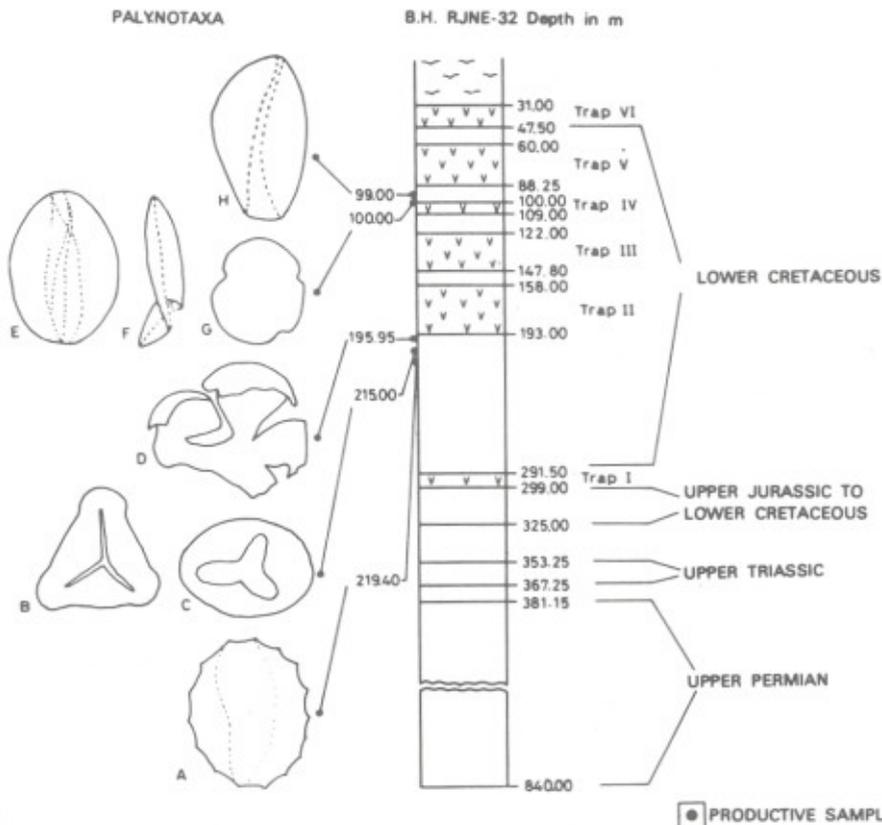
Neeru Prakash

Sectioning of *Nipania* chert blocks has revealed the occurrence of a variety of plant remains belonging to conifers and Pentoxylaceae. Conifers are represented by *Brachyphyllum*, *Pagiophyllum*, *Elatocladus* and detached cones. *Carnoconites* cones attached to an axis have also been found.

Shyam C. Srivastava and S. R. Manik

### Programme 2.8 : Palynological diversity and palaeoclimate through Gondwana Sequence in Rajmahal Basin

Objective : To study selected horizons, mainly from bore-cores to



Lithology of Bore-hole RJNE-32 showing the depth levels of various traps and productive samples containing angiospermous pollen. A, *Retimonocolpites peroreticulatus*; B, Type A; C, Aff. *Clavatipollenites* sp. 1; D, Type B; E, *Retimonocolpites* sp.; F, *Liliacidites* sp.; G, Cf. *Stephanocolpites* sp.; H, Cf. *Stellatopollis* sp.

fill the existing lacunae in the data for building a complete sequence

- : To tag results with other data, such as megafloreal and sedimentological information and geological set-up
- : To determine age and palaeoclimatic condition as depicted by spore and pollen patterns

In the north-western part of Rajmahal Basin, a palynological succession ranging from Permian to Early Cretaceous has been worked out. The palynoflora reveals that the angiospermous pollen first appeared in the first intertrappean bed. The forms assigned to *Retimonocolpites perireticulatus*, aff. *Clavatipollenites* sp., cf. *Retimonocolpites* sp., *Liliacidites* sp. and cf. *Stephanocolpites* sp. are associated with a typical Early Cretaceous palynoassemblage and are the oldest record of reticulate monocolpate and colpoidate angiospermous pollen from India known so far.

Spore-pollen species range charts for Permian and Triassic assemblages for the Rajmahal Basin have been prepared.

Archana Tripathi

**Programme 2.9 : Organic petrographic evaluation of Permian coal seams from Rajmahal Basin, Bihar**

- Objective* : To assess the quality of coals for suitability in various industrial and domestic purpose with emphasis on coking and blending potentiality

Microconstituents of Chuperbhita field coals (43 samples) have been re-estimated to assess the Gelification Index (GI) and Tissue Preservation Index (TPI). Predominance of mixed coal types suggests inferior quality for selective utilization. However, coal facies resolution, in general, suggests vitric facies (wet reducing conditions) with occasional fusic facies (dry oxidative conditions). The coals seem to have been formed under lower delta plain environments.

B. D. Singh and B. K. Misra

**Programme 2.10 : Palynology of the Gondwana Sequence in Satpura Basin**

- Objective* : To study palynostratigraphy, biozonation, palaeoecology, palaeoenvironment, correlation of various strata in the central part of the basin

The Napupura section in Jatamao (Hoshangabad District) has been studied. Some characteristic spores and pollen are: *Impardecispora*, *Matonisporites dubius*, *Ischyosporites* and *Aequitriradites*. Qualitative and quantitative analyses of the palynoassemblage have been carried out.

made.

The Khardi Nadi Section (Jatamao), Hoshangabad District contains some more palynofossils: *Densoisporites*, *Triporoletes densus*, *Contignisporites glebulentus* and *Coptospora*. Quantitatively the assemblage is composed of *Calliatasporites* (30-40%), *Araucariacites* (20-25%) and *Podocarpidites* (3-6%). Palynoassemblage closely compares with those from the Umia and Jabalpur formations.

The Morghat section (Seoni-Malwa), Hoshangabad District, Satpura Basin, Madhya Pradesh records poor palynoassemblage. A few characteristic Early Cretaceous taxa have been identified as *Triporoletes densus* and *Cooksonites*. These compare with palynoassemblages of the Jabalpur and Umia formations and are assigned an Early Cretaceous age.

Pramod Kumar

**Programme 2.11 : Palynofloral patterns and boundary demarcations in Gondwana Sequence of Godavari Graben**

- Objective*
- : To standardise palynoflora from different formations of Gondwana Sequence
  - : To recognise biozones having stratigraphical significance
  - : To demarcate time boundaries with special reference to P/T boundary
  - : To decipher the nature and significance of evolution of various palynofloras

Palynostratigraphic study of samples from (bore-hole GAV-1) Amavaram area reveals that the coal seams between 29.65-41 m contain high percentage of *Schizopollis* and the presence of genera, viz., *Striasulcites*, *Densipollenites*, *Weylandites*, *Verticypollenites*, *Lunatisporites* and *Corisaccites* indicates a Late Permian affinity.

Study of (bore-core GSS-1), Sattupalli area reveals the presence of *Gondisporites*, *Falcisporites*, *Weylandites*, *Striasulcites*, *Lueckisporites*, *Corisaccites*, *Verticypollenites*, *Vitreisporites* and *Densoisporites* at 74.40-152.70 m. This palynoflora compares with the Raniganj palynoflora. A Barakar palynoflora having nonstriate-disaccate pollen occurs at 356.6 m. The Talchir palynoflora showing *Parasaccites-Plicatipollenites* occurs at 402 m.

The palynoflora in the bore-holes KYG-28 (37.50-39.70 m), Koyagudem Block and GMM-2 (491.45-576.40 m), from Mandmari area comprises chiefly non-striate disaccate pollen showing a Lower Barakar affinity.

Nine palynozones representing Talchir to Kamthi have been demarcated in bore-holes GRK-1, GRK-24 and GRK-25 from Ramakrishnapuram area.

Presence of *Leiosphaeridia* in higher percentage in Talchir Formation indicates marine influence.

The palynoflora of bore-hole GAG-1 (539-605 m), Ayyanapalli Gompana block shows the presence of monosaccate pollen. Presence of *Gangamopteris* leaf impressions has been observed in a core sample. The assemblage shows affinity with the Talchir palynoflora.

Suresh C. Srivastava and Neerja Jha

**Programme 2.12 : Organic petrographic evaluation of coals from Godavari Basin**

*Objective* : *To assess the rank and quality of coal from Mailaram and other areas*

Coal samples collected from Ramagundam and Bhopalpalli areas were processed for organic petrological studies. 51 coal samples so far examined from Ramagundam area revealed the presence of both anthroxylous and attrital material constituents. The preliminary examination of these samples showed that they are by and large composed of dull-coal constituents.

Similarly 30 coal pellets examined from Mulug coal belt revealed that they are also composed of dull coal constituents. The relative distribution of individual microconstituents from both are in progress. Simultaneously the degrees of maturation of these coals is being examined by reflectance analysis.

O. S. Sarate

**Programme 2.13** : **Organic petrographic evaluation of coal seams from Talcher Coalfield**

*Objective* : *To assess quality of coals for coking property and other industrial applications*

The programme of work was postponed because the proposed field work could not be undertaken due to the political disturbances during October-November, 1990 and acute shortage of petrol/diesel during Gulf war.

Anand Prakash and Rakesh Saxena

PROJECT 3 : CENOZOIC PLANT BIOGEOGRAPHY OF PENINSULAR INDIA

**Programme 3.1** : **Floristics and plant megafossil biostratigraphy of the Deccan Intertrappean sediments**

*Objective* : *To study and understand the Deccan Intertrappean fossils*

: *To determine their age for reconstruction of vegetational history, phytogeography of Peninsular India*

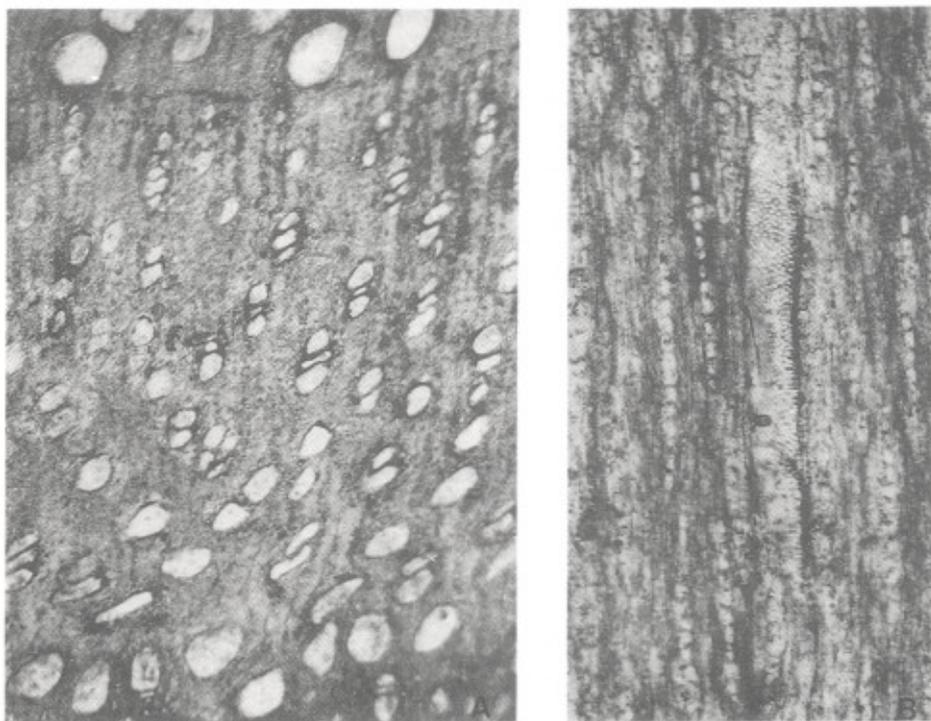
Slides prepared from about 50 fossil woods from the localities around Nawargaon, Wardha District, Maharashtra were studied. Twelve new taxa have been identified and tentatively assigned to the families Meliaceae, Apocynaceae, Myristicaceae, Irvingiaceae, Simaroubaceae, Sapindaceae, Burseraceae, Moraceae, Tiliaceae, Erythroxylaceae, etc.

M. B. Bande

**Programme 3.2** : **Studies on the Tertiary floras of Western India**

*Objective* : *To build up floristic history and phytogeography of western India*

About 75 fossil woods from the Deccan Intertrappean of Kutch Basin and Late Tertiary of Bikaner area were studied. The Intertrappean woods have been identified with those of Flacourtiaceae (*Hydnocarpus*, *Homalium*), Icacinaceae (*Gomphandra*), Euphorbiaceae and Arecaceae. These form the first record of



Fossil wood of *Zizybus oxyphylla* Edgw. from the Mar Formation of Bikaner, Rajasthan; **A.** transverse section  $\times 35$ ; **B.** transverse longitudinal section  $\times 90$ .

Intertrappean woods from Gujarat. Most of the woods studied from Bikaner belong to the genus *Lagerstroemia* of Lythraceae.

The dicotyledonous woods from Bikaner indicate more humid conditions during the deposition of Late Tertiary sediments as compared to the present day desertic climate around Bikaner.

J. S. Guleria

**Programme 3.3 : Palynostratigraphy and Palaeofloristics of the Mesozoic-Tertiary Sediments in Rajasthan Basin**

*Objective* : To establish palynological succession in the Cretaceous-Tertiary sequences

: To deduce palaeoenvironment

Fifty two samples from bore-hole No. MK 322, Kapurdi District, Barmer, Rajasthan have yielded Palaeocene-Eocene palynological assemblages. Significant forms present in this sequence are: *Dandotiaspora dilata*, *Proxapertites microreticulatus*, *Lakiapollis assamicus*, *Tricolpites* sp., *Tricolporopollis rubra* and *Matanomadbiasulcites giganticus*. Lower part of this sequence shows dominance of *Dandotiaspora* whereas, the middle part is very rich in tricolporate pollen grains. 18 samples from bore hole No. MK 165, Kapurdi District, Barmer, Rajasthan contain forms like *Dandotiaspora*, *Proxapertites* and *Spinizonocolpites*, which suggest a Palaeocene age for the sediments studied.

S. K. M. Tripathi

**Programme 3.4 : Neogene plant megafossils of West Coast**

*Objective* : To study morphotaxonomy of plant megafossils; palaeofloristics, palaeoecology and palaeogeography

A large number of carbonised woods collected from Varkala Cliff section and Kundara and Payangadi clay mines, Kerala Coast were studied from their microtome sections and from polished sections under reflected light. The genera identified as new to the area are *Shorea* (Dipterocarpaceae), *Anisophyllea* and *Carallia* (Rhizophoraceae).

Rashmi Srivastava

**Programme 3.5 : Palynological investigation of the Tertiary sediments of Kerala Basin with reference to their biostratigraphy, palaeoecology and age**

*Objective* : To study morphotaxonomy of spore-pollen from the measured sections of Quilon and Warkalli beds  
: To establish palynostratigraphic zonation  
: To determine their correlative value  
: To determine the palaeoclimate and environment of deposition prevailing at the time of sedimentation

Palynological investigation of samples collected from Kundra-Kannanur road section shows the presence of important genera, viz., *Lygodiumsporites*, *Intrapunctisporites*, *Crassoretitrites*, *Polypodiisporites*, *Quilonipollenites*, *Lakiapollis*, *Tricolporopollis*, *Meliapollis*, *Margocolporites*, *Myricipites*, *Ctenolophonidites* and *Malvacearumpollis*.

M. R. Rao

**Programme 3.6 : Tertiary megafossils from Neyveli Lignite, Tamil Nadu**

*Objective* : To study morphotaxonomy of Tertiary megafossils from Neyveli Lignite and relate them with extant plants  
: To deduce palaeoenvironmental, palaeoecological and phytogeographical information

Carbonised woods found associated with Neyveli Lignite have been investigated. A tiliaceous wood, possibly belonging to the genus *Grewia*, has been identified in the area.

Anil Agarwal

**Programme 3.7 : Palynostratigraphic investigations of the Neyveli Formation and its relationship with other lignite bearing formations of south India**

*Objective* : To study palynoflora from the Neyveli Formation of south Arcot District, Tamil Nadu

- : To find out relationship of the Neyveli Formation with other lignite bearing formations, if any
- : To trace lateral continuity of the biozones established in Jayamkondacholapuram area
- : To deduce palaeoclimate and environment of deposition
- : To solve the controversy regarding the age of the Neyveli Lignite

Palynological study, incorporating description of palynofossils, qualitative and quantitative analyses, palaeoclimate, environment of deposition, correlation and age of the Neyveli Formation encountered in Jayamkondacholapuram area has been completed. The assemblage consists of 12 genera and 25 species of fungal remains, 12 genera and 19 species of spores and 45 genera and 86 species of angiosperm pollen. The taxa represent the following families Cyatheaceae, Osmundaceae, Polypodiaceae, Gleicheniaceae, Schizaeaceae, Arecaceae, Potamogetonaceae, Liliaceae, Meliaceae, Brassicaceae, Gunneraceae, Araliaceae, Oleaceae, Rubiaceae, Caesalpiniaceae, Bombacaceae, Rhizophoraceae, Sapotaceae, Myricaceae, Alangiaceae, Ericaceae, Hippocrateaceae, Betulaceae, Ctenolophonaceae and Onagraceae. A tropical climate with plenty of rainfall and back mangrove environment of deposition has been deduced. The Neyveli Formation is divisible into three cenozones, viz., *Neocouperipollis* spp. Cenozone, *Triangulorites bellus* Cenozone and *Trilatiporites sellngii* Cenozone, which are closely comparable with the Late Palaeocene-Middle Eocene palynozones/palynofloras from Kutch (Gujarat), Rajasthan, Bengal Basin, Garo Hills, Khasi Hills, Jaintia Hills (Meghalaya) and Cauvery Basin (Tamil Nadu) and therefore an Upper Palaeocene to Middle Eocene age has been confirmed for the Neyveli Formation.

R. K. Saxena

**Programme 3.8 : Organic petrological study of Rajasthan lignites**

- Objective*
- : To carry out petrological evaluation of Rajasthan lignites
  - : To prepare basinal models showing deposition of lignite beds and their coalification trends

The programme of work was postponed because the proposed field work could not be undertaken due to the political disturbances during October-November, 1990 and acute shortage of petrol/diesel during Gulf war.

Anand Prakash and Rakesh Saxena

**Programme 3.9 : Organic petrology of Kutch lignites, Gujarat**

- Objective*
- : To evaluate Panandbro lignite for various industrial uses
  - : to understand genesis of lignite and palaeoenvironmental conditions

The programme of work was postponed because the proposed field work could not be undertaken due to the non-receipt of permission from the authorities of Gujarat State Directorate of Geology and Mining, later political disturbances during October-November, 1990 and acute shortage of petrol/diesel during Gulf war.

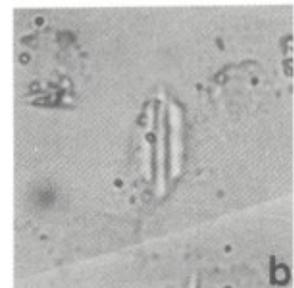
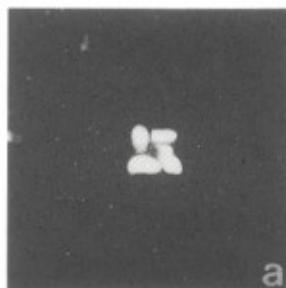
G. K. B. Navale, B. K. Misra and Alpana Singh

PROJECT 4 : PHYTOPLANKTON BIOSTRATIGRAPHY OF MARINE SEDIMENTARIES OF INDIA

**Programme 4.1** : **Phytoplankton biostratigraphy of Cretaceous-Palaeogene sequences of south Shillong Plateau, Meghalaya with emphasis on time boundaries and palaeoceanography**

- Objective*
- : To document lithological succession and facies variations in outcrop areas
  - : To study dinocyst morphology and biostratigraphy and to document phytoplankton rich levels
  - : To integrate dinocyst, calcareous plankton and palaeontological data for stratigraphic precision
  - : To carry out palynofacies and organic petrographic studies
  - : To carry out oxygen isotope and geochemical studies across K/T boundary
  - : To attempt palaeoceanographic interpretations

Analysis of dinoflagellate cysts and calcareous nannoplanktons from 5 cm interval samples collected across the Iridium rich clay layers in Therriaghat section has generated significant data to resolve the K/T boundary in the area, permitting direct correlation with planktonic foraminifera and geochemical data. Late Maestrichtian calcareous nannoplankton zone (CC26) has been recognised by the abundance of stratigraphically significant species of *Micula*, *Achangelskiella*, *Litbraphidites* and *Eiffellithus* which coincides well with the disappearance of marker Maestrichtian dinoflagellate cyst species *Dinogymnium acumminatum* below the clay layer. The basal Danian has been marked above the clay layer on the first appearance of dinoflagellate cyst species *Danaea californica*, *Carpatella cornuta*



Calcareous nannoplankton from Late Maestrichtian, Umshorengkew River section, Meghalaya; **a**, *Micula murus* (Martini) Bukry 1973, Zonal marker (cc 26 Zone); **b**, *Litbraphidites quadratus* Bramlette & Martini 1964.

and *Kenleyia* spp. alongwith rare presence of nannoplankton taxa, viz., *Thoracosphaera* and *Braarudosphaera*.

K. P. Jain, Rahul Garg and Khowaja Ateequzzaman

**Programme 4.2 : Cretaceous phytoplankton biostratigraphy and palaeoceanographic set up of East Coast petroliferous basins**

- Objective*
- : *To document lithological succession in outcrop areas*
  - : *To study dinocyst morphology, taxonomy and biostratigraphy*
  - : *To integrate phytoplankton data with palaeontological and sedimentological data*
  - : *To carry out palynofacies study, document plankton-rich levels*
  - : *To carry out stable carbon isotope (C) and organic petrographic studies*
  - : *To attempt palaeoceanography modelling*

A palynological assemblage has been recovered from a subsurface sedimentary sequence of Mahanadi Basin, underlying the volcanics (Rajmahal Trap). The assemblage as a whole indicates Early Cretaceous (Neocomian) aspect.

K. P. Jain, Rahul Garg and Khowaja-Ateequzzaman

**Programme 4.3 : Neogene calcareous nannoplankton Palaeoceanography of Andaman and Nicobar Islands**

- Objective*
- : *To compare Neogene calcareous nannoplankton assemblage of Andaman and Nicobar Islands with that known from nearshore and high latitude and to select cosmopolitan markers*
  - : *To integrate calcareous nannoplankton and planktonic foraminiferal zonations to improve dating resolution*
  - : *To record palaeoenvironmental events with special reference to Antarctica glaciation event based on plankton assemblage backed by stable isotope and organic data*

Index cards of calcareous nannofossils and geological material published from Neogene of Andaman and Nicobar Islands were completed.

S. A. Jafar and Jyotsana Rai

**Programme 4.4 : Late Cenozoic diatom biostratigraphy of Andaman and Nicobar Islands**

- Objective*
- : *To study morphology and taxonomy of diatom and silicoflagellate taxa from Late Cenozoic surface and sub-*



*Coscinodiscus marginatus* Ehrenberg from Kamorta, Andaman and Nicobar islands.

*surface sections (type locality/reference sections) of  
Andaman Nicobar Islands*

- : *To establish biozonation for age determination and correlation with geologically synchronous beds*
- : *To interpret palaeoenvironment, palaeogeography and time boundaries*
- : *To integrate the diatom biostratigraphy with the established foraminiferal biozones and isotope study*

A rich diatom assemblage has been recovered from South Coast Cliff section (75 m thick), Kamorta Island. Some significant taxa identified in the assemblage are, viz., *Coscinodiscus*, *Actinocyclus*, *Craspedodiscus*, *Arachnoidiscus*, *Asterolampra*, *Azpeitia*, *Rhaphoneis*, *Rossiella*, *Triceratium*, *Endictya*, *Gephyria*, *Tbalassiosira*, *Campyloneis*, *Mastogolia* and *Grammatophora*. Two stratigraphically significant species, viz., *Coscinodiscus lewisianus* and *Actinocyclus moronensis* are reported

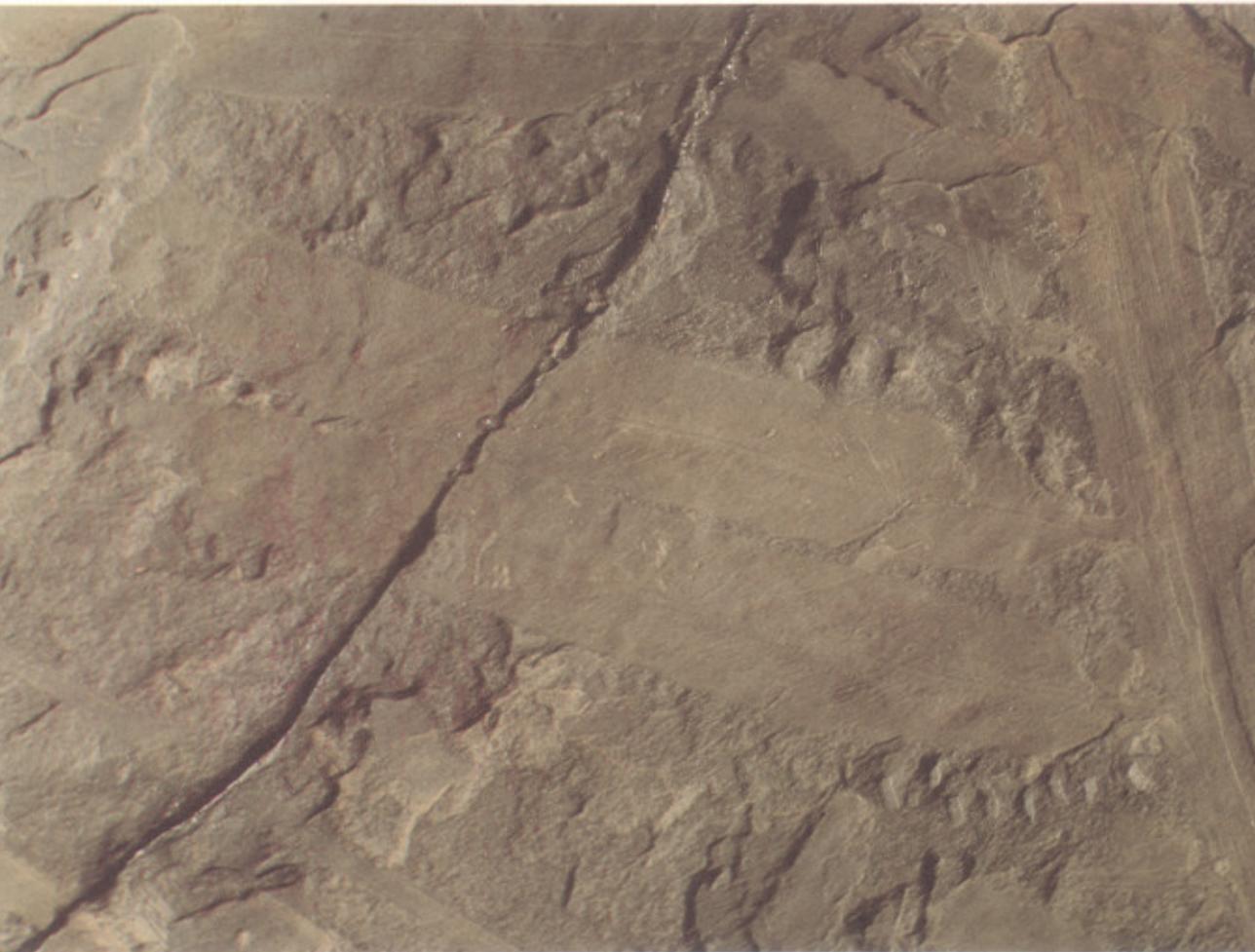
representing the NTD 6 and NTD 9 zones of low latitude which correlate well with the same zones identified from North coast and Champin Jetty section of Nancowry Island.

Anil Chandra

PROJECT 5 : PALAEOFLORISTIC DIVERSIFICATION IN THE HIMALAYA

**Programme 5.1 : Palaeozoic flora of Kashmir region: Biozonation, affinities and biogeography**

*Objective* : To make extensive collections of plant fossils from the peri-Gondwana stratigraphical sequences, their identification and comparison with Gondwana, Cathaysian and Angaran elements to trace their origin



*Kasbmiropteris meyenii* Kapoor ex Kapoor, Maheshwari & Bajpai from the Mamal Formation, Kashmir.

The nomenclature status of *Kashmiropteris meyenii* Kapoor 1969 has been formalised by giving a diagnosis and assigning types as obligatory under the provisions of the International Code of Botanical Nomenclature. The taxon though compares in gross morphology with *Protoblechnum* (*Comsopteris*) *wongii*, known from Cathaysian and Angaran assemblages, yet differs in details. It has an apparent resemblance with the leaves of extant *Cycas* and *Stangeria*. The complete leaf has been reconstructed from the three available specimens.

A specimen of an almost complete insect has also been studied.

H. K. Maheshwari, Usha Bajpai and H. M. Kapoor (Emeritus Scientist)

**Programme 5.2 : Palynofloras of the Tethyan sediments of the Himalaya, their provenance and regional relationship**

*Objective* : To search palynofossils in the well dated sequence of Palaeozoic and Mesozoic sediments of Niti (Spiti), Malla Jobar (Kumaon) and Kashmir (Guryul ravine and Pahalgaon)

Certain closely comparable palynofossils do occur in the Permian and Triassic of Gondwanaland as well as China. In order to determine the pattern of their occurrence and probable causes of such wide distribution of related morphologies, a thorough analysis of available data as well as study of certain material was done. It has been concluded after a synthesis that the spread of progenitors of forms has been effective by the calving off of the blocks from the northern part of the greater Gondwanaland and their accretion with Laurasia during Permian and Triassic.

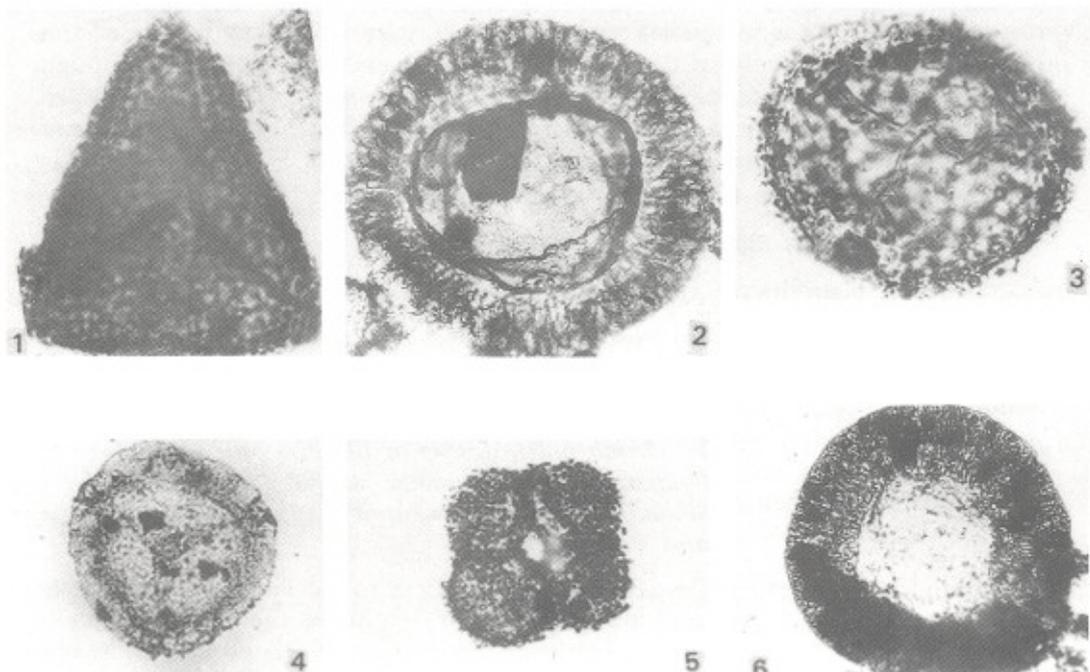
R. S. Tiwari and Vijaya

**Programme 5.3 : Palynostratigraphic studies, evaluation of rank and properties of coal and associated sediments in eastern Himalaya**

*Objective* : To correlate the palynoflora with petrography of coal and to compare with the known palynofloras from the peninsular Gondwana  
: To reconstruct marine pathways, palaeoecology and palaeoenvironment during the deposition of the Permian sediments in Siang District

Completed palynological study of samples collected in 1989 from West Siang District, Arunachal Pradesh, viz., Takso-Begi, Gensi Bigi, Gensi Tatamari, New Bomte and Bomte Takso sections. The study of coal ball and associated sediments and identification of palynofossils is continued. It was observed that the palynoassemblages recovered from coal balls as well as the associated sediments are closely related, except that in the former the zonate spores are more in frequency. In the section, two assemblages have been identified: the Rilü Member contains Talchir palynoflora while Bomte Member records Karharbari and Barakar palynofloras in succession.

Suresh C. Srivastava, Anand Prakash and A. P. Bhattacharyya



Palynomorphs recovered from a coal-ball in Garu Formation, Arunachal Pradesh suggesting an Early Permian affiliation; 1. *Pseudoreticulospora barakarensis*, 2. *Plicatipollenites indicus*, 3. *Lundbladispora* sp., 4. *Indotriradites sparsus*, 5. *Quadrisporites borridus*, 6. *Parasaccites korbaensis*.

**Programme 5.4 : Palynological history of the Tertiary sediments of Jammu area**

*Objective*

- : To study palynofossils from the Palaeocene-Miocene sediments
- : To carry out palynozonation, age determination and correlation of the assemblage
- : To develop information on phytogeography and understanding of the orogeny of Himalaya

Ninety nine Subathu samples from Dali, Sair, Khargala and Kalakot areas of Jammu were processed and an assemblage consisting of dinoflagellate cysts and pteridophytic spores was recovered. Thirty species of dinocyst taxa were identified. Some important taxa are: *Homotryblium*, *Hystrichokolpoma*, *Spiniferites* and *Achomosphaera*. Morphotaxonomic study of the recovered palynofossils is now being carried out.

H. P. Singh and Samir Sarkar

**Programme 5.6 : Neogene Himalaya: Floristics, evolutionary patterns and climate**

*Objective*

- : To undertake extensive study of fossil plants from stratigraphically dated Neogene sediments of different regions of the Himalaya



Fossil leaf of *Dipterocarpus* from the Siwalik sediments of Arjun Khola, Nepal.

: To build up the floral succession for interpreting palaeoecology, phytogeography and evolution of the Himalayan flora

Plant megafossils, mostly leaf-impressions and a few fruits, from the Lower Middle Siwalik sediments exposed along Arjun Khola-Ghorai road section, Nepal have been studied. The extant taxa identified in the assemblage are *Dipterocarpus* sp., *Shorea assamica*, *Anisoptera glabra* (Dipterocarpaceae), *Glycomis arborea* (Rutaceae), *Terminalia tomentosa*, *Terminalia chebula* (Combretaceae), *Diospyros embryopteris*, *Diospyros montana* (Ebenaceae), *Cyclostemon* (Euphorbiaceae) and *Macbilus villosa* (Lauraceae). The fruits of *Dipterocarpus* and *Terminalia tomentosa* have been identified. The assemblage indicates warm and humid climate during the deposition of the Lower and Middle Siwalik sediments.

N. Awasthi and Mahesh Prasad

#### Programme 5.7

: Palynology, palaeoecology and palaeogeography of the Tertiary sediments of Nepal Himalaya

- Objective* : To study palynofossils from the Mio-Pliocene sediments.
- : To carry out palynozonation and age determination of assemblages together with reflections on the past vegetation and environment of deposition

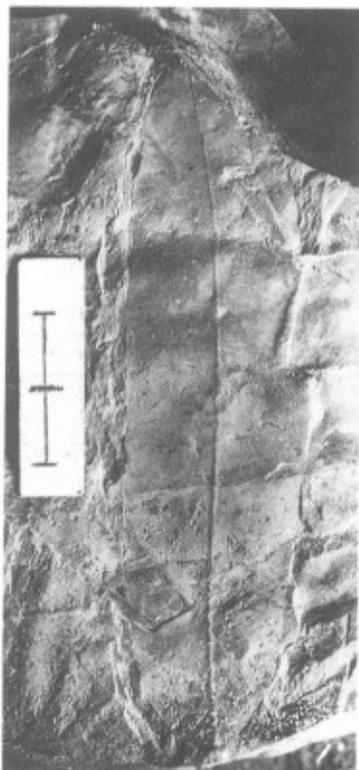
Samples from profiles 2 and 3 of Siwalik sediments near Arjun Khola in Nepal have yielded some fresh water swampy elements, viz., *Botryococcus*, *Azolla* and *Ceratopteris* as is the case in the Surai Khola assemblage. Some palynofossils have close affinity with *Botryococcus*, *Cyathea*, *Lygodium*, *Ceratopteris*, *Lycopodium* and *Polypodium*. Quantitative analysis of the Surai Khola palynoflora from Bankas, Paira Khola and Chorkhola shows a distinct change in palynofloral composition between Bankas and Paira Khola beds. Palynoassociations from different beds depict an interplay of semi-evergreen vegetational pattern during Siwalik times in the area.

Samir Sarkar

- PROJECT 6 : BIOSTRATIGRAPHY AND PALYNOFACIES OF PETROLIFEROUS BASINS OF EAST INDIA

**Programme 6.1 : Tertiary floral history of northeast India**

- Objective* : To study morphotaxonomy of megafossils from the Palaeogene and Neogene sediments of Assam, Meghalaya and Arunachal Pradesh



Fossil leaf resembling extant *Podocarpus neritifolius* from Makum Coalfield (Oligocene), Assam.

: To reconstruct Tertiary floral history, palaeoecology and phytogeography

Six of the fossil leaves collected from Makum Coalfield have been assigned to the extant genera *Parishia* (Anacardiaceae), *Saccopetalum* (Annonaceae), *Heynea* (Meliaceae), *Pterygota* (Sterculiaceae), *Memecylon* (Melastomaceae) and *Entada* (Fabaceae). Two more genera, *Podocarpus* (Podocarpaceae) and *Mesua* (Clusiaceae), have been identified. These taxa are inhabitants of the tropical evergreen forests of Asia and suggest that similar climatic conditions might have prevailed in northeast India during the deposition of Makum coals.

Nilamber Awasthi and R. C. Mehrotra

**Programme 6.2 : Palynostratigraphy of sedimentary rocks in Therriaghat Section and its correlation with Jaintia and Garo Hills sediments**

- Objective* :
- : To work out palynostratigraphy of different Tertiary formations
  - : To palynologically differentiate Langpar (Lower Palaeocene), Langpar—Lakadong (Middle Palaeocene), Lakadong—Umalatodoh—Prang (Lower-Middle Eocene), Prang—Kopili (Upper Eocene) and Kopili-Barail (Lower Oligocene) sediments
  - : To correlate the Therria assemblages with those of Jaintia and Garo Hills

The Lakadong palynological assemblage is divided into *Lycopodiumsporites speciosus* Cenozoone and *Kielmeyerapollenites syncolporatus* Cenozoone in the ascending order. *Lycopodiumsporites speciosus* Cenozoone is characterized by the presence of *Lycopodiumsporites speciosus*, *Dandotiaspora dilata*, *Dandotiaspora telonata*, *Proxapertites crassimurus* and *Neocouperipollis kutcbensis*. *Kielmeyerapollenites* has the good representation of *Kielmeyerapollenites syncolporatus*, *Dandotiaspora dilata*, *Lygodiumsporites lakiensis*, *Palmidites plicatus* and *Polymargocolporites mawlensis*.

The Prang assemblage is dominated by pteridophytic spores: the angiospermic pollen are only occasionally found. Dominant species in the assemblage are: *Todisporites kutcbensis*, *Lygodiumsporites lakiensis*, *Osmundacidites kutcbensis*, *Cyatbidites minor*, *Striatriletes susannae*, *Podocarpidites kbasiensis*, *Polypodiaceasporites chatterjii* and *Polypodiisporites repandus*. The angiospermous pollen are represented by *Lakiapollis ovatus* and *Pellicieripollis langenbeimii*.

R. K. Kar

**Programme 6.3 : Palynostratigraphy of Tura Formation (Palaeocene), Garo Hills, Meghalaya**

- Objective* :
- : To establish significance of the palynoflora in biostratigraphic zonation, correlation and dating
  - : To study palynofloras recovered from selected sections in order to recognise their ecological importance and to trace evolutionary lineage

: To deduce palaeoclimate and depositional environment prevalent at the time of deposition

The palynological assemblage recovered from Simsangiri is dominated by *Dandotiaspora telonata*, *Dandotiaspora dilata*, *Matanomadbiasulcites maximus*, *Spinizonocolpites echinatus*, *Lakiapollis ovatus* and *Kielmeyerapollenites eocenicus*. On the basis of palynological assemblage it was deduced that Simsangiri coal seam exposed near Simsang Village is a lateral extension of the Nangwal Bibra middle coal seam.

Occurrence of vicin threads was recorded in the extant palm pollen of *Daemonorops ruber* under scanning electron microscope.

K. Ambwani

**Programme 6.4 : Palynological investigation of the Tertiary sediments of Jaintia and Cachar Hills**

*Objective* : To study morphotaxonomy and affinity of palynofossils

: To select ecologically and stratigraphically important palynotaxa for biostratigraphic zonation, correlation and dating

: To infer palaeoclimate and environment of deposition of the sediments

Samples from Disang (Eocene) exposed along Silchar-Halflong road are poor in palynological contents. Pteridophytic spores mainly consist of *Striatriletes* and *Polypodiaceasporites*. *Tricolpites crassireticulatus* along with others represents the angiosperms.

The affinity of a few tricolporate reticulate pollen was established with the pollen of modern *Calophyllum*.

J. P. Mandal

**Programme 6.5 : Palynological studies of Khasi (Upper Cretaceous) and Garo (Late Tertiary) groups in the South-Shillong front, Meghalaya**

*Objective* : To collect and process samples for quantitative and qualitative analyses of the palynofloras

: To establish palynological zonation for correlation and dating of each unit of rocks

: To infer palaeoclimate and depositional environment

: To study extant pollen and spores for comparison with extinct spore and pollen

From the Cretaceous sediments of Meghalaya a poor yield of palynofossils is recorded; following taxa are identified, viz., *Araucariacites*, *Densoisporites*, *Cicatricosisporites*, *Appendicisporites*, *Klukisporites*, *Coptospora*, *Contignisporites*, *Minerisporites*, *Ariadnaesporites*, *Azolla* along with some angiospermid pollen.

R. S. Singh and A. Rajanikanth

Samples from Baghmara Formation are found to be palynologically rich, while samples from Simsang and Chengapara formations are poor in fossil content. A preliminary investigation shows that the Simsang and Baghmara formations are characterised by *Biretisporites oligocenicus* and *Dictyophyllidites indicus*. The palynotaxa from Chengapara are: *Surmaespora sinuosa*, *Striatriletes sinuosus*, *Malayaeaspora costata*, alongwith pollen of *Pinuspollenites* and *Piceapollenites*. In general, the Garo group shows the presence of dinoflagellate cysts, fungal remains, pteridophytic spores and gymnospermous and angiospermous pollen. Quantitatively, the pteridophytic spores constitute a major part of the palynoassemblages followed by gymnospermous and angiospermous pollen.

R. S. Singh

**Programme 6.6 : Palynostratigraphy of the Tertiary sediments of Mikir and North Cachar Hills, Assam**

- Objective*
- : To select stratigraphically and ecologically important palynotaxa of North Cachar Hill
  - : To study ultrastructure of important palynofossils to trace their relation with pollen of modern taxa
  - : To reconstruct the environment of deposition and palaeoclimate during sedimentation

Shale and clay samples collected around Mahur and Lumiding-Halflong road section are poorly fossiliferous; the species identified are: *Striatriletes susannae*, *Microverrucosus paucicostatus*, *Polypodiaceasporites chatterjii*, *Polypodiisporites repandus*, *Pellicieroiipollis langenbergii*, *Polyadipollenites* sp. and *Tripoporipollenites* sp.

Madhav Kumar

**Programme 6.7 : Palynostratigraphy of Barail sediments in Upper Assam**

- Objective*
- : To study Barail sediments in order to know their lithic characters, nature of contact and palynofossil content
  - : To study morphotaxonomy of the palynofossils
  - : To establish palynological zonation in the entire Barail sedimentary succession
  - : To study the botanical affinity of various spore-pollen taxa

Palynological investigation of Tikak Parbat Formation from Dangri Kumari, Upper Assam was completed. Palynofossils recovered are placed into 31 genera and 47 species. Pteridophytic spores are dominant followed by angiospermous pollen and fungal remains. The important genera are: *Lygodiumsporites*, *Osmundacidites*, *Polypodiaceasporites*, *Dictyophyllidites*, *Striatriletes*, *Pellicieroiipollis*, *Meyeripollis*, *Acanthotricolpites*, *Graminidites*, *Cucurbitariacites*, *Pluricellaesporites*, etc. Based on palynofossils it was inferred that the sediments were deposited in a humid tropical environment.

B. D. Mandaokar

**Programme 6.8 : Palynostratigraphy of the Kopili Formation of Khasi and Jaintia Hills, Meghalaya**

- Objective* : To establish palynological zones for correlation and dating
- : To deduce palaeoclimate and depositional environment
- : To carry out SEM studies of important palynofossils to trace evolutionary trends

Palynological studies of Kopili Formation from Kopili River section, Garampani and Khorungma (type area) near Umrangso and Umshrongkew River section, Therrighat were completed. All the three sections have more or less similar palynological composition. Some important palynofossils are: *Diporisorites*, *Pluricellaesporites*, *Operculosculptites*, *Lygodiumsporites*, *Acanthotricolpites*, *Pellicieripollis*, *Triporopollenites* and *Margocolporites*. The assemblage is well represented by algae, fungi, bryophytes, pteridophytes and angiosperms.

G. K. Trivedi

**Programme 6.9 : Comparative palynological studies on African and Indian Upper Cretaceous-Palaeocene sediments**

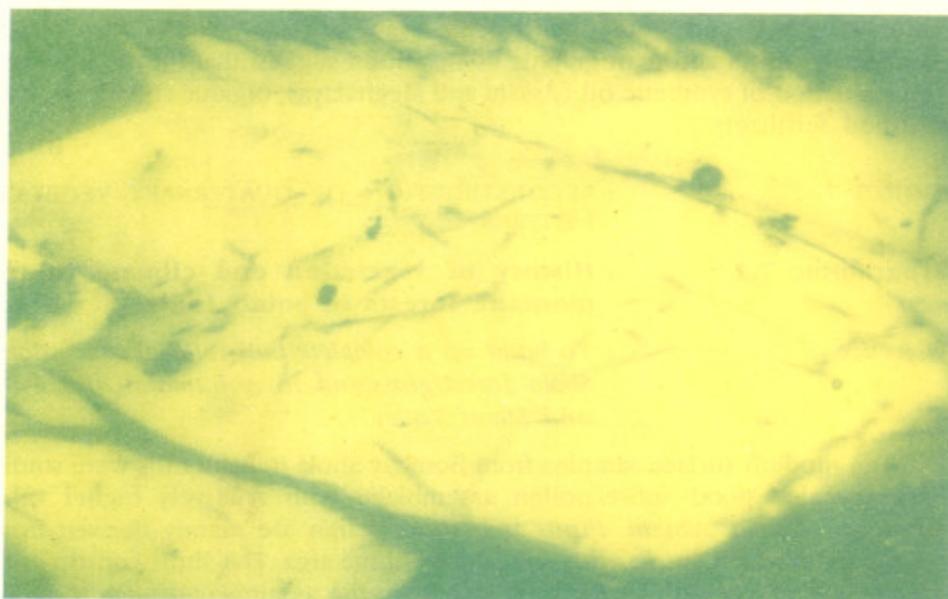
- Objective* : To study Upper Cretaceous-Tertiary palynofossils from Senegal and Tanzania to evaluate palynological assemblage and identify common palynofossil markers
- : To trace patterns of migration for deciphering palaeogeographical distribution and spread of angiosperm taxa
- : To explore possibilities of obtaining comparative material from southeast Asia

Palynological assemblage from bore-hole Pemba 5, Tanzania comprises *Cyatbidites minor*, *Striatriletes susannae*, *Microverrucosus*, *Tsugaepollenites velatus*, *Bombacacidites triangulus* and *Crassoretitriletes vanraadsboovenii* which indicates a Miocene age for the samples.

Palynological investigations of bore-hole CM 5, Senegal reveals the presence of a heterosporous pteridophyte abundant Campanian palynoassemblage. The Maastrichtian palynoassemblage is characterized by *Ariadnaesporites* complex with a feeble representation of heterosporous pteridophytic palynofossils. The Maastrichtian-Palaeocene transition zone is characterized by *Matanomadbiasulcites maximus*, *Proxapertites operculatus*, *P. cursus*, *Bacutripurites orluensis*, *Diporoconia* sp., *Tercisus grandis* and *Periretisyncolpites magnosagenatus*.

B. S. Venkatachala, R. K. Kar and A. Rajanikanth

**Programme 6.10 : Biodiagenesis of Tertiary coals from Nagaland and Kerogen study from Tertiary sequence of Assam-Arakan Basin**



Fungal decomposition/degradation of resinite in coal from Garo Hills, Meghalaya.

*Objective* : To evaluate Tertiary coals from Nagaland and kerogen study from Tertiary sequence of Assam-Arakan Basin

A major biopetrological synthesis on Tertiary coals and lignites from coalfields of Meghalaya, Nagaland and Assam and lignite fields of Gujarat, Rajasthan and Tamil Nadu was completed, based mostly on the generated data. Palynological and megafloral information was utilized to assess the nature of coal and lignite forming plant communities and the nature of ancient peat types.

In general, Tertiary coal and lignite seams were formed from coastal and mangrove-rich to mangrove-mixed wet forest plant communities growing under humid tropical climate. As the rate of microbial degradation, both under aerobic and anaerobic conditions was quite high, coal and lignite seam formation warranted appreciably high amount of vegetal supply. Evidences indicate that majority of coal and lignite seams originated from autochthonous vegetal source accumulating in rheotrophic swamps.

Persistent association of syngenetic pyrite and calcite with almost every coal and lignite seam as well as with associated fine-grained sediments indicate anaerobic microbial degradation. When microbial degradation was severe, thin/minor pyritous, fine-grained and organic matter-rich partings punctuating the seams were formed, e.g., seam nos. 1 and 2 in several areas of Meghalaya, basal seam in Makum Coalfield (Assam) and Panandhro Lignitefield in Gujarat. Many a coal seams in Assam, Meghalaya and Gujarat terminated not because of lack of vegetation and faster rate of basin subsidence but because of exceptionally high rate of organic matter degradation with the result prevailing rate of vegetal supply fell short to produce fine-grained clastic bed instead of peat.

The coal and lignite seams were formed in lagoonal (Assam, Nagaland, Tamil Nadu, Gujarat) and estuarine (Meghalaya) swamps. Their source material, coalification trend and petrographic composition suggest that they are better suited for production of synthetic oil (Assam and Meghalaya), organic chemicals, sulphuric acid and fertilizers.

B. K. Misra

PROJECT 7 : RECONSTRUCTION OF QUATERNARY VEGETATIONAL PATTERNS

**Programme 7.1 : History of vegetation and climate in tropical montane forests in south India**

*Objective* : To build up a complete palynofloral succession of the Shola forest/grassland in Annamalai hills, Palni hills and Silent Valley

Ten modern surface samples from Bombay Shola in Palni hills were studied and have revealed good spore/pollen assemblage with relatively higher values for arboreals. *Acacia*, *Albizia*, *Pinus* and *Alnus* pollen are mainly derived from their counterparts which are recently introduced in the area. The Shola constituent pollen are present in low profile. Ferns, abundant in the assemblage, seem to be of local origin.

The common feature of all the modern surface samples so far analysed is that the samples collected from within the forest have yielded greater amount of arboreal pollen which declined proportionately in the samples collected from outskirts and away from the forest.

Ten top samples of a 3 m deep profile, date ca. 40,000 yrs B.P. from Bombay Shola in Palni hills have been analysed. The study has revealed the occurrence of tree pollen in low profile which closely matches with the composition of modern surface samples. Thus, a careful analysis of modern surface samples shall greatly help in the precise interpretation of pollen diagram.

H. P. Gupta and S. K. Bera

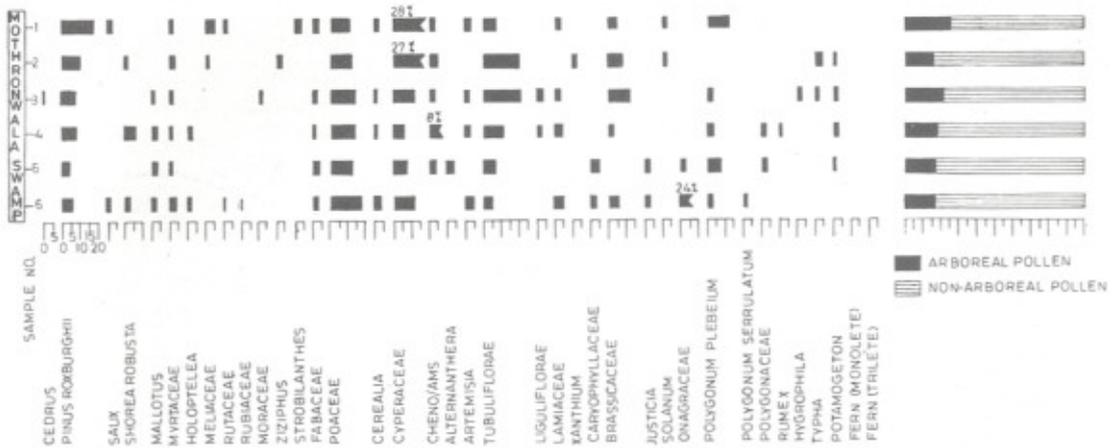
Pollen morphological studies of about 30 characteristic plant species of Shola forest have been done.

H. A. Khan

**Programme 7.2 : Depositional environment and climate during the Quaternary period in the Himalaya : A palynological approach**

*Objective* : To build up a fine resolution climatic sequence of Quaternary period in the Himalayan region

Studied 6 surface samples from Mothronwala swamp, Dehradun and found a poor pollen assemblage. The tree taxa, viz., *Pinus*, *Holoptelea*, *Syzygium*, *Ziziphus* and members of Meliaceae are scantily present. Non-arboreals like Poaceae, Cyperaceae, *Artemisia*, *Polygonum plebejum*, Chen/Ams and Tubuliflorae are the chief constituents which closely compare with the modern vegetation composition of the area.



Pollen spectra showing modern pollen/vegetation relationship from Mothronwala swamp, Dehradun, U.P.

Two metre deep profile (GT-3) from Gola Tappar, Dehradun was studied and a pollen diagram was made. The study reveals the existence of open-grassland in the region. The arboreals such as *Syzygium*, *Acacia*, *Terminalia*, *Emblica*, *Ziziphus*, *Strobilanthes*, etc. are poor, quantity wise. Grasses, sedges, Cheno/Ams, *Polygonum plebejum*, *Artemisia*, Caryophyllaceae, etc. represent the ground cover. Besides, a large number of fungal spores like *Alternaria*, *Helminthosporium*, *Curvularia*, *Tetraploa*, *Diplodia*, *Nigrospora*, Microthyriaceae, etc. have been encountered throughout the sequence.

Chhaya Sharma and M. S. Chauhan

Pollen analysis of 8 surface samples from the vicinity of Nachiketa Tal, Garhwal Himalaya showed the dominance of arboreals over non-arboreals. *Quercus*, *Pinus*, *Alnus*, *Betula* and *Juglans* are major constituents, as in modern vegetation of the area. Poaceae, Cyperaceae, Cheno/Ams, Rosaceae, etc. are dominant taxa of herbaceous vegetation. The excessively high values of fern spores depict enhanced humidity. Pollen morphology of about 48 (or 50) plant species distributed in the temperate belt of Garhwal Himalaya was studied; a workable pollen-key has been prepared.

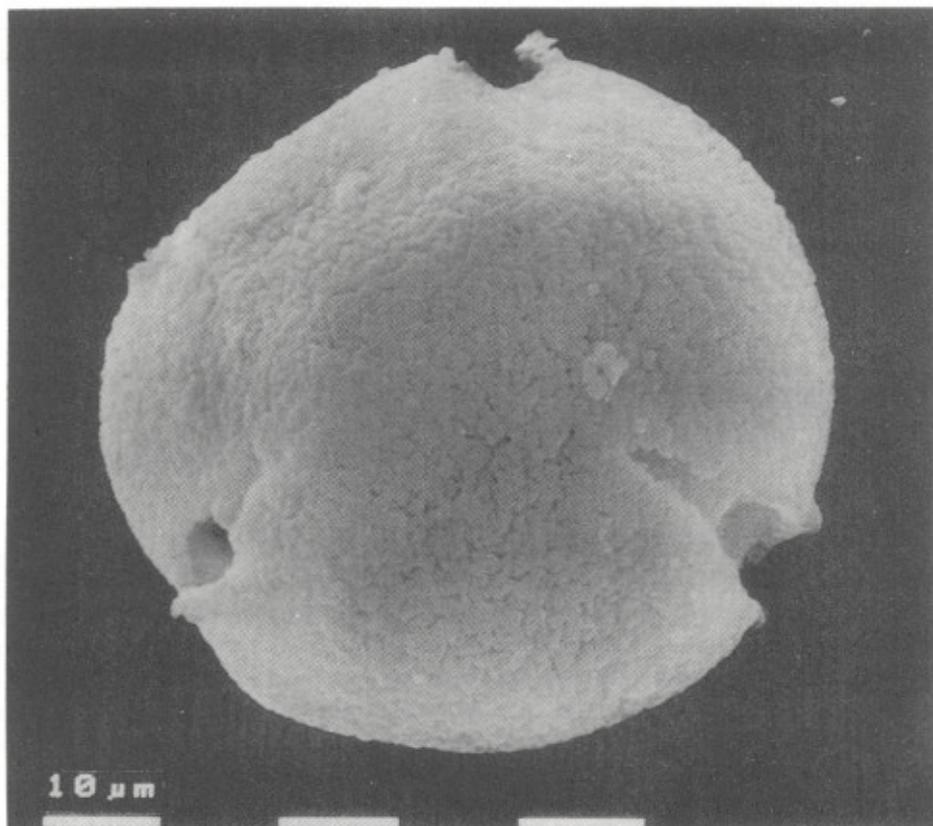
Pollen of *Alangium salvifolium hexapetalum* show gammate-granulate sculpturing while that of *A. salvifolium* is rugulate/gemmate-verrucate-granulate as studied through SEM studies.

Chhaya Sharma and Asha Gupta

### Programme 7.3 : History of mangrove vegetation in India

*Objective* : To study palynostratigraphy and dispersed organic matter analysis of the sediments from Chilka Lake in Mahanadi-Brahmani-Baitarini deltaic region in Orissa

Twenty samples from Rambha profile, southern flank of Chilka Lake were studied. Mangrove taxa belonging to Rhizophoraceae, such as *Sonneratia*,



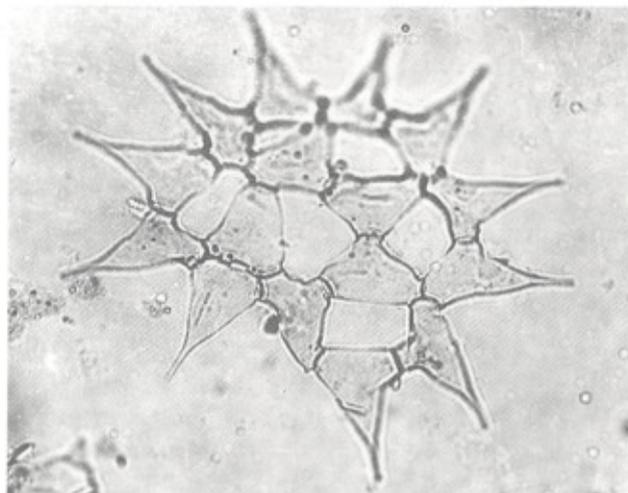
SEM photograph of pollen of *Alangium chinense* (Lour.) Harm.

*Avicennia*, *Heritiera*, *Excoecaria*, *Aegialities*, *Acrostichum*, etc., microforaminifera, dinoflagellate, concentricystis and diatoms were poorly represented. However, herbaceous and fresh water elements such as *Typha*, *Potamogeton*, *Lemna*, *Impatiens*, *Nymphaea*, Brassicaceae, Caryophyllaceae, Chenopodiaceae, Poaceae, Asteraceae, Malvaceae, etc. were recorded in good frequencies. The palaeofloristic picture of Rambha sediments depicts that the southern flank of Chilka Lake was more under fresh water influence with periodical inter-mixing of sea water.

Dispersed organic matter (DOM) study of Balugaon profile has been finalised. The study quantifies various stages of biodegradation which confirm the deltaic depositional environment.

Several types of *Pediastrum* colonies have been encountered indicating fresh water milieu.

The water sample, collected at the mouth of Chilka Lake has yielded a variety of diatoms, mostly belonging to Centrales; Pennales have also been encountered albeit in low frequency. Pollen and fungal spores are almost absent. A few pollen of Chenopodiaceae, Poaceae and Apiaceae, etc. have been recorded. Diatoms belong to different species of *Coscinodiscus* which are about 80 per cent of the total population. The occurrence of such high values of *Coscinodiscus* is indicative of typical marine



*Pediatrion* from Chilka Lake, Orissa.

environment wherein continuous discharge of sea water is expected. The other genera of diatoms recorded are: *Nitzschia*, *Hantzschia*, *Pleurosigma/Gyrosigma*, *Biddulphia*, *Synedra*, *Cymbella*, *Melosira*, *Diploneis/Cocconeis*, etc.

H. P. Gupta and Asha Khandelwal

**Programme 7.4 : Dendrochronology of temperate and tropical trees and seasonality of cambium activity**

- Objective* : To reconstruct climate (temperature and precipitation) from tree rings
- : To study environmental factors determining the seasonality of cambium activity

Tree-ring widths of twenty dated tree cores of *Cedrus deodara* and *Pinus wallichiana* from Kanasar, U.P. Himalaya have been measured. Ten tree-ring samples of *Cedrus deodara* collected from Harsil, U.P. Himalaya have been dated through Master Plot of this taxon which extends back to 1356 A.D. Most of these cores have been dated over 500 years. Eighteen tree cores of *Pinus gerardiana* and 8 of *Pinus wallichiana* collected from Kinnaur, Himachal Pradesh have been mounted, polished and skeleton plots of each core were prepared.

Growth and climate relationship of *Tectona grandis* and *Cedrela toona* have been studied. These two taxa have been found potential to reconstruct vagaries of monsoon in the past.

R. R. Yadav (on deputation to USSR) and Amalav Bhattacharyya

**Programme 7.5 : Growth-ring analysis in fossil woods from Palaeozoic to Cenozoic era in Indian Sub-continent**

- Objective* : To carry out a detailed survey and preparation of a catalogue of fossil woods, producing growth rings from Palaeozoic to Cenozoic Era in Indian subcontinent

: To analyse growth rings of fossil woods to understand change in productivity of trees in relation to climate during geological past

Literature survey was continued to prepare a list of fossil woods, producing growth rings from Palaeozoic to Cenozoic in the Indian Subcontinent.

R. R. Yadav (on deputation to USSR) and Amalav Bhattacharyya

**Programme 7.6 : Plant remains from Pre- and Proto-historic sites in northern and northwestern India**

- Objective* :
- : To study agricultural practices in context of different cultures in time and space
  - : To sketch the perspectives of ecological potential of contemporary agro-ecosystem and their contemplated further development
  - : To determine the interaction of pre-historic man with the floral wealth
  - : To reconstruct regional models of environment around the cultural settlements

Seed and fruit remains of crops, weeds and other wild taxa collected from Senuwar, a key-site of Neolithic-Chalcolithic cultures (ca. 2,000-600 B.C.), District Rohtas, Bihar, were investigated. The finds in different cultural phases are as under:

**Neolithic (Period-IA : 2,000-1,800 B.C.)**

*Oryza sativa*, *Hordeum vulgare*, *Triticum sphaerococcum*, *Sorghum bicolor*, *Eleusine coracana*, *Lens culinaris*, *Pisum arvense* and *Latyrus sativus*.

The weeds *Setaria gluca*, *Vicia birsuta*, *Vicia sativa*, *Amaranthus* sp., *Oryza rufipogon*, *Panicum* sp., *Rumex dentatus*, *Coix lachryma—jobi* and *Ipomoea pestigridis* are found in association. Fruits of *Artocarpus lakoocha* and *Ziziphus nummularia* are also recorded.

**Neolithic-Chalcolithic (Period—IB : 1,800-200 B.C.)**

In addition to the crop plant remains of rice, barley, dwarf-wheat, field-pea, grass-pea and lentil, found in preceding phase, *Triticum aestivum* *Dolichos biflorus* and *Vigna radiata* are also recorded.

*Oryza rufipogon*, *Setaria glauca*, *Rumex dentatus*, *Panicum* sp. and *Vicia sativa* continued to occur as woody wild plants. *Polygonum plebejum*, *Latyrus apbaca*, *Coccinia grandis*, *Ziziphus oenoplea*, *Trianthema monogyna* and *Datura* sp. are new records.

**Chalcolithic (Period—II : 1,200-600 B.C.)**

Evidence of almost all the cereal and pulse crops found in earlier phases is noticed. Cultivation of oil-seed crops of *Linum usitatissimum* and *Sesamum indicum* took place. *Indigofera* sp., *Perilla ocimoides*, *Cenchrus ciliaris* and *Asphodelus tenuifolius* are new wild taxa.

K. S. Saraswat

Investigations of seventy wood charcoal samples from Harappan site—Shikarpur, in Rann of Kutch (ca. 2500-2200 B.C.) has revealed the occurrence of *Prosopis spicigera*, *Ziziphus* sp., *Acacia nilotica*, *Randia dumetorum*, *Bombax malabaricum*, *Hardwickia binata*, *Shorea robusta*, Rhizophoraceae and Sterculiaceae. The presence of timber species belonging to desertic and coastal plants has suggested the prevalence of arid conditions during the Harappan times.

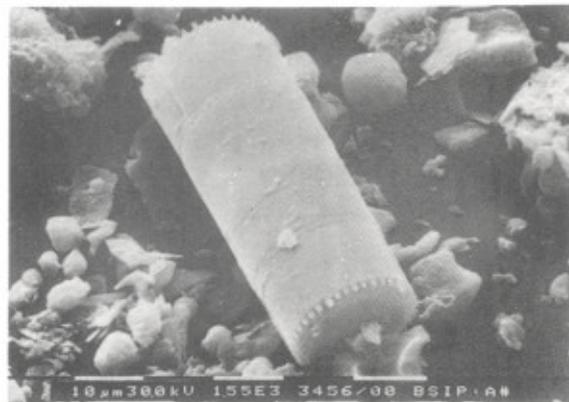
Chanchala

**Programme 7.7 : Aerospora of Lucknow: Its biochemical and clinical implications**

- Objective*
- : To daily monitor the aerospora of Lucknow and surrounding areas for their seasonal and diurnal periodicity
  - : To identify aeroallergens by biochemical and clinical investigations
  - : To enumerate biota in the aerospora both quantity-wise and quality-wise employing both gravimetric and volumetric techniques in order to achieve precision in seasonal and diurnal periodicity

*Rain Spora*—1990-91 reconnaissance of rain water samples employing conventional techniques have witnessed the occurrence of a variety of diatoms belonging to *Melosira*, *Synedra*, *Cymbella*, *Hantzschia*, *Cyclotella*, *Gyrosigma*, *Pleurosigma*, *Stauroneis*, *Pinnularia*, *Navicula*, *Fragilaria*, *Dimeregrammopsis* (?), etc. Pollen of *Polygonum*, *Cannabis sativa*, *Aegle marmelos*, *Typha*, *Ricinus communis*, *Embllica officinalis*, *Pinus* sp., Poaceae, Chenopodiaceae, Amaranthaceae, Apiaceae, Cyperaceae, Malvaceae, Brassicaceae and Meliaceae have been recorded. Other biota includes filamentous alga, bacteria, fern/moss spores, stellate hairs, parenchymatous pieces, branched and unbranched hyphae, animal body parts and animalcules.

*Volumetric samples*—Samples collected from Chowk and I. T. College crossing, Lucknow were passed on to the Department for biogenic pollutants for analysis. The total duration of sampling ranged 30-35 minutes on different dates and times. The



*Melosira*— a diatom from Lucknow.

biotic entities recorded are: pollen of *Polygonum*, *Parthenium hysterophorus*, *Pinus*, *Artemesia*, *Heliotropium*, Poaceae, Chenopodiaceae, Amaranthaceae, Cyperaceae, Brassicaceae, Apiaceae and Asteraceae. Spores of *Alternaria*, *Helminthosporium*, *Nigrospora*, *Curvularia*, *Aspergillus/Penicillium*, etc.

It is concluded that (i) the Chowk sample is more abundant in pollen and spores as compared to I.T. College crossing samples, (ii) some of the pollen and spores recovered from these samples are undoubtedly causative agents of respiratory and cutaneous diseases.

Asha Khandelwal

PROJECT 8 : GEOCHRONOMETRY OF INDIAN ROCKS

**Programme 8.1 : Radiocarbon dating of Quaternary deposits and materials of archaeobotanical importance**

*Objective* : *To date Quaternary sediment profiles, ocean sediment cores, coastal and shell deposits and kankar horizons in the Ganga plain*  
: *To establish the Liquid Scintillation counting method for C-14 dating*

Seventy five samples were processed for radiocarbon dating, both by the gas counting and liquid scintillation counting methods. C-14 ages were obtained for 52 samples. Dating and correlation with palynological data of the ocean sediment core near Andaman Islands have indicated that a volcanic eruption had occurred in Narcodam Islands about 17,500 to 20,000 years B.P. The sediment containing shells in coastal deposits at Idythra, Karnataka was dated to 6,400 yrs using shells and organic matter. It confirms that the mid-Holocene sea level rise is well represented at the locality. Three profiles of peat deposits from Nilgiris have been dated. Five check samples under the programme of International C-14 dating intercomparison exercise were analysed and data have been sent to the International Atomic Energy Agency. Dating of archaeological and archaeobotanical samples from different cultural horizons at Senuwar, Rohtas have firmly established chronology of the settlement to the time bracket *ca.* 2,000 to 600 B.C. The two Kankar profiles in the Gomti alluvial deposits gave ages in the range of 2,000 to 8,500 years and were consistent with depth. The profile away from the active channel is in the reverse order with respect to C-14 ages. This may be due to the effect of rain water percolation in the soil as against the fast run-off in the active channel.

The liquid scintillation counting method for C-14 dating has been set up. Datings of some check samples have been carried out and the system is being tested further for samples where carbon quantity is relatively high.

G. Rajagopalan

**Programme 8.2 : Fission-Track dating of minerals and fossil materials**

*Objective* : *To carry out Fission-Track dating of glauconite from Vindhyan Supergroup and other equivalent formations*

- : *To attempt Fission-Track dating of petrified woods from the Deccan Intertrappean beds*
- : *To carry out Fission-Track dating of check samples and International standard samples*

F-T dating of glauconitic sandstone samples from Koludih (2), Hatwa Khas (2) and Garua (1) around Sidhi area, Madhya Pradesh has been completed. The F-T ages obtained are:  $1110 \pm 190$  Ma and  $1100 \pm 235$  Ma for Koludih;  $1135 \pm 230$  Ma and  $1145 \pm 205$  Ma for Hatwa Khas and  $1140 \pm 225$  Ma for Garua samples. The F-T data suggest that these samples belong to the same bed which is exposed at Bordi and Khyra in Sidhi District and has previously been dated as  $1125 \pm 20$  Ma. This bed appears to be equivalent to the Kheinjua Formation of Lower Vindhyan (Semri) Group.

After scanning the separated glauconitic grains, it has been found that the dating of samples from Gaddi, Churhat, Sidhi area, Madhya Pradesh will not be possible, as the grains are not of fully-evolved type. F-T ages for other samples are:  $990 \pm 155$  Ma for Baghwar, Sidhi area and  $955 \pm 140$  Ma and  $1130 \pm 185$  Ma for Semia, Newari area, Sonbhadra, Uttar Pradesh. These F-T age results indicate (1) the presence of glauconitic sandstone bed at Lower Vindhyan—Upper Vindhyan boundary at Chhuia Ghati, Baghwar, Sidhi area, confirming previous work done at this area, (2) the glauconitic sandstone bed at Semia, Newari belongs to Kheinjua Formation of Lower Vindhyan (Semri) Group.

One glauconitic sandstone sample BSFT 244 (3T/5) from Ahu River bridge (well no. 6) has been dated to  $1030 \pm 175$  Ma.

Ten transverse thin sections of the petrified wood samples collected from Ghughua, Umaria, Silther, Mehadwani, Parapani in Shahpura area, Mandla District, Madhya Pradesh have been prepared. After mounting, grinding, polishing and etching for fossil tracks, these thin sections were sent for thermal neutron irradiation.

A. P. Srivastava

**Programme 8.3 : Potassium-Argon dating of sedimentary and igneous rocks**

- Objective*
- : *To date the glauconitic sandstone collected from Vindhyan deposits in Uttar Pradesh and Rajasthan and further collection*
  - : *To date the Deccan Trap samples and synthesize the data with fossil studies in collaboration with Cenozoic Department*
  - : *To develop data acquisition and reduction system*

Attention was focussed on the Mass analyser which has already been considerably modified. Filament assemblies were prepared and fitted in the analyser after procuring the necessary material. A defective LN<sub>2</sub> trap was replaced after it was found that it was limiting the vacuum in the system due to an internal leak. Residual gas spectra were recorded using Quadrupole mass spectrometer and gettering

effects studied especially on masses 2, 12, 16, 18, 28, 38, 39, 40, 41, 43 and 44 etc. Glauconite-separation on three Vindhyan glauconite samples was carried out using magnetic separator, from which individual grains were further handpicked under stereo-microscope.

C. M. Nautiyal

**PROJEKT 9** : ANNOTATED ATLASES, CATALOGUES, MONOGRAPHS AND BOOKS

**Programme 9.1** : **Data bank for Palaeozoic-Mesozoic palynology, using Expert System and compilation of catalogues, atlases and other palynological information**

*Objective* : *To index and update new data into the existing data banks*  
 : *To develop data-base for distribution of stratigraphically important taxa*  
 : *To establish data-base for identification and retrieval of palynotaxa*

Updating of data bank for Palaeozoic and Mesozoic palynology and related aspects has been done.

Group Effort (PGGP Department)

For achieving finer zonations, species range-charts have been prepared representing the horizons from Early Permian to Cretaceous in the Damodar and Rajmahal basins. The First Appearance Datum (FADs) and Last Appearance Datum (LADs) of important species have been located and the palynostratigraphic sequences based on spore/pollen species have been determined for boundary demarcations between various formations.

Archana Tripathi

**Programme 9.2** : **Gondwana flora of India**

*Objective* : *To write a reference book on the Gondwana plants*

Compilation of bryophytic, lycophytic and sphenopsid remains has been completed. Line drawings of important genera have been completed.

Shaila Chandra and Jayasri Banerji

**Programme 9.3** : **A catalogue of fossil dinoflagellates from India**

*Objective* : *Morphological re-interpretation and documentation of published data*

Nomenclatural priority of *Hystrichokolpoma indicum* Salujha & Kindra 1981 has been restored considering *Hystrichokolpoma indicum* Khanna & Singh 1981 its junior synonym.

K. P. Jain, Rahul Garg and Khowaja-Atequzzaman

Tertiary dinoflagellate cyst assemblages described from Kutch have been critically re-evaluated. Available figured specimens of Early Eocene, Oligocene and Miocene assemblages have been re-studied, re-photographed for discussing morphological features for their proper taxonomic assessment and re-allocation. Four species, viz., *Areoligera digitata*, *Cleistosphaeridium cephalum*, *Operculodinium paucispinosum* and *O. robustum*, have been rejected. One new species, viz., *Glaphyrocysta indica* and two new combinations, viz., *Apteodinium unicornum* (Kar) and *Polysphaeridium ornamentum* (Jain & Tandon) have been proposed. An assessment of various palynozonation schemes has revealed major lacunae in the presentation of stratigraphic and palynological data as well as several inconsistencies in the given charts, histograms and descriptions in the text.

The status of systematic descriptions of certain Middle Eocene and Oligocene dinoflagellate cyst taxa has been reviewed, exemplifying several unexpected errors, inconsistencies and ambiguities. It is recommended that the readers should consult original papers of reproduced versions for correct citations and understanding.

K. P. Jain and Rahul Garg

**Programme 9.6 : An Atlas of angiospermic pollen taxa from the Indian Tertiary sediments**

*Objective* : To evaluate all published taxa and to identify valid taxa for use in stratigraphical and palaeoecological studies

: To circumscribe and delineate the valid taxa

The following assignments have been carried out and are near completion

Terminology	— R. K. Saxena — K. Ambwani
Tricolpate pollen	— M. R. Rao — J. Mandal
Tricolporate pollen	— S. K. M. Tripathi — Madhav Kumar
Polycolpate pollen	— R. S. Singh
Polycolporate pollen	— B. D. Mandaokar
Porate and inaperturate pollen	— Samir Sarkar

**Programme 9.7 : Patterns of leaf architecture and cuticle in some tropical dicotyledonous families**

*Objective* : To study leaf architecture and cuticle of some tropical angiospermous families: *Magnoliaceae*, *Annonaceae*, *Dilleniaceae*, *Combretaceae*, *Lauraceae*, *Myrtaceae* and *Fabaceae*

Leaves of *Magnolia grandiflora*, *Michelia champaca*, *M. fuscata* and *Michelia* species were processed for cuticle and mounts of leaf venation. Morphology,

venation pattern and cuticular features were described. It has been observed that besides other morphological characters, the architectural patterns and cuticular features can also play important role in the identification of various genera and species belonging to the family Magnoliaceae.

D. C. Saini

**Programme 9.8 : Inventory of Type and Figured palaeobotanical specimens/slides (Megafossils) available with Repository of BSIP Museum**

*Objective* : *Publication of inventory and a guide book to the BSIP Museum*

Preparation of Inventory (Part I) of Type and Figured specimens and a guide book to BSIP museum is being finalized.

G. P. Srivastava  
(Coordinator, Group Effort—Museum)

**Programme 9.9 : A catalogue of fossil plants from India**

*Objective* : *To prepare an inventory of plant micro- and mega-fossils reported from Indian sedimentary sequences during the period 1971-1990*

: *To publish the inventory as a Birbal Sahni Centenary contribution*

The following assignments have been carried out and are nearing completion.

Resource persons	: Shaila Chandra and Suresh C. Srivastava
Shaila Chandra	: Palaeozoic-Mesozoic palaeobotany
Suresh C. Srivastava	: Gondwana palynology including Upper Cretaceous
Manoj Shukla	: Pre-Gondwana palaeobotany
A. Rajanikanth	: Fossil calcareous algae
Khowaja-Ateequazzaman	: Dinoflagellates
Jyotsna Rai	: Nannofossils
Anil Chandra	: Diatoms and silicoflagellates
R. K. Saxena	: Tertiary palynology
M. S. Chauhan	: Quaternary palynology
Rajni Tewari	: Palaeozoic-Mesozoic megaspores
Rashmi Srivastava	: Cenophytic palaeobotany
Chanchala	: Archaeobotany

**Programme 9.10 : Four Decades of Indian palaeobotany : A critical assessment 1950-1990**

- Objective* : To critically analyse and evaluate palaeobotanical data generated during the period 1950-1990 for synthesis and review
- : To compile state-of-the-art reports on selected themes
- : To publish a compendium as a Birbal Sabni Centenary contribution

The following research papers are under preparation. Synopsis of the papers has been discussed with the Director.

- P. K. Maithy : Palaeobiology of the Vindhyan sediments
- B. S. Venkatachala & Manoj Shukla : The early biosphere—Some Indian records
- H. K. Maheshwari : Provincialism of Gondwana floras
- Shaila Chandra : Changing patterns of the Permian Gondwana vegetation
- A. K. Srivastava : Alien elements in the Gondwana flora of India
- Usha Bajpai : Morphological trends in the Gondwana plants
- Jayasri Banerji : Life and time of *Williamsonia*.
- Shyam C. Srivastava : Triassic flora of India—Transition-
- M. B. Bande : Palaeogene vegetation of Peninsular India
- J. S. Guleria : Neogene vegetation of Peninsular India
- N. Awasthi : Changing patterns of vegetation through the Neogene Siwalik succession
- Vijaya : Evolutionary trends in saccate pollen during the Gondwana
- Suresh C. Srivastava : Permian palynological assemblage in the Godavari Graben
- R. S. Tiwari & Archana Tripathi : Palynofossil assemblages through the Indian Gondwana (marker assemblages)
- R. S. Tiwari : The northern extension of the Indian Gondwana—a palynological approach
- H. P. Singh : Tertiary palynofossils and the Himalayan orogeny
- R. K. Kar : Stratigraphical implications of Tertiary palynological succession in the north-eastern and western India
- R. K. Saxena : Neyveli lignites and associated sediments, their palynology, palaeoecology and correlation with the west-coast lignites
- H. P. Gupta : Changing pattern of vegetation in the intermontane Kashmir Basin since 3 my : a palynological approach

- Chhaya Sharma : Palaeoclimatic oscillations since last deglaciation in western Himalaya: A palynological assay
- Asha Khandelwal : Holocene history of mangrove vegetation in India—a palynological interpretation
- K. S. Saraswat : Plant economy in relation to socio-economic evolution in ancient India
- A. Rajanikanth : Rock building calcareous Cretaceous-Tertiary algae from India—an ecological perspective
- K. P. Jain, Rahul Garg & Khowaja-Ateequazzaman : Fossil dinoflagellate cysts : an emerging tool in Indian biostratigraphy
- S. A. Jafar : Calcareous nannoplankton in Indian basins—problems and potentials
- Anil Chandra : Siliceous microfossils and their significance in Indian biostratigraphy
- B. K. Misra : Genesis of Indian Tertiary coals and lignites
- Anand Prakash : Himalayan coals—their nature, formation, composition and rank
- G. K. B. Navale : Temporal and spatial variation of Gondwana coals—organic petrographic analysis

### Sponsored Projects

- Sp. 1** — **Geology, palaeobiology, geochemistry and isotopic composition of Archaean sediments of India (DST/No. SP/12/PCO/86)**

*Objective* — *To search stromatolitic structures and organic remains in the Archaean sediments and their evolution*

Thin sections of cherts associated with stromatolites and the banded Iron Formation in Dharwar Craton were examined to search for microfossils. These cherts in Timmappanagudi area of Sandur Schist Belt show presence of structures akin to microfossils and laminite. The laminite like structures are present in cherts associated with BIF and are also present in Bheemangundi and Donimalai areas of Sandur Schist Belt. The spheroidal structures may or may not have a central darker area. The average size of spheroids is 30  $\mu\text{m}$  though their size ranges from 5-70  $\mu\text{m}$ . Detailed study of these structures is under process.

B. S. Venkatachala, Manoj Shukla, Mukund Sharma and Rajendra Bansal

- Sp. 2** — **Studies of palaeoclimates through the**

**application of palaeobotanical methods  
(DST No. ES/63/028/86)**

*Objective*

— *To reconstruct regional palaeogeography and terrestrial palaeoenvironmental history of the Quaternary period with special reference to Holocene*

Three pollen spectra were constructed based on pollen analysis of 25 surface samples from Gangtok, Gangtol-Khechipiri and Khechipiri, Sikkim Himalaya. The study reveals that in the forested region *Alnus*, *Quercus*, *Pinus*, *Betula* are the dominant arboreal taxa and Poaceae dominate herbage; scattered occurrence of Urticaceae, Chen/Ams, Caryophyllaceae is noticed.

The modern pollen spectra constructed from the open area on way from Gangtok to Chhangu depict poor arboreals and rich non-arboreals mainly represented by Poaceae, *Artemisia*, Urticaceae, Chen/Ams, etc. Ferns are also well represented.

Pollen analysis of a 3 m deep profile from Khechipiri Lake has revealed that around 3,000 years B.P. the area was dominated by *Quercus-Alnus-Betula*, *Pinus-Betula-Carpinus* association depicting warm temperate climate in the region. Subsequently, around 1000 years B.P., it was replaced by *Alnus-Quercus-Rhododendron* forest community indicating a more humid climate than before. The top section of the profile portrays almost the picture of present-day forest composition.

Pollen analysis of partly investigated profiles from Joye-Pokhari and Mirik lakes, Darjeeling, on the other hand, shows dominance of non-arboreals over arboreals. Arboreals are represented by low values of *Quercus*, *Alnus*, *Rhododendron*, *Betula*, Rosaceae, etc. The rich herbaceous vegetation is mainly composed of Poaceae, Cyperaceae, Ranunculaceae, etc.

Preliminary investigation of 2 samples from Bilaspur, Kumaon Himalaya has revealed an assemblage consisting of arboreals and non-arboreals.

Chhaya Sharma, M. S. Chauhan and Mukesh Chandra Pant

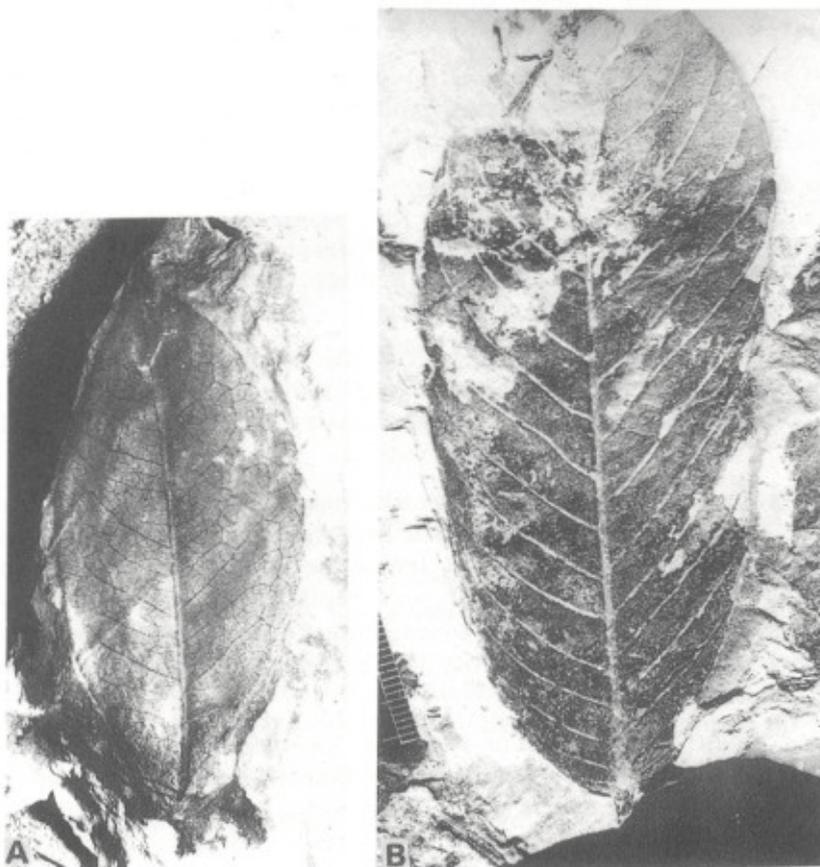
**Sp. 7**

— **Vegetational history of the Siwalik Group in the Himalayan foot-hills of Uttar Pradesh, India  
(DST No. SP/SY/038/87)**

*Objective*

— *Comparative study of plant megafossils with extant plants and to reconstruct the palaeofloristics, phytogeography and palaeoecology of the Himalayan foot-hills in Uttar Pradesh*

Fossil woods and leaf-impressions collected from the Siwalik sediments of Haridwar, Kalagarh, Kathgodam and Koilabas were studied. The assemblage is constituted by 65 species belonging to 50 genera and 25 families of angiosperms and pteridophytes. Five families, viz., Thelypteridaceae, Poaceae, Burseraceae, Sabiaceae and Rosaceae and 13 genera, viz., *Uvaria*, *Cananga*, *Uncobia*, *Acronychia*, *Trichilia*, *Sabia*, *Samanea*, *Morinda*, *Myrsine*, *Ardisia*, *Carissa*, *Homonoya* and *Glochodion* are new additions to the Siwalik flora of Uttar Pradesh. An evergreen-



Leaf-impressions of **A**, *Acronychia baveri* (Rutaceae); **B**, *Uvaria hamiltonii* (Anonaceae) from Kathgodam Siwalik sediments, Nainital.

semi-evergreen vegetation was inferred to be in existence during the period of deposition.

Mahesh Prasad

## Collaborative Project

**Project : Palynology of the Mesozoic sediments of Kutch Basin**

Photoplates on the Mesozoic palynological assemblage of Kutch have been completed. Revision and modification of the morphotaxonomy is almost in final stage.

H. K. Maheshwari, K. P. Jain, Rahul Garg and B. N. Jana

## Work other than Programmes

### Palynological investigations and $^{14}\text{C}$ dating of a gravity core, Narcondam Island

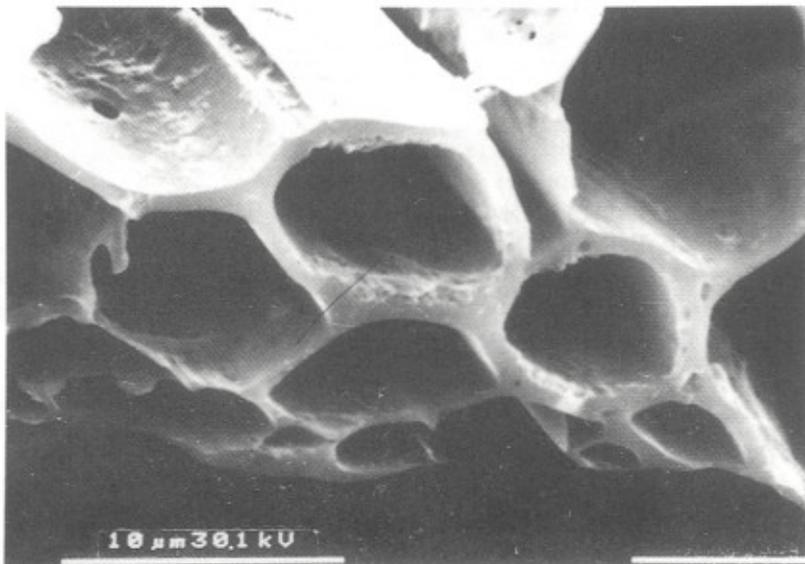
The carbonates in the sediments from a 1.38 m long gravity core collected off Narcondam Island at a depth of 1,134 m by RV Samudra Manthan Cruise 61, drilled by the Geological Survey of India was  $^{14}\text{C}$  dated. The top most sediment is dated as  $4500 \pm 150$  yrs B.P. and the base at 1.38 m as  $20,000 \pm 480$  yrs B.P. The sedimentation rate is rather uniform and calculated at 9.3 cm/1000 yrs. Spores and pollen in the sediments are scanty while phytoplankton are abundant. The spores are mostly represented by *Lycopodium*, *Lygodium* and *Polypodium*, whereas the pollen belong to different taxa of coastal palms and mangroves. Peltate scales of mangrove plants are also occasionally found.

Fragments of fusinite found in abundance from 1.18 to 1.38 meter of core representing a time span of 2,000 yrs between 18,000 yrs and 20,000 yrs B.P. testify to intermittent volcanic activity at Narcondam during this period.

B. S. Venkatachala, G. Rajagopalan, R. K. Kar and A. Rajanikanth

### Palynological studies of Deccan Intertrappean sediments

New palynological data from two widely separated intertrappean sequences at Padwar (near Jabalpur) in the north and at Naskal (near Hyderabad) in the south have helped to document the latest stratigraphic record of the Indian dinosaurs and the near synchrony of the basal basaltic flows in the central, eastern and southern sectors of the Deccan Province. Important Maastrichtian palynofossils were recovered from the Padwar intertrappeans which comprise *Azolla cretacea*,



SEM photograph of wood fibres from near Narcondam, Andaman Islands lacking middle lamella due to volcanic activity.

*Aquilapollenites bengalensis*, *Diporoconia* spp. and associated forms. The Naskal assemblage is characterized by *Gabonispurites* cf. *G. vigourouxii* and *Ariadnaesporites* sp.

B. S. Venkatachala, R. K. Kar and A. Rajanikanth  
(in collaboration with Professor A. Sahni)

### Palynological studies of Subathu sediments

Palynological information already collected from the Lower Tertiary formations exposed on the western side of the Surajpur thrust, Himachal Pradesh has been analysed. It is being evaluated for its correlative potential with the available palynological data published from different sections on the eastern side of the Surajpur thrust. Some palaeoecologically significant taxa, viz., *Operculodinium*, *Lingulodinium*, *Polysphaeridium* and *Spiniferites* have been identified. Palynofloral composition confirms a shallow marine environment of deposition for the Subathu Formation.

H. P. Singh and Samir Sarkar

### Yellow Rain

During the first quarter of February, viscous yellow spots from leaves and other objects were collected from Maqboolganj and Vikas Nagar, Lucknow. Their size varies from 1-3 mm, shape varies from circular, subcircular, oval to linear. These yellow spots were pollen analysed date-wise and area-wise. The study has revealed that each spot contains enormous quantity of pollen exclusively belonging to angiosperms. In addition, a few insect-appendages, algal hyphae and fungal spores have also been encountered. The pollen assemblage is predominated by pollen of Oleaceae, Brassicaceae, *Salmaia*, etc. Whereas *Morus*, Myrtaceae and Fabaceae are co-dominant. Commassie Brilliant R-250 test was also tried on these pollen that gave negative signals for proteins.

A. P. Bhattacharyya, Asha Khandelwal and H. P. Gupta

### Studies on Plio-Pleistocene woods of Africa

Work on the Plio-Pleistocene woods from Sahabi, Omo and Semliki (Africa) was continued. Descriptions and photography of about 70 fossil woods from these localities were completed. Some of the genera further identified are: *Cordia*, *Cordyla*, *Crotolaria*, *Croton*, *Cryptosepalum*, *Cynometra*, *Diospyros*, *Ekebergia*, *Ficus*, *Garcinia*, *Heeria*, *Irvingia*, *Kigelia*, *Landolphia*, *Millettia*, *Monotes*, *Ostryoderris*, *Parinari*, *Platysepalum*, *Pseudobersama*, *Rothmania*, *Sterculia*, *Terminalia*, *Tessamanni*, *Vitex*, *Ximena*, etc.

M. B. Bande

### Organopetrological investigations of Himalayan coals

The geological and organic petrological information about the Himalayan coals occurring in the sediments of various ages have been collected. The coal petrological investigations, particularly dealing with the rank and nature of microconstituents, have also been carried out from a few places in eastern Himalaya. These details were utilized in the preparation of a paper entitled "Himalayan coals, their nature,

formation, composition and rank". It contains mainly the details of maceral, microlithotype and reflectance analyses of coal occurring in remote Himalayan areas. It has been observed that the Himalayan coals are comparatively higher in rank than the coals of a same age found in the Peninsular areas. This was effected primarily due to the intense tectonic activity in the Himalaya. Besides, depositional environment and effect of tectonic activity on the vegetal matter have also been discussed.

The details of the biodiagenetic studies carried out in the Institute mainly on the aspects of coal utilization and internal combustion are being collected. This information will be presented in the form of a report which is under preparation.

The spectral fluorimetric study on the selected liptinite macerals from Karewa lignite/peat, Kashmir Valley has been carried out. It indicates the presence of two distinctly different types of sporinites which are characterized by the maximum fluorescence intensity in the green and yellow region. In addition, the various dispersed organic matter types found in the lignite/peat have also been described. The source material was dominantly composed of land derived organic matter, which has been converted into lignite/peat under low energy, lacustrine environment.

Anand Prakash and Rakesh Saxena

### **Palynological and organopetrological studies on Tertiary sediments of south India**

Well preserved fossil pollen of *Transdanubiaepollenites* previously reported from the Eocene of Hungary have been recovered for the first time from the Miocene sediments of south India. A study is made to elucidate characteristic patterns in the origin and orientation of striations in the genus *Schizaeoisporites* in order to improve understanding of the specific characteristics. This led to the emendation of the generic diagnosis to include spores (fossil) having significant oblique origin and orientation of striations. It also necessitated re-description of *S. grandiformis* Ramanujam 1972 and proposal of two new species—*S. proximobliquus* and *S. obliquus*.

A detailed synthesis on organic composition of Neyveli lignites was completed; utilizing also published geological findings. The study indicates that the lignites originated from terrestrial angiospermic vegetation (moist tropical forests) including inlands, coastal, beach, back mangrove, mangrove and mangrove associate plant communities, accumulating in a lagoon under warm and humid climate.

G. K. B. Navale and Alpana Singh

A comparative organic petrographic study was carried out from East and West Bokaro coal basins. The study has distinctly shown the identical facies development of the coals in both the basins suggesting that the geographic division of the coal basins marked by the existence of Lugu Hill does not make any difference in the genesis of the coal. Both East and West Bokaro areas represent parts of the one depositional basin. However, the role of intrusives in East Bokaro Basin have

appreciably increased the rank of these coals which is apparent in Dhori and Angwali blocks.

G. K. B. Navale & Rakesh Saxena

Contributed to the preparation of activities of International Geosphere—Biosphere Programme.

B. S. Venkatachala, H. P. Singh, H. K. Maheshwari and A. Rajanikanth

Contributed to the preparation of Radio Serial on 'Human Evolution.'

B. S. Venkatachala, H. P. Singh, Manoj Shukla and Mukund Sharma

## International Geological Correlation Programmes

### **I.G.C.P. Project No. 136: Numerical calibration of the geological time scale**

A. P. Srivastava, Junior Scientific Officer,  
Member, International Working Group

### **I.G.C.P. Project No. 216: Global Biological Events in Earth History**

K. P. Jain, Assistant Director (Sp. Gr.)  
Member, National Working Group

### **I.G.C.P. Project No. 237: Gondwana Flora**

H. K. Maheshwari, Assistant Director (Sp. Gr.)  
Member, National Working Group  
Co-Convener, National Working Group

R. S. Tiwari, Assistant Director (Sp. Gr.)  
Member, National Working Group

### **I.G.C.P. Project 245 : Non-marine Cretaceous Correlation**

K. P. Jain, Assistant Director (SG)  
Suresh C. Srivastava, Assistant Director,  
Members, National Working Group

### **I.G.C.P. Project No. 261: Stromatolites**

Manoj Shukla, Senior Scientific Officer  
Member, National Working Group

## Global Sedimentary Geology Programme (IUGS)

### **Cretaceous Resources/Events and Rhythms (CRER)**

K. P. Jain, Assistant Director (Sp. Gr.),  
Member, National Working Group

## Doctoral Thesis Submitted

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Name	University	Title of Thesis
<b>J. S. Antal</b>	Lucknow	Studies on Tertiary plants from the Himalayan foot-hills of North Bengal

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## Papers Submitted

- Agarwal, Anil**—Fossil wood of *Grewia* from Neyveli Lignite deposits, India. *Vegetos*.
- Agarwal, Anil**—Studies of leaf-compression from Neyveli Lignite deposits, India. *Phytomorphology*.
- Ambwani, K.**—Leaf-impressions belonging to the Tertiary age of north east India. *Phytomorphology*.
- Ambwani, K. & Kumar, M.**—Occurrence of vicin threads in *Daemonorops ruber* Bl. *Curr. Sci*.
- Awasthi, N. & Srivastava, R.**—Additions to the Neogene flora of Kerala Coast, India. *Geophytology*.
- Awasthi, N., Mehrotra, R. C. & Lakhanpal, R. N.**—Leaves of *Podocarpus* and *Mesua* from the Oligocene sediments of Makum Coalfield, Assam, India. *Geophytology*.
- Bajpai, Usha & Maheshwari, H. K.**—On two enigmatic infructescences from the Permian Gondwana of Rajmahal Hills. *Palaeobotanist*.
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- Bhattacharyya, A., Yadav, R. R., Borgaonkar, H. P. & Pant, G. B.**—Growth-ring analysis of Indian tropical trees: Dendroclimatic potential. *Curr. Sci*.
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- Chandra, Shaila & Singh, K. J.**—The genus *Glossopteris* from the Upper Permian beds of Handapa, Orissa, India. *Rev. Palaeobot. Palynol.*
- Chandra, Shaila & Srivastava, A. K.**—Occurrence of cordaitalean like foliage in the Lower Gondwana flora of India. *Acta palaeobot.*
- Chauhan, M. S. & Sharma, Chhaya**—Modern pollen/vegetation relationship in subtropical belt of Kumaon Himalaya, India. *Grana*.
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- Kapoor, H. M., Bajpai, Usha & Maheshwari, H. K.**—*Kashmiropteris meyenii* Kapoor: a probable cycadalean leaf from the Early Permian Mamal Formation in Kashmir Himalaya. *Palaeobotanist*.
- Kar, R. K.**—Two new spore genera from the Miocene sediments of north east India. *Geophytology*.
- Kar, R. K.**—Palynology of Miocene and Mio-Pliocene sediments of north-east India. *J. Palynol.*
- Khowaja-Ateequzaman, Garg, R. & Jain, K. P.**—Some observations on dinoflagellate cyst genus *Alterbidinium* Lentin & Williams 1985. *Palaeobotanist*.
- Kumar, M.**—Palynological and palaeoecological studies of Palaeocene coal seams in Jarain and Laitrynbai areas, Jaintia Hills, Meghalaya. *Geophytology*.
- Kumar, P.**—Palynodating of Chaugan beds exposed near Khatama Caves. Hoshangabad District, Madhya Pradesh, India. *Geophytology*.
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- Maithy, P. K.**—On *Krishnania* Sahni & Shrivastava, a mid-Proterozoic macrofossil. *J. palaeont. Soc. India*.
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- Misra, B. K. & Singh, Alpna**—*Meliapollis* complex: a re-evaluation of the genus *Meliapollis* (Sah & Kar) Navale & Misra 1979. *Rev. Palaeobot. Palynol.*
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- Prasad, M.**—Fossil fern *Goniopteris prolifera* Presl. from the Siwalik sediments near Nainital, U.P., India. *Curr. Sci.*
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- Sahni, A., Venkatachala, B. S., Kar, R. K., Rajanikanth, A., Prakash, T., Prasad, G. V. L. & Singh, R. Y.**—New palynological data from the Deccan Intertrappeans: Implications for the latest record of Dinosaurs and synchronous initiation of volcanic activity in India. *Nature*.

- Saini, D. C.**—Additions to the flora of upper Gangetic Plain—II. *Indian J. Forestry*.
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- Saini, D. C.**—New records for flora of Gorakhpur. *Jl econ. tax. Bot.*
- Saini, D. C.**—New distributional record of *Kallstroemia pubescens* (G. Don) Dandy from upper Gangetic Plain. *Geophytology*.
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- Saxena, R. & Navale, G. K. B.**—A proposal to coal typology. Gondwana Working Group, 43rd I.G.C.P., Port Alegre.
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- Saxena, R. K.**—New specific epithets for some later homonym palynofossil taxa from the Indian Tertiary sediments. *Taxon*.
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- Shukla, Manoj, Sharma, Mukund, Bansal, Rajendra & Venkatachala, B. S.**—Pre-Ediacaran assemblages from India and their evolutionary significance. *Glaessner memorial volume, Mem. Geol. Soc. India*.
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- Singh, Alpana**—Note on the orientation pattern of striations in the genus *Schizaeoisporites* Potonie 1951. *Palaeobotanist*.
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- Singh, Alpana & Singh, B. D.**—Particulate organic matter in relation to depositional aspects of the main lignite seam in Neyveli Lignite field, Cauvery Basin, India. *Indian J. Geol.*
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- Jafar, S. A., Mainali, U. C., Awasthi, N., Singh, O. P., Misra, B. K. & Tripathi, S. K. M. (1990).** Significance of calcareous nannofossils exuded from mud-volcanoes and terrestrial palynofossils/vegetal matter in flysch outcrops, Andaman-Nicobar Island, India. *Seminar on Recent Geoscientific Studies in the Bay of Bengal and the Andaman Sea; Department of Science & Technology Thematic Workshop on Bengal and Nicobar fans, Calcutta* : 25-26.
- Jafar, S. A. (1991).** The principle of magnitude meaning of being small. *IGA short course, Techniques in Micropalaeontology Application of Electron Microscopy, Punjab University, Chandigarh* : 162-167.
- Jafar, S. A. (1991).** Electron microscopy of nannofossils. *IGA Short course, Techniques in Micropalaeontology Application of Electron Microscopy, Punjab University, Chandigarh* : 168-174.
- Saxena, R., Navale, G. K. B., Chandra, D. & Prasad, Y. V. S. (1990).** Effect of stratigraphy on spontaneous combustion of coal in the Gondwana Basin of Raniganj Coalfield, Bihar, India. *International Coal Symposium (in honour of Prof. Peter Hacquebard). Proc. VII Annual Meeting of the Soc. for Organic Petrology, Calgary, Canada.*
- Srivastava, A. P. & Rajagopalan, G. (1990).** Radiometric dating method for petrified wood and its application to fossils from Deccan Intertrappean beds. *7th International conference on Geochronology, Cosmochronology and Isotope Geology. ANU, Canberra, Australia.*
- Srivastava, Shyam C. (1990).** Compressed Triassic fructifications from India and their usefulness in Gondwana. *3rd International Senckenberg Conference, Frankfurt, Germany.*

- Srivastava, Shyam C. & Manik, S. R. (1990).** Indian seed compressions from Triassic of Nidpur in evolutionary perspective. *II European Palaeobotanical Conference, Madrid, Spain.*
- Venkatachala, B. S., Rajagopalan, G., Kar, R. K. & Rajanikanth, A. (1990).** Palynological studies and  $^{14}\text{C}$  dating of a gravity core from the sea bed west of Narcondam Island in the Andaman Sea. *Sem. Recent Geoscientific Studies Bay of Bengal and Andaman Sea, Calcutta* : 19.

## Field Excursions

### **Ambwani, K.**

A field excursion to Garo Hills, Meghalaya was undertaken. About 220 rock samples for palynological investigation were collected from the different localities of this region.

### **Awasthi, N.**

A joint field excursion with Prof. T. Tokuoka and party from Shimane University, Japan was undertaken to the Siwalik of Nepal around Butwal and Barghat area and collected plant megafossils.

### **Awasthi, N. & Prasad, M.**

Collected plant megafossils from the Siwalik of Arjun Khola, Surai Khola and from west Deokhuri Valley, Nepal.

### **Bhattacharyya, A.**

Measured tree ring widths of dated tree-ring sequences of *Cedrus deodara* and *Cedrela toona* at the Indian Institute of Tropical Meteorology, Pune.

Tree ring samples from dry temperate forest, Kinnaur, Himachal Pradesh were collected.



Lithological contact between Lakadong Limestone and Lakadong Sandstone members of the Sylhet Limestone Formation, Cherrapunji area, Meghalaya.



Chui Hill section near Jabalpur, Madhya Pradesh showing Gondwana, infra- and Deccan Intertrappean sediments.

**Chandra, Anil**

Field work at 115 m thick diatomite section of the Monterey Formation, California was undertaken.

**Jana, B. N.**

Collected palynological samples from outcrop sections as well as bore cores of north western part of Talcher Coalfield and also from Athgarh Formation.

**Kar, R. K.**

Visited Geology Department, Oil India Limited, Duliajan, Assam to finalize a paper entitled, "Palynological study of Upper Tertiary sediments in Upper Assam Basin" in collaboration with the geologists of Oil India Limited.



A Quaternary section showing laminations near Bhim Tal, Kumaon Himalaya.

A field excursion for about a month was undertaken in Assam, Mizoram and Tripura to collect palynological samples from Bhuban Formation.

**Kumar, Pramod**

Collected rock samples from Mohpani Village (Narsinghpur District), along Sitarewa River.

Collected samples from the Jabalpur Formation in Katni area near Kharaura and Paharua villages.

Collected rock samples (Jabalpur Formation) from Barkhera and Bhonpar villages along Mahanadi River.

**Maithy, P. K. & Babu, Rupendra**

Collected samples and stromatolites from the Vindhyan sediments exposed around Damoh-Rehli and Satna, Madhya Pradesh.

**Prasad, Mahesh**

Collected plant megafossils from the Siwalik sediments of Haridwar, Kalagarh, Kathgodam and Koilabas (at Indo-Nepal Border), Uttar Pradesh.

**Rajagopalan, G. & Srivastava, A. P.**

Field excursion to Vindhyan exposures at and around Jhalawar and Taraj, south-east Rajasthan has been made to collect glauconitic sandstone samples.

**Rajanikanth, A.**

Collected suitable rock samples for palynological investigations from the "infra" trappean sediments of Jabalpur and Rajahmundry areas.

Study tour to French Institute, Pondicherry was undertaken.

**Ram-Awatar & Meena, K. L.**

Visited Belpahar, Gopalpur and Shahdol area of Son-Mahanadi Graben. Collected bore-core and out-crop samples (Orissa and Madhya Pradesh).

**Saraswat, K. S.**

Collected archaeobotanical remains from an ancient mound in the village Senuwar, district Rohtas, Bihar.

**Sarate, O. S.**

Field excursion was undertaken to collect samples from various localities of Godavari Graben. About 350 samples have been collected during this excursion. The



Coring operation to collect sedimentary profile from Jorepakhri Lake, Darjeeling



*Inzeria* Krylov 1963 from Tadpatri Formation, Cuddapah Supergroup exposed on the Pulivendla-Vempalle Road.

samples represent Kothagudem, Koyagudem, Belampalli, Manuguru (Malug coal belt, i.e., Bhopalpalli and Chelpur areas).

#### **Sarkar, Samir**

A field trip was undertaken in Arjun Khola area of Nepal to collect Siwalik samples from profile 12 and 13 of Lamahi-Ghorai Road. Stratigraphically located Siwalik samples were collected from two new localities, viz., Bhalubong and Rehar for correlation purpose.

#### **Saxena, R.**

Participated in the post conference excursion to Canadian coalfields along the Rocky Mt. Hills. The characteristic features of Canadian coalfields were studied.

#### **Sharma, Chhaya, Chauhan, M. S. & Gupta, Asha**

Undertook field excursion to Garhwal Himalaya and collected 7 soil profiles and 21 surface samples from sub-tropical and temperate zones of Dehradun and

Uttarkashi respectively. Modern plant specimen alongwith polleniferous materials were also collected from this region.

**Sharma, Chhaya, Chauhan, M. S. & Pant, M. C.**

Undertook field excursion to Kumaon Himalaya in collaboration with Kumaon University and collected about 100 samples from different localities from Bilaspur Quaternary Section.

**Sharma, Mukund**

Systematic sampling of chert and stromatolites from Tadpatri, Pulivendla, Vempalle and adjoining areas was done.

**Sharma, Mukund and Bansal, Rajendra**

Systematic sampling and preparation of lithologs of various quarries exposed around Rohtasgarh. Stromatolites and cherts have been collected from Harna, Sihaldeh, Nauhatta, Jaradag and Jadunathpur, district Rohtas, Bihar.

**Singh, K. J.**

Visited Talcher Coalfield, localities near Saranga Village, Dhebanol District, and near Tehranpur Village, Dhenkanal District to collect plant animal and sedimentary structures from Talchir Formation.

**Singh, R. S.**

A field trip to collect palynological samples from Garo Group, Meghalaya was undertaken.

**Srivastava, Shyam C.**

Field work was undertaken in Devonian, Maastrichtian (Upper Cretaceous) and Tertiary localities, in Germany, Netherlands and Messel floras of (petroleum bearing sediments) Germany respectively.

**Chandra, Anil**

Visited Monterey, California to study the famous 115 m thick diatomite section of the Monterey Formation (Miocene).

## Papers presented at Symposia/Conferences/Meetings

- Guleria, J. S.**—African elements in the Upper Tertiary flora of Rajasthan, western India. *IIIrd Euro-African-Regional Wood Anatomy Symposium*, Zurich, Switzerland.
- Guleria, J. S.**—A fossil wood of *Ziziphus* showing ring-porosity from Rajasthan, Western India. *IIIrd Euro-African-Regional Wood Anatomy Symposium*, Zurich, Switzerland.
- Jafar, S. A.**—Nannoplankton biostratigraphy and palaeoenvironmental framework of Cretaceous Palaeocene sedimentaries of Andaman Islands, India. *Group Monitoring Workshop in SERC Projects in Earth Sciences, Department of Science & Technology*, New Delhi, BSIP, Lucknow.
- Jafar, S. A.**—Calcareous nannofossils from mud-volcanoes. *CSIR-DAAD Symposium on biosciences*, Lucknow (Poster Presentation).
- Jafar, S. A., Mainali, U. C., Awasthi, N., Singh, O. P., Misra, B. K. & Tripathi, S. K. M.**—Significance of calcareous nannofossils exuded from mud-volcanoes and terrestrial palynofossils/vegetal matter in flysch outcrops, Andaman-Nicobar Island, India. *Seminar on Recent Geoscientific Studies in the Bay of Bengal and the Andaman Sea and Department of Science & Technology, Thematic Workshop on Bengal and Nicobar fans*, Calcutta.
- Kar, R. K.**—Palynological studies and  $^{14}\text{C}$  dating of a gravity core from the sea bed, west of Narcondam Island in the Andaman Sea. *Seminar on Geoscientific studies in the Bay of Bengal and the Andaman Sea*, Calcutta (with Venkatachala, B. S.; Rajagopalan, G. & Rajanikanth, A.).
- Shukla, Manoj & Sharma, Mukund**—Palaeobiology of Suket Shale, Vindhyan Supergroup—Age implications. *Workshop on Precambrian of central India*, Nagpur.
- Saxena, R.**—Effect of stratigraphy on the spontaneous combustion of coal from the Gondwana Basin of Raniganj Coalfield, Bihar, India. *International 'Coal Symposium' (in honour of Prof. Peter Hacquebard)*.
- Srivastava, A. P.**—“Radiometric dating method for petrified wood and its application to fossils from Deccan Intertrappean beds. *7th International conference on Geochronology, Cosmochronology and Isotope Geology*, Australian National University, Canberra, Australia.
- Vijaya & Tiwari, R. S.**—Impact of Gondwanic palynofloras on East Tethyan realm during Permian and Triassic times. *Third International Symposium on shallow Tethys*, Sendai, Japan.

## Lectures delivered

- S. A. Jafar**—*The principle magnitude meaning of being small*, IGA short course. Techniques in Micropalaeontology. Application of Electron Microscopy, Punjab University, Chandigarh.  
—*Electron microscopy of nannofossils*, IGA Short course. Techniques in Micropalaeontology. Application of Electron microscopy, Punjab University, Chandigarh.
- C. M. Nautiyal**—*Science and scientists* at Rotary Club, Meerut.  
—*Pribvi Ka Vikas*, Akashwani, Lucknow.
- G. Rajagopalan**—*Dating methods for archaeology*, National Research Laboratory for conservation of Cultural Property, Lucknow.  
—*Radiocarbon dating: method and applications* to scientists of the Central Ground Water Board, Lucknow.
- R. Saxena**—*Role and contribution of palaeontology in science and technology* at Akashwani, Lucknow.
- A. P. Srivastava**—*F-T dating of Vindhyan glauconitic sediments*, Department of Geology, Latrobe University, Melbourne, Australia.
- A. K. Srivastava**—“*Jivaashm : Vaijanik dharobar*”, Akashwani, Lucknow.
- Shyam C. Srivastava**—*Birbal Sabni Institute—a major palaeobotanical Centre and Gondwana palaeobotany in India* at the Department of Botany, University of Antwerp, Belgium.
- B. S. Venkatachala**—*Greening of the Earth*, J. C. Bose Memorial Lecture Series, Department of Science and Technology, New Delhi, April, 1990.  
—*Past of the Green World*, First Savitri Sahni Smarak Lecture, September, 1990.  
—*Synergy: need of the hour*, Presidential remarks to the 4th Savitri-Sahni Smarak Lecture, January, 1991.  
—*Scientific temper*, Address to Academic Staff College, Lucknow University, January, 1991 and Regional Science Centre, Aliganj, Lucknow, February, 1991.  
—*Plant fossils—the natural archives for signatures of past environment and climate*, International Geosphere Biosphere Programme (IGBP) workshop, National Physical Laboratory, New Delhi, February, 1991.  
—*Impact of plant fossil research on evolutionary Botany—Some thoughts*, Academic Staff College, Refresher course, Botany Department Lucknow University, March 1991.

## Technical Assistance rendered to Other Agencies

### **Training provided to outsiders**

Mr D. Franceschi, French Institute, Pondicherry was acquainted with tropical fossil pollen collection available in the Institute. Given training on wood anatomy of fossil and living Ebenaceae for a period of one week in July, 1990.

Mr M. Konomatsu, Ph.D. Student, Department of Geology, Osaka City University, Japan was given training on morpho-taxonomy of Siwalik leaves from January—February 1991.

### **Technical assistance to agencies/universities/institutes**

#### *Radiocarbon dating of samples for :*

French Institute, Pondicherry.

Physical Research Laboratory, Ahmedabad.

Wadia Institute of Himalayan Geology, Dehradun.

Geological Survey of India, Calcutta.

#### *SEM Facility*

Lucknow University, Lucknow

Allahabad University, Allahabad

Banaras Hindu University, Varanasi

French Institute, Pondicherry

#### *Others*

Coal Wing, Geological Survey of India, Calcutta

Himalayan Geology Division, G.S.I., Lucknow

## Deputation/Training/Study Abroad

### **Anil Chandra**

Participated in the 11th International Symposium on living and fossil diatoms at San Francisco, California (August, 1990). Also visited the Micropalaeontology Laboratory, Department of Geology, California State University, Los Angeles and Micropalaeontology Division of the Japan Petroleum Exploration Company Limited (JAPEX) at Chiba, Japan.

### **J. S. Guleria**

Participated in the III Euro-African Regional Wood Anatomy Symposium, Zurich, Switzerland during July, 1990. Visited Universitäts-Institut und Staatssammlung für Paläontologie und Historische Geology, Munich, Institut für Holzforschung (Institute for Wood Research), Munich and the Nature Museum, Senckenberg at Frankfurt, Germany.

### **R. Saxena**

Participated in the International Coal Symposium in honour of Prof. Peter Hacquebard and participated in the VII Annual meeting of T.S.O.P. at Canada. Visited various coal microscopic facilities at Devon, Vancouver, Victoria and Alberta Research Council, Edmonton. Participated in group discussion on role of resin in spontaneous combustibility of coals, Washington, U.S.A.

### **A. P. Srivastava**

Participated in 7th International Conference on Geochronology, Cosmochronology and Isotope Geology held at Australian National University, Canberra, Australia from September 1990. Visited Radiocarbon Dating Laboratory in Research School of Earth Sciences, ANU, Canberra, Australia; Department of Biogenesis in Research School of Pacific Studies, ANU, Canberra, Australia; Geology Department, La-trobe University, Melbourne, Australia; Geotrack International, Melbourne, Australia.

### **Shyam C. Srivastava**

Participated in the 3rd International Senckenberg Conference; Frankfurt, Germany; also visited palaeobotanical and geological centres in Netherland and Belgium.

### **Vijaya**

Participated in 3rd International Symposium on shallow Tethys, Sendai, Japan in September, 1990.

## Courses/Lectures in the Institute by outside Scientists

- Professor Manfred Schidlowski : Stable isotope in the evolution of  
Max Planck Institute life, January, 1991  
fur Chemie, Mainz, Germany
- Dr John Rigby : Australian Permian flora  
Queensland Department September, 1990  
of Mines, Queensland  
Minerals & Energy Centre,  
Brisbane, Australia

## Deputation to Conferences/Symposia/Seminars/ Workshops

- |  |   |
|--|---|
| <b>Manoj Shukla &amp; Mukund Sharma</b>        | . Workshop on Precambrian of central India, Nagpur August, 1990   |
| <b>A. Rajanikanth</b>                          | . Workshop on Deccan volcanics, Geological Survey of India, Nagpur, September, 1990   |
| <b>B. S. Venkatachala</b>                      | . Group Monitoring Workshop in Earth Sciences, Lucknow, September, 1990   |
| <b>R. K. Kar</b>                               | . Geoscientific studies in Bay of Bengal and the Andaman Sea, Calcutta, October, 1990   |
| <b>G. Rajagopalan</b>                          | . Seminar on Geoscientific studies on Bay of Bengal and Andaman Sea, Geological Survey of India, October, 1990  |
| <b>K. S. Saraswat</b>                          | . Seminar on Archaeological perspectives of U.P. and future prospects, U.P. State Archaeological Organization, Lucknow, October 13-15, 1990   |
| <b>P. K. Maithy</b>                            | . C.S.I.R.—DAAD Symposium on Biosciences, Lucknow, November, 1990   |
| <b>Chhaya Sharma</b>                           | . Group Monitoring Workshop in Atmospheric Science, IITM, Pune, December, 1990; presented the work carried out in the D.S.T. sponsored project (ES/63/028/86)<br>. International Seminar on "Rising trends in Palaeo-anthropology, environmental changes and human response (last two million years)", Deccan College, Pune, December, 1990 |
| <b>C. M. Nautiyal</b>                          | . V National Symposium on Mass Spectrometry, Physical Research Laboratory, Ahmedabad, January, 1991   |
| <b>B. S. Venkatachala &amp; A. Rajanikanth</b> | . Asian Workshop on the International Geosphere—Biosphere Programme—A study of global change, National Physical Laboratory, New Delhi, February, 1991   |
| <b>G. Rajagopalan</b>                          | . Discussion meeting on $^{14}\text{C}$ technique, Physical Research Laboratory, Ahmedabad, February, 1991  |
| <b>Shyam C. Srivastava</b>                     | . 78th Indian Science Congress, Indore, 1991  |

## Representation in Committees/Boards

- |                           |  |
|---------------------------|--|
| <b>J. S. Antal</b>        | . Editor, Geophytology   |
| <b>Anand-Prakash</b>      | . Treasurer, Indian Association of Palynostratigraphers  |
| <b>N. Awasthi</b>         | . Chief Editor, Geophytology   |
|                           | . Editor, Newsletter, The Palaeobotanical Society  |
|                           | . Member, Managing Council, Indian Association of Palynostratigraphers   |
| <b>Usha Bajpai</b>        | . Member, Managing Council, Indian Association of Palynostratigraphers   |
| <b>M. B. Bande</b>        | . Member, Executive Committee, The Palaeobotanical Society   |
| <b>Anil Chandra</b>       | . Member, Executive Council, Indian Society of Geoscientists   |
| <b>Shaila Chandra</b>     | . Vice President, Indian Society of Geoscientists  |
| <b>J. S. Guleria</b>      | . Representative for Asian Countries, III Euro-African-Regional Wood Anatomy Symposium, Zurich, Switzerland        |
|                           | . Member, Symposium on Resolution Committee, III Euro-African-Regional Wood Anatomy Symposium, Zurich, Switzerland |
| <b>H. P. Gupta</b>        | . Business Manager, Indian Association of Palynostratigraphers   |
| <b>K. P. Jain</b>         | . Secretary, Indian Association of Palynostratigraphers  |
|                           | . Member, National Working Group, IGCP-216   |
|                           | . Member, National Working Group, IGCP-245   |
|                           | . Member, National Working Group, IUGC-CRER  |
| <b>Asha Khandelwal</b>    | . Joint Secretary, The Palaeobotanical Society   |
| <b>Hari K. Maheshwari</b> | . Member, Committee for Fossil Plants, International Association for Plant Taxonomy                                |
|                           | . Editor, The Palaeobotanist   |
|                           | . Editor, Indian Association of Palynostratigraphers   |
|                           | . Co-Editor, Asian Journal of Plant Science  |
|                           | . Member, National Working Group, IGCP-237   |
| <b>P. K. Maithy</b>       | . Member, Editorial Board, Geoviews  |

- B. K. Misra** . Joint Secretary, Indian Society of Geoscientists
- G. K. B. Navale** . Member, International Committee of Coal Petrology  
 . Member, International Commission of Coal Nomenclature and Analysis  
 . Member, Editorial Board, International Journal of Coal Geology  
 . Member, Indian Standard Institution (Coal)
- K. S. Saraswat** . Secretary (Technical), Indian Archaeological Society, New Delhi
- R. K. Saxena** . Secretary, Indian Society of Geoscientists  
 . Member, Editorial Board, ISG Bulletin
- Manoj Shukla** . Editor, Geophytology
- H. P. Singh** . Editor, Palaeobotanist  
 . Treasurer, The Palaeobotanical Society  
 . Member, Editorial Board, Geophytology
- A. K. Srivastava** . Treasurer, Indian Society of Geoscientists
- Suresh C. Srivastava** . Secretary, The Palaeobotanical Society  
 . Member, Managing Council, Indian Association of Palynostratigraphers  
 . Member, Editorial Board, Geophytology
- R. S. Tiwari** . Editor, The Palaeobotanist  
 . Member, Executive Council, Indian Society of Geoscientists  
 . Member, Executive Council, The Palaeontological Society of India  
 . Co-Editor, Asian Journal of Plant Sciences  
 . Member, National Working Group, IGCP-237
- S. K. M. Tripathi** . Member, Executive Council, The Palaeobotanical Society
- B. S. Venkatachala** . Vice-President, International Federation of Palynological Societies  
 . Member, Committee for Fossil Plants, International Association for Plant Taxonomy  
 . Member, Editorial Board, Acta Palynologica, Montpellier, France  
 . Chief Editor, The Palaeobotanist

- . President, The Palaeobotanical Society
- . Chairman, Programme Advisory and Monitoring Committee of the Palaeoclimate and Palaeoenvironmental Research, Department of Science & Technology
- . Member, National Committee on National Core and Drill Cutting Sample Library, Department of Science & Technology
- . Member, Research Advisory Committee, Wadia Institute of Himalayan Geology, Dehradun
- . Member, Committee on Radio Serial—"Human Evolution", National Council for Science and Technology Communication, New Delhi
- . Expert Member, Board of studies in Botany, Garhwal University, Srinagar (Garhwal), Uttar Pradesh
- . Member, Managing Council, Indian Association of Palynostratigraphers

**Vijaya**

## Honours and Awards

**Chhaya Sharma**

- . Elected, Fellow of Indian Association of Palynostratigraphers

**Rakesh Saxena**

- . Elected, Member of the Society for Organic Petrology, Canada

## Publications of the Institute

### **The Palaeobotanist**

Volume 38 of the journal, "Palaeobotanist", was brought out as a special volume on the Proceedings of the Symposium "Vistas in Indian Palaeobotany" held at the Institute. In all, it comprises 43 papers in 415 printed pages.

Manuscripts of the next volume 39, number 1 were also sent to Press.

### **Birbal Sahni Memorial Lecture**

Manuscript of the Nineteenth Birbal Sahni Memorial Lecture "Rates of floral turn-over and diversity change in the fossil record" delivered by Norman Frederiksen, United States Geological Survey was sent to Press. Its proofs were also corrected and returned to Press.

### **Sir Albert Charles Seward Memorial Lecture**

The 35th A. C. Seward Memorial Lecture entitled "Floristic composition and distribution of evergreen forests in the Western Ghats, India" by Dr J. P. Pascal, Director, French Institute, Pondicherry was sent to Press. Its bromide pulls were checked and returned to Press.

### **Research Activities—1985-1990**

A special Report comprising 172 pages on the Research Activities of the Institute during 1985-1990 was published. It incorporates scientific activities related to national and international research programmes. It also includes information on papers published, field excursions, representation in committees/boards, honours and awards, deputation to conferences, organisational structure.

### **Annual Report**

Annual Reports of the Institute, both in English and Hindi were published and sent to various departments, institutions and universities.

The publications of the Institute netted an income of Rs. 2,36,688.80, out of which about Rs. 71,000 were earned in foreign exchange which is approximately equivalent to U.S. \$ 3,956.75.

## Library

The holdings of the Library are:

Particulars	Additions during 1990-1991	Total
Books	62	4391
Journals	103	9259
Reprints	456	33370
Microfilms/Fisches	—	290
Theses	3	82
Reports	—	46
Maps & Atlases	—	55
Reference Books	4	184

The services of the Library were also made available to scientists of other organisations and universities. The total number of registered borrowers is 123. Sixty nine current periodicals are being procured on exchange basis and sixty five current periodicals are subscribed by the Library.

### Reprint Section

(i) Reprints of research papers purchased	64
(ii) Reprints sent out in exchange	6079
(iii) Institutions on exchange list	57
(iv) Individuals on exchange list	362

### Library facility provided to:

Lecturer in Geology, NEHU, Shillong  
 Department of Botany, M.L.K. College, Balrampur  
 Department of Botany, Lucknow University, Lucknow  
 Faculty of Science, Osaka City University, Osaka, Japan  
 Publication and Information Directorate, CSIR, New Delhi  
 P.G. Department of Geology, Utkal University, Vali Vihar, Orissa  
 Ms J. B. Thompson, The Australian National University, Canberra, Australia

## Herbarium

Preparation of the inventory of Herbarium holdings and re-arrangement of pollen slides are in progress. About 141 plant specimens have been collected from Badrinath and Kedarnath, Uttar Pradesh Himalaya.

The holdings of the herbarium materials are:

Particulars	Addition during 1990-1991	Total
<b>Herbarium</b>		
Herbarium sheets of plant specimens	232	12,140
Herbarium sheets of leaf specimens	10	260
<b>Xylarium</b>		
Wood blocks	—	3,935
Wood discs	—	29
Wood core samples	—	187
Wood slides	—	4,705
<b>Sporothek</b>		
Polleniferous material	740	1,190
Pollen slides	—	11,384
<b>Carpothek</b>		
Fruits/seeds	30	2,101
Photo negatives	—	5

### Plant material received from :

Department of Quaternary Biogeography  
& Archaeobotany 740 pollen samples

### Exchange/Loan Programme

Material sent to:

Dr R. R. Yadav 40 core samples  
Laboratory of Dendroclimatochronology  
Institute of Botany, 53, Laisves aleya  
Kaunas 233 000, Lithuania  
USSR

### Herbarium facility provided to:

Dr M. P. Singh  
Department of Botany  
Uttar Pradesh, P.G. College, Varanasi

Dr S. C. Tripathi  
Department of Botany  
Gorakhpur University, Gorakhpur

Dr Kamal  
Department of Botany  
Gorakhpur University, Gorakhpur

Professor David K. Ferguson  
Rijksuniversitair Centrum  
University of Antwerp  
Antwerp, Belgium

Dr A. D. H. Bivar  
School of Oriental and African studies  
University of London, London

Dr Masahiko Kowonatsv  
Department of Geoscience  
Osaka City University  
Sumiyoshi, Osaka City, 558, Japan

## Museum

Computerised Inventory (Part I) of the fossil specimens displayed in both the Halls of Museum has nearly been completed.

National Science Day was celebrated on February 28, 1991 at the Institute. The Museum and laboratories of the Institute observed this day as an Open House for the benefit of general public. A stall was put up at the Regional Science Centre, Lucknow during the Science Festival depicting our activities. General public and students took interest in our exhibits.

For dissemination and popularization of Science of Palaeobotany, fossil specimens were gifted to seven educational Institutions in the country. A set of fossil plants from different geological horizons was gifted to the National Science Centre, Delhi for their gallery—"Information imbibed in nature". A lecture was also arranged for the benefit of graduate students of I.T. Degree College, Lucknow.

Fossil specimens/samples collected by the Institute staff from 109 localities as a result of their field work were registered. Samples/specimens received from other organizations were also registered and passed on to the concerned scientists for investigations.

Scientists from Japan, Germany, U.K., U.S.A., Belgium and Australia also visited the Institute's Museum.

### Type and Figured specimens/slides/negatives

Type and Figured specimens of thirty six research papers were deposited in the Institute repository.

Teachers and students of nine educational institutions visited the Museum of the Institute.

	Additions during the year	Total
Type and Figured specimens	161	4,859
Type and Figured slides	181	10,194
Negatives of the above	350	13,060

### New Collections

Institute staff have submitted specimens/samples as detailed below collected during field excursion

Departments	Specimens/Samples	
Non-vascular Plants	22	—
Palaeophytic Evolutionary Botany	230	—
Mesophytic Evolutionary Botany	—	361
Cenophytic Evolutionary Botany	1121	—
Quaternary Biogeography and Archaeobotany	463	—
Pre-Gondwana & Gondwana Palynostratigraphy	—	903

Post-Gondwana Palynostratigraphy of Peninsular India	—	486
Post-Gondwana Palynostratigraphy of Extra-Peninsular India	—	443
Biodiagenesis	—	247
Planktonology	—	229

**Specimens/samples received for investigation**

Director Himalayan Geology Division G.S.I., Northern Region, Lucknow Calcutta		9
Palaeontology Division G.S.I., Northern Region, Lucknow		572 5
G.S.I., Bhutan Unit, Samchi		14
Director I/C, Tamil Nadu/Karnataka & Pondicherry, G.S.I.		21

**Presentation of fossil specimens within the country**

Jamshedpur Workers College, Jamshedpur		
Institute of Sciences, Aurangabad		
P.G. Department of Botany, Darjeeling Government College, Darjeeling		
Department of Botany, N.K. Mahavidyalaya, Lucknow		
Department of Botany, Lucknow Christian College, Lucknow		
Department of Geology, Mahila Vidyalaya, Lucknow		
Regional Science Centre, New Delhi, Lucknow		
National Science Centre, New Delhi		

## Visitors during the Year

Group of Forest Range Officers, Training College, Balaghat, M.P.

Department of Botany, Magadh University, Bodhgaya, Bihar

Department of Botany, I.T. College, Lucknow, U.P.

Lucknow University, Lucknow, U.P.

Bharat Kala Bhawan, Banaras Hindu University, Varanasi, U.P.

Bipin Bihari College, Jhansi, U.P.

St. Teresa's College, Cochin, Kerala

Panchaiyappa College, Madras, Tamil Nadu

D.A.V. College, Kanpur, U.P.

### **Distinguished Visitors**

Dr Dan Wujek

Biology Department, Central Michigan University  
U.S.A.

Prof. M. M. Johri

Tata Institute of Fundamental Research, Bombay

Dr R. P. Verma

Chief of Geology and Drilling  
C.M.P.D.I., Ranchi

Dr Nachiketa Das

Department of Science & Technology  
New Delhi

Dr H. N. Srivastava,

Additional D.G.M., Indian Meteorology Department,  
Pune

Dr Franceschi

French Institute, Pondicherry

Prof. Katsumi Takayasu

Department of Geology, Shimane University  
Matsuo 690, Japan

Professors Manfred and Ingrid

Schidlowski, Max Planck Institut fur chemie  
Mainz, Germany

Drs David and Micke Ferguson

University of Antwerp, Antwerp  
Belgium

Dr Masahiko Konomatsu  
Department of Geosciences, Osaka University  
Osaka, Japan

Dr Makolin Grant  
SOAS, University of London, England

Mary and Fred Snowdon  
291 Coniscliffe Road,  
Darlington DL3 8AA, England

Dr M. Kedves,  
Cell Biology & Evolutionary Micropalynology Lab  
University of Szeged, Hungary

Prof. R. N. Kapil  
Department of Botany  
University of Delhi, Delhi

Dr M. M. Nair  
Indian Agricultural Research Institute, New Delhi

Mr R. M. Chakraborti  
Nehru Science Centre, Bombay

## Founder's Day Celebrations 1990

Founders Day was celebrated on 14th November, 1990. In the morning floral tributes (*PUSHPANJALI*) were offered on the Samadhi of Professor Birbal Sahni. In the evening, the 20th Professor Birbal Sahni Memorial lecture was organised. Welcoming the distinguished guests, Dr H. P. Singh, Deputy Director, Birbal Sahni Institute of Palaeobotany recalled the ideals of Professor Sahni and voiced his services rendered to science. Professor C. V. Subramanian was the Chief Guest at the function. In his address he appealed to the scientists to emulate the scientific spirit of Professor Sahni.

Professor K. S. Valdiya, Head, Department of Geology, Kumaun University, Nainital delivered the 20th Prof. Birbal Sahni Memorial Lecture on "Late Precambrian basins in the Himalaya : Tectonics, sedimentation and life". A vote of thanks was proposed by Dr G. K. B. Navale, Assistant Director (SG), Birbal Sahni Institute of Palaeobotany, Lucknow.

## Republic Day Celebrations 1991

The Republic Day Celebration, on January 26, 1991 began with unfurling of the National Flag by the Director, Dr B. S. Venkatachala. Later, he addressed the staff and exhorted the scientists to meet their societal obligations by taking science to people for bringing in general awareness and scientific culture. The B.S.I.P. staff along with active co-operation of Facultative Consultative Committee, Joint Consultative Committee and Ladies Club of the Institute organised programmes of games and a cultural show. The cultural programme was organised in the Auditorium of the Institute. The staff and their family members participated in a variety of items like dance, drama, music and fancy dresses.

## Scientists

### Director

B. S. Venkatachala, Ph.D., F.G.S., F.Pb.S., F.Pn.S.

### Distinguished Scientist (w.e.f. 27.2.1991)

Hari P. Singh, Ph.D., F.Pb.S.

### Assistant Directors (Special Grade)

Krishna P. Jain, Ph.D., F.Pb.S., F.I.A.P., F.P.S.

Ranjit K. Kar, Ph.D., F.Pb.S.

Hari K. Maheshwari, Ph.D., F.Pb.S., F.I.A.P., F.P.S.

Prabhat K. Maithy, Ph.D., F.Pb.S.

Garud K. B. Navale, Ph.D., F.G.S., F.G.M.S., F.I.A.M.S., F.Pb.S.

Govindraja Rajagopalan, Ph.D., F.Pb.S., F.S.G.

Ram S. Tiwari, Ph.D., F.Pb.S., F.I.A.P., F.P.S., F.S.G.

### Assistant Directors

Anand-Prakash, Ph.D., F.I.A.P.

Nilambar Awasthi, Ph.D., F.Pb.S., F.I.A.P.

Mohan B. Bande, Ph.D.

Jayasri Banerji, Ph.D.

Anil Chandra, Ph.D., F.P.S., F.S.G.

Shaila Chandra, Ph.D., F.S.G.

Hari P. Gupta, Ph.D., F.I.A.P.

Syed A. Jafar, Dr.Phil.nat., F.P.S.

Kripa S. Saraswat, Ph.D., F.B.S.

Chhaya Sharma, Ph.D.

Shyam C. Srivastava, Ph.D.

Suresh C. Srivastava, Ph.D., F.I.A.P.

### Senior Scientific Officers

Krishna Ambwani, Ph.D.

Rahul Garg, Ph.D., F.P.S., F.S.G.

Jaswant S. Guleria, Ph.D.

Brijendra N. Jana, Ph.D.

Hafiz A. Khan, Ph.D.

Pramod Kumar, Ph.D.

Jagannath P. Mandal, Ph.D.

Chandra M. Nautiyal, Ph.D.

Ramesh K. Saxena, Ph.D., F.S.G., F.P.S.

Manoj Shukla, Ph.D., F.G.S.

Jaswant Singh, Ph.D.

Ashwini K. Srivastava, Ph.D.

Gajendra P. Srivastava, Ph.D.

Archana Tripathi, Ph.D., F.P.S.

Vijaya, Ph.D., F.L.S., F.P.S.

**Junior Scientific Officers**

Anil Agarwal, Ph.D.  
 Rupendra Babu, Ph.D.  
 Usha Bajpai, Ph.D.  
 Samir K. Bera, Ph.D.  
 Amalava Bhattacharyya, Ph.D.  
 Anant P. Bhattacharyya, Ph.D.  
 Chanchala, Ph.D.  
 Mohan S. Chauhan, Ph.D.  
 Asha Gupta, Ph.D.  
 Neerja Jha, Ph.D.  
 Asha Khandelwal, Ph.D.  
 Khowaja-Ateequazzaman, Ph.D.  
 Madhav Kumar, Ph.D.  
 Bhagwan D. Mandaokar, Ph.D.  
 Surendra R. Manik, Ph.D.  
 Kalyan L. Meena, Ph.D.  
 Kindu L. Meena, Ph.D.  
 Rakesh C. Mehrotra, Ph.D.  
 Basant K. Misra, Ph.D.  
 Neeru Prakash, Ph.D.  
 Mahesh Prasad, Ph.D.  
 Annamraju Rajanikanth, Ph.D.  
 Jyotsana Rai, Ph.D.  
 Ram-Awatar, Ph.D.  
 Mulagalapalli R. Rao, Ph.D.  
 Dinesh C. Saini, Ph.D.  
 Omprakash S. Sarate, Ph.D.  
 Samir Sarkar, Ph.D.  
 Rakesh Saxena, Ph.D.  
 Mukund Sharma, M.Sc., F.G.S.  
 Alpana Singh, Ph.D.  
 Bhagwan D. Singh, Ph.D.  
 Kamal J. Singh, Ph.D.  
 Rama S. Singh, Ph.D.  
 Abhay P. Srivastava, Ph.D.  
 Rashmi Srivastava, Ph.D.  
 Rajni Tewari, Ph.D.  
 Surya K. M. Tripathi, Ph.D.  
 Gyanendra K. Trivedi, Ph.D., F.P.S.  
 Ram R. Yadav, Ph.D.

**Research Fellows***Sponsored Projects*

Rajendra Bansal, M.Sc., F.G.S.  
 Mukesh Pant, M.Sc.

*C.S.I.R. Fellow*

Om Prakash Singh, M.Sc.

## Technical and Administrative Personnel

### Publication

Jaswant Singh, Ph.D. (Joint Editor—Scientist)

### Library

Jagendra N. Nigam, B.A., B.Lib.Sc. (S.T.A.—Librarian)

Ajai K. S. Rathore, B.Sc., B.Lib.Sc. (S.T.A.—Library)

Kavita Kumar, B.Sc., B.Lib.Sc. (J.T.A.—Library)

### Museum

Naresh C. Saxena, B.A. (S.T.A.—Museum)

Prem Prakash, B.Sc. (S.T.A.—Museum)

Sant R. Yadav, B.A. (Fossil Cataloguer)

### Herbarium

Jagdish C. Srivastava, M.Sc. (S.T.A.—Herbarium)

Diwakar Pradhan, B.Sc. (S.T.A.—Herbarium)

### Laboratory Services

Hirendra N. Boral, B.Sc. (T.O.)

Balasubramanian Sekar, B.Sc., A.I.C. (T.O.)

Indra Goel, B.Sc. (J.T.O.)

Asha Guleria, B.Sc. (J.T.O.)

Kamala M. Chhabra, B.Sc. (S.T.A.)

Madhabi Chakraborty, B.Sc. (S.T.A.)

Eknath G. Khare, B.Sc. (S.T.A.)

Tapan K. Mandal, B.Sc. (S.T.A.)

Vinod K. Singh, M.Sc. (S.T.A.)

Sunita Khanna, B.Sc. (S.T.A.)

Reeta Banerji, B.Sc. (J.T.A.)

Ramesh C. Misra, B.Sc. (J.T.A.)

Chandra Pal, B.Sc. (J.T.A.)

Vijay P. Singh, B.Sc. (J.T.A.)

Avinesh K. Srivastava, B.Sc. (J.T.A.)

Sangita Gupta, B.Sc. (L.A.)

Keshav Ram, B.A. (L.A.)

### Technical Services

Madhukar Arvind, B.Sc. (J.T.A.—Computer) (w.e.f. 1.6.1990)

Chandra Bali (Section Cutter)

Alok K. Ghosh (Electrician)

Chhotey Lal (Section Gutter)

Vijai S. Panwar (Glass Blower)

Purshottam S. Saluja (Mechanic)

### Photography and Drawing

Paresh C. Roy (S.T.A.—Photographer)

Pramod K. Bajpai, B.F.A. (J.T.O.—Artist)

Pradeep Mohan, B.F.A. (J.T.A.—Photography)

**Administration**

Surendra B. Verma, M.A., B.Com., D.P.A., LL.B. (Registrar)  
Suraj P. Chadha, B.A. (P.S. to Director)  
Hari S. Srivastava, B.Com. (S.O.[G])  
Bhagwan Singh (S.O.[A])  
Ramesh Chandra (Assistant)  
Nitya N. Joshi (Assistant)  
Radha Ballabh Kukreti (Jr. Assistant)  
V. Nirmala (U.D.C.)  
P. Thomas (U.D.C.)  
Usha Chandra (U.D.C.)  
Hari Lal (U.D.C.)  
Koshy Thomas (L.D.C.)  
Gopal Singh, B.A. (L.D.C.)  
S. Murukan Pillai, B.A. (L.D.C.)  
N. Unnikannan (L.D.C.)  
S. S. Rathore (L.D.C.)—(w.e.f. 4.3.1991)

**Accounts Section**

J. C. Singh, M.A. (Accounts Officer)  
Tej N. Shukla, B.A. (S.O. [F & A])  
Baresh K. Jain, B.A. (Assistant [F & A])  
Raj K. Takru, B.A. (Assistant)  
Raj K. Kapoor, B.A. (U.D.C.)  
Dhoom Singh, B.A. (Cashier)  
Swapna Acharya, B. A. (L.D.C.)

**Stores**

Inder J. Mehra, B.A. (Senior Assistant)  
Inder J. S. Bedi (Assistant)  
Ruchita Chatterji, M.A. (Store Keeper)  
Kunwar P. Singh (L.D.C.)

**Sponsored Projects**

Jagdish Prasad (T.A.)

**Drivers**

Hanuman Prasad  
Lallan  
Bilbir Singh  
Nafees Ahmed

**General Help**

Sarju Prasad (Daftari)  
Sia Ram (Duplicating Machine Operator)  
Raja Ram (Attendant)  
Satrughan (Attendant)  
Sunder Lal (Attendant)  
Prem Chandra (Attendant)  
Ram Singh (Attendant)—(w.e.f. 9.7.1990)  
Rajendra Kumar (Attendant)—(w.e.f. 9.7.1990)

K. C. Chandola (Attendant)  
 Chhange Lal (Attendant)  
 Haradhan Mahanti (Attendant)—(w.e.f. 9.7.1990)  
 Sri Ram (Peon)  
 Kedar Nath Yadav (Peon)  
 Mohammad Shakil (Binder)  
 Bam Singh (Peon)  
 Kailash Nath (Peon)  
 Ram Kishan (Peon)—(w.e.f. 11.7.1990)  
 Munni (Peon)—(w.e.f. 11.7.1990)  
 Maya Devi (Peon)—(w.e.f. 11.7.1990)  
 Mani Lal (Peon)—(w.e.f. 22.2.1991)  
 Ram Ujagar (Peon)—(w.e.f. 22.2.1991)  
 Ram Dheeraj (Peon)—(w.e.f. 22.2.1991)  
 Krishna Kumar Bajpai (Peon)—(w.e.f. 22.2.1991)  
 Dhan Bahadur Kunwar (Peon)—(w.e.f. 22.2.1991)  
 Mahadev Prasad (Peon)—(w.e.f. 22.2.1991)  
 Hari Kishan (Peon)—(w.e.f. 22.2.1991)  
 Prem Shanker (Chowkidar)  
 Ram Dhari (Chowkidar)  
 Vishnu Kumar (Chowkidar)  
 Ram Deen (Chowkidar)  
 Kesho Ram (Chowkidar)  
 Bishnu Dutt (Chowkidar)  
 Rameshwar Prasad Pal (Mali)

## Promotions and Appointments

### Promotions

- Ram Singh, Pro-Tempore Attendant, promoted as Attendant (Regular) w.e.f. 9.7.1990
- Rajendra Kumar, Pro-Tempore Attendant, promoted as Attendant (Regular) w.e.f. 9.7.1990
- Haradhan Mahanti, Pro-Tempore Attendant, promoted as Attendant (Regular) w.e.f. 9.7.1990
- B. Sekar, Junior Technical Officer, promoted as Technical Officer w.e.f. 1.4.1990
- Asha Guleria, Senior Technical Assistant, promoted as Junior Technical Officer w.e.f. 1.4.1990
- Indra Goel, Senior Technical Assistant, promoted as Junior Technical Officer w.e.f. 1.4.1990
- Sunita Khanna, Junior Technical Assistant, promoted as Senior Technical Assistant w.e.f. 1.4.1990
- B. N. Jana, Junior Scientific Officer, promoted as Senior Scientific Officer w.e.f. 1.4.1990
- P. K. Bajpai, Senior Technical Assistant, promoted as Junior Technical Officer (Artist) w.e.f. 1.4.1990
- Alpana Singh, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990
- Jyotsana Rai, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990
- Rupendra Babu, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990
- M. S. Chauhan, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990
- Asha Gupta, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990
- A. P. Bhattacharya, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990
- Kindu L. Meena, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990
- Neeru Prakash, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990
- G. K. Trivedi, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990

Rashmi Srivastava, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990

S. R. Manik, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990

B. D. Singh, Senior Scientific Assistant, promoted as Junior Scientific Officer w.e.f. 1.4.1990

Madhukar Arvind, Computer Operator, deployed as Junior Technical Assistant (Computer) w.e.f. 01.06.1990

Ram Kishan, Safaiwala, deployed as Peon w.e.f. 11.07.1990

Munni, Safaiwali, deployed as Peon w.e.f. 11.07.1990

Maya Devi, Safaiwali, deployed as Peon w.e.f. 11.07.1990

### Appointments

H. P. Singh, Deputy Director, appointed as Distinguished Scientist w.e.f. 27.2.1991

Shail Singh Rathore was appointed as Lower Division Clerk w.e.f. 4.3.1991

Mani Lal was appointed as Peon w.e.f. 22.2.1991

Ram Ujagar was appointed as Peon w.e.f. 22.2.1991

Ram Dheeraj was appointed as Peon w.e.f. 22.2.1991

Krishna Kumar Bajpai was appointed as Peon w.e.f. 22.2.1991

Dhan Bahadur Kunwar was appointed as Peon w.e.f. 22.2.1991

Mahadev Prasad was appointed as Peon w.e.f. 28.2.1991

Hari Kishan was appointed as Peon w.e.f. 11.3.1991

## Obituary

A. K. Singh Rathore (STA)

13.7.1990

## Organisational Structure

### Governing Body

#### **Chairman**

Professor H. Y. Mohan Ram,  
Department of Botany, University of Delhi,  
Delhi 110 007

#### **Members**

Sri B. K. Chaturvedi,  
Joint Secretary & Financial Adviser,  
Department of Science and Technology, Technology Bhawan,  
New Mehrauli Road,  
New Delhi 110 016

Sri O. P. Dhoundial,  
Director-General, Geological Survey of India  
27 Jawaharlal Nehru Road,  
Calcutta 700 016

Dr M. P. Nayar,  
Director, Botanical Survey of India,  
P-8 Brabourne Road,  
Calcutta 700 001

Dr M N Qureshy  
Nominee of Secretary to the Government of India,  
Department of Science and Technology, Technology Bhavan,  
New Mehrauli Road,  
New Delhi 110 016

Dr S. C. D. Sah,  
Former Director, Wadia Institute of Himalayan Geology  
Vikashpuram,  
Dehradun 248 001

Professor C. P. Sharma,  
Nominee of Vice-Chancellor, University of Lucknow,  
Department of Botany, University of Lucknow,  
Lucknow 226 007

Professor Dalbir Singh,  
Department of Botany, University of Rajasthan,  
Jaipur 302 004

Professor J. S. Singh  
Centre of Advance Study of Botany  
Banaras Hindu University  
Varanasi 221 005

**Secretary**

Dr B. S. Venkatachala,  
Director, Birbal Sahni Institute of Palaeobotany,  
Lucknow 226 007

**Assistant Secretary (Non-member)**

Sri S. B. Verma,  
Registrar, Birbal Sahni Institute of Palaeobotany,  
Lucknow 226 007

**Finance and Building Committee****Chairman**

Professor H. Y. Mohan Ram  
Department of Botany, University of Delhi,  
Delhi 110 007

**Members**

Sri B. K. Chaturvedi,  
Joint Secretary & Financial Adviser,  
Department of Science and Technology, Technology Bhavan,  
New Mehrauli Road,  
New Delhi 110 016

Shri S. C. Jain,  
Former Divisional Engineer, Northern Railway,  
A-431, Indira Nagar  
Lucknow 226 016

Dr M. N. Qureshy,  
Nominee of Secretary to the Government of India,  
Department of Science and Technology, Technology Bhavan,  
New Mehrauli Road,  
New Delhi 110 016

Professor C. P. Sharma  
Head, Department of Botany, University of Lucknow,  
Lucknow 226 007

Chief Engineer U.P.P.W.D. or his nominee,  
95th Circle, P.W.D.,  
Lucknow 226 001

**Secretary**

Dr B. S. Venkatachala,  
Director, Birbal Sahni Institute of Palaeobotany,  
Lucknow 226 007

---

## Research Advisory Council

### **Chairman**

Dr B. S. Venkatachala  
Director, Birbal Sahni Institute of Palaeobotany,  
Lucknow 226 007

### **Members**

Dr S. K. Acharyya  
Deputy Director-General  
Geological Survey of India,  
North-Eastern Region,  
Shillong

Dr Sunirmal Chanda,  
Bose Institute,  
93/1, Acharya Prafulla Chandra Road,  
Calcutta 700 009

Professor V. S. Rama Das,  
School of Life Sciences,  
University of Hyderabad,  
Hyderabad 500 134

Dr S. K. Jain,  
Former Director, Botanical Survey of India,  
A-26, Mall Avenue Colony,  
Lucknow 226 001

Professor H. D. Kumar,  
Centre of Advance Study in Botany,  
Banaras Hindu University,  
Varanasi 221 005

Professor E. C. Manoharachari,  
Department of Botany,  
Osmania University,  
Hyderabad 500 005

Professor D. D. Pant,  
106, Tagore Town,  
Allahabad 211 002

Professor Dalbir Singh  
Department of Botany,  
University of Rajasthan,  
Jaipur 302 004

Professor M. S. Srinivasan,  
Department of Geology,  
Banaras Hindu University,  
Varanasi 221 005

**Convener**

Dr H. P. Singh,  
Birbal Sahni Institute of Palaeobotany,  
Lucknow 226 007

## Departments

1. Department of Non-Vascular Plants
2. Department of Palaeophytic Evolutionary Botany
3. Department of Mesophytic Evolutionary Botany
4. Department of Cenophytic Evolutionary Botany
5. Department of Quaternary Biogeography & Archaeobotany
6. Department of Pre-Gondwana and Gondwana Palynostratigraphy
7. Department of Post-Gondwana Palynostratigraphy of Peninsular India
8. Department of Post-Gondwana Palynostratigraphy of Extra-Peninsular India
9. Department of Planktonology
10. Department of Biodiagenesis
11. Department of Radiometric Dating

---

## Internal Committees

**Research Programming Committee**

B. S. Venkatachala — Convener  
H. P. Singh  
K. P. Jain  
H. K. Maheshwari  
R. S. Tiwari

**Excursion Committee**

P. K. Maithy — Convener  
N. Awasthi

**Instrument Maintenance Committee**

Suresh C. Srivastava — Convener  
Anil Chandra

**Quality Control Committee**

M. B. Bande — Convener  
Bhagwan Singh  
B. K. Jain

**Purchase Committee**

B. S. Venkatachala — Convener  
H. P. Singh  
Suresh C. Srivastava  
M. B. Bande  
Registrar  
Accounts Officer  
Section Officer (S&P)

**Maceration Committee**

K. P. Jain — Convener  
Suresh C. Srivastava

**Building Construction and Maintenance Committee**

H. K. Maheshwari — Convener  
Anand Prakash  
Registrar  
S.O.(A)  
P.K. Bajpai

**Vehicle Maintenance Committee**

Anand-Prakash — Convener  
Registrar  
R. K. Takru — Vehicle in-Charge

---

**Faculty Consultative Committee**

N. Awasthi	— Chairman
Anand Prakash	— Secretary
Shyam C. Srivastava	
Vijaya	
O. S. Sarate.	

**Garden Maintenance Committee**

G. P. Srivastava	— Convener
D. C. Saini	

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

We have audited the annexed Balance Sheet of Birbal Sahni Institute of Palaeobotany, Lucknow as at 31st March, 1991 and its relative Income & Expenditure Account and Receipts & Payment Account for the year then ended with the records produced before us.

In our opinion and to the best of our information and according to the explanations given to us the said accounts read with the comments thereon attached hereto in Annexure-I give a true and fair view:

- (i) In the case of Balance Sheet of the state of affairs of the Institute as at 31st March, 1991;
- (ii) In the case of Income and Expenditure Account, of the excess of Income over Expenditure for the year ended on that date.

*For KISHORE & KISHORE  
Chartered Accountants*

(R. K. MATHUR)  
*Partner*

*Place* : Lucknow  
*Date* : 12.09.1991

*Annexure-I*

**Comments on Accounts of  
Birbal Sahni Institute of Palaeobotany, Lucknow  
as at 31st March, 1991**

1. Accounts have been maintained on cash system except for adjustments for unsettled advances.
2. Fixed assets are at cost and no depreciation has been provided.
3. Balances of various projects and seminars have not been incorporated in the Balance Sheet and Income and Expenditure Account.
4. Advances have directly been charged to the final head of expenditure in the Receipt and Payments Account, instead of debiting the advance. However, the unsettled advances have been adjusted in the Income and Expenditure Account and taken to advance in Balance Sheet.
5. Advances include Rs. 4.95 lacs remaining unsettled for want of submission of adjustment Bills by the parties, that has resulted in understating the expenditure and overstating the advances.
6. Deposit and advances includes Rs. 26.08 lacs to C.P.W.D., Lucknow and Rs. 48.95 lacs to others under Plan Capital respectively which remained unadjusted resulting in under-stating the capital expenditure and overstating the Deposits and Advances.
7. Completion certificates for various works transferred to works and Building, wherever required, still remains to be obtained.
8. The final bill of the Multi-Storyed Building contractor is still under dispute and no adjustment has been made in accounts for his claim pending decision of Hon'ble court.
9. The figures have been recasted and regrouped wherever deemed necessary.

*For KISHORE & KISHORE  
Chartered Accountants*

(R. K. MATHUR)  
*Partner*

*Place : Lucknow  
Date : 12.09.1991*

**BIRBAL SAHNI INSTITUTE OF****Balance Sheet as at**

<i>Liabilities</i>	<i>Up to Last Year 1989-90</i>	<i>Total up to 1990-91</i>
Capital	3,46,33,837.82	3,82,56,888.52
Excess of Income over Expenditure	34,83,304.17	34,92,612.86
Donations/Gifts	4,25,741.20	4,31,291.20
G.P.F. Deposits	61,04,515.06	74,55,132.41
Deposits under Security & Earnest money	1,42,291.79	54,208.90
Group Insurance	—	40,677.76
<b>Total Rs.</b>	<u>4,47,89,690.04</u>	<u>4,97,30,811.65</u>

Sd/-  
(J. C. SINGH)  
*Accounts Officer*

**PALAEOBOTANY, LUCKNOW****31st March, 1991**

<i>Assets</i>	<i>Up to Last Year 1989-90</i>	<i>Total up to 1990-91</i>
Land & Buildings	49,94,466.50	59,55,335.30
Apparatus & Equipment	1,81,00,301.54	1,96,44,462.41
Apparatus & Equipment Donated	1,38,868.15	1,38,868.15
Vehicles	6,51,398.57	6,51,398.57
Furniture & Fixtures	18,79,509.62	19,79,507.32
Furniture & Fixtures Donated	4,264.07	4,264.07
Books & Journals etc.	15,24,716.60	19,05,032.60
Founder's Library Books	50,000.00	50,000.00
Investments (Donations)	98,600.00	1,04,600.00
Founder's Fossil Collection	50,000.00	50,000.00
Unesco Coupons	793.02	543.12
Advances	17,43,013.53	53,89,386.95
Deposits with CPWD	20,89,885.00	26,08,529.00
Security money	3,000.00	3,000.00
Loans to Employees	23,42,066.77	24,78,928.37
GPF Accumulations	61,04,515.06	74,55,132.41
Closing Stock	9,502.90	5,830.00
Sundry Debtors	3,498.00	—
Closing Cash Balances:		
i) In hand	226.80	464.10
ii) In Bank	50,01,063.91	13,05,529.28
<b>Total Rs.</b>	<b>4,47,89,690.04</b>	<b>4,97,30,811.65</b>

Sd/-  
(S. B. VERMA)  
Registrar

Sd/-  
(B. S. VENKATACHALA)  
Director



STIGMARA - TREE BASE