

# ANNUAL REPORT

1981-82



**BIRBAL SAHNI  
INSTITUTE OF PALAEOBOTANY  
LUCKNOW**



## Introduction

The Institute is engaged in the advancement of palaeobotanical knowledge in all its diverse aspects and disseminating it all over the world. The research work at the Institute is carried out under various projects distributed among the following departments:

1. Precambrian Biology and Palaeozoic Palaeobotany,
2. Mesozoic Palaeobotany,
3. Cenozoic Palaeobotany,
4. Quaternary Palynology,
5. Oil Palynology,
6. Coal Palaeobotany, and
7. Geochronology Laboratory.

Some of the outstanding achievements made during the year are as follows:

Some primitive algae and cryptarchs have been recorded from the Vindhyan Supergroup. Similarly solitary spheroidal cells, cells enclosed in enveloping sheath and arranged in the form of a colony have been reported from the Marwar Supergroup. Some new species of ferns have been reported from the Rajmahal Hills. In the Jurassic-Cretaceous beds of Kachchh basin, the presence of nannofossils has been recorded at one more locality. Seven new fossil dicotyledonous woods have been reported from the Deccan Intertrappean beds of Nawargaon. The flora of these beds indicates a warm tropical climate with heavy rainfall and a uniform temperature throughout the year. The study of Tertiary megafloora of Kachchh revealed that the present xeric conditions in this area are due to climatic changes in the Post-Pliocene epoch. The age of the Jhingurdah seam of Singrauli Coalfield—the

thickest coal deposit of the country—has been dated palynologically as Upper Permian. The reticulate type of miospores were more dominant than the foveolate-fossulate type in the beginning of the Tertiary of Kachchh. Two-fold vegetational development—the chirpine-oak phase and the oak-chirpine phase—has been recognised in the Sat Tal pollen profile. The pollen analytical studies of the Kathmandu Valley suggest that from pre-40,000 radiocarbon years to possibly the end of the last Glacial period, the valley was occupied by lakes and marshes. The C-14 dates have confirmed the Holocene age for the sediments from Laltila and Kunjaben in Tripura Series. A glauconite sample from the Lameta Series has been dated to  $87 \pm 8$  Ma by fission track method. This age agrees well with the geological age—Turonian.

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## Governing Body

### Chairman

Prof. A. K. Sharma, F. N. A.,  
Botany Department,  
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Calcutta 700 009

### Members

Shrimati Savitri Sahni,  
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Secretary to the Government of India,  
Department of Science & Technology,  
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New Delhi 110 029

Joint Secretary (Finance),  
Department of Science & Technology,  
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Director-General,  
Geological Survey of India,  
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Director-General,  
Archaeological Survey of India,  
New Delhi 110 011

Director,  
Botanical Survey of India,  
Botanic Gardens, Sibpur,  
Howrah 711 103

Prof. B. S. Trivedi, F. N. A.,  
Botany Department, Lucknow University,  
Lucknow 226 007

Dr S. C. D. Sah,  
Director, Wadia Institute of Himalayan Geology,  
Dehradun 245 001

Prof. J. N. Rai,  
Nominee of the Vice Chancellor,  
Lucknow University,  
Lucknow 226 007

**Secretary**

Director,  
Birbal Sahni Institute of Palaeobotany,  
Lucknow 226 007

**Assistant Secretary (Non-Member)**

Registrar,  
Birbal Sahni Institute of Palaeobotany,  
Lucknow 226 007

## Honours and Awards

Kumari Jayasri Banerji .. Awarded the Dr P. N. Srivastava  
Prize of Birbal Sahni Institute  
of Palaeobotany.

- Kumari Madhu Ahuja** .. Awarded the degree of Doctor of Philosophy for her work "Studies on the Neogene fossil woods from Kalagarh", by the Lucknow University.
- Shrimati V. Lalitha** .. Awarded the degree of Doctor of Philosophy for her work "Studies on the Middle Tertiary Flora of north-eastern India" by the Lucknow University.
- Vishnu-Mittre** .. Co-chairman, VIII Conference of Ethnographic and Folk Culture Society, Lucknow.
- .. Chairman Session III (B), IV. Geobotanical Conference, Lucknow.

### **Representation on Committees/Boards**

- Anand Prakash** .. Treasurer, Indian Association of Palynostratigraphers.
- .. Member, Executive Committee, The Palaeobotanical Society.
- N. Awasthi** .. Editor, Geophytology.
- .. Member, Executive Committee, The Palaeobotanical Society.
- M. N. Bose** .. Member, Scientific Advisory Committee for Geo-sciences relating to Oil Exploration and Production, Ministry of Petroleum, Chemicals & Fertilizers.

- .. Member, Research Advisory Committee, Wadia Institute of Himalayan Geology, Dehradun.
  - .. Chairman, Editorial Board, The Palaeobotanist.
  - .. Member, National Working Groups for IGCP-Project nos. 4, 106 and 145.
- K. P. Jain**
- .. Secretary, Indian Association of Palynostratigraphers.
  - .. Joint Secretary, The Palaeontological Society of India.
- R. K. Kar**
- .. Joint Secretary, IV Indian Geophysical Conference.
  - .. Member, Editorial Board, Proceedings of the IV International Palynological Conference Proceedings.
- H. A. Khan**
- .. Secretary, Palynological Society of India.
- R. N. Lakhanpal**
- .. Chief Editor, The Palaeobotanist.
  - .. Member, Sectional Committee for Botany, Indian National Science Academy.
  - .. Member, Executive Committee, International Association for Angiosperm Palaeobotany.
- H. K. Maheshwari**
- .. Member, Committee for Fossil Plants, International Association for Plant Taxonomy.

- .. Member, Steering Committee, Symposium on "Cretaceous of India" (IAP)
  - .. Editor, The Palaeobotanist.
  - .. Editor, Indian Association of Palynostratigraphers.
  - .. Member, Editorial Board, Proceedings of the IV International Palynological Conference.
- P. K. Maithy
- .. Member, International Working Group on Precambrian Biostratigraphy.
  - .. Member, National Working Group for IGCP Project no. 29.
  - .. Member, Editorial Board, Geoviews.
- G. K. B. Navale
- .. Member, International Committee of Coal Petrology.
  - .. Member, International Subcommittee on Gondwana Coal ICCP.
  - .. Member, International Commission on Coal and Lignite Nomenclature and Analysis.
  - .. Member, International Commission on ACPG & ACPI.
  - .. Member, National Working Group for IGCP Project no. 166.
  - .. Member, Editorial Board, Coal Geology.

- .. Joint Secretary, Organising Committee of Indian Coal Petrology.
- .. Joint Secretary, The Palaeobotanical Society.
- U. Prakash .. Regional Representative for India, International Association for Angiosperm Palaeobotany.
- Chhaya Sharma .. Member, Executive Committee, The Palaeobotanical Society.
- H. P. Singh .. Member, Executive Committee, The Palaeobotanical Society.
- .. Member, Editorial Board, Proceedings of the IV International Palynological Conference.
- J. Singh .. Member, Editorial Board, Proceedings of the IV International Palynological Conference.
- J. C. Srivastava .. Assistant Editor, Indian Journal of Museum.
- Suresh C. Srivastava .. Editor, Geophytology.
- R. S. Tiwari .. Chief Editor, Geophytology.
- .. Editor, The Palaeobotanist.
- .. Member, National Working Group for IGCP Project no. 106.
- Vishnu-Mittre .. Member, Central Advisory Board of Archaeology.
- .. Invitee, Advisory Committee, National Museum of Man, Ministry of Education & Culture.

- .. Member, Committee of Research Studies, Burdwan University
- .. Member, Executive Council, Indian Aerobiological Society.
- .. Member, Editorial Board, Proceedings of the IV International Palynological Conference Proceedings.

## Research

### Department of Precambrian Biology and Palaeozoic Palaeobotany

*Project* : Palaeobiology of Vindhyan Supergroup and its equivalent formations

*Objective* : To study biota and organo-sedimentary structures from Precambrian rocks and their significance in stratigraphy

Biota comprising algae and cryptarchs has been recorded from the Semri and Kaimur groups, Vindhyan Supergroup. The algal remains are *Gloeocapsomorpha*, *Gunflintia*, *Oscillatorioopsis*, *Palaeoseytonema*, *Myxococcoides*, *Sphaerophycus*, *Corymbococcus* and a new form comparable to modern *Chaemosiphon*. The cryptarchs are *Lophosphaeridium*, *Orymatosphaeridium*, *Kildinella*, *Granomarginata* and *Nucellosphaeridium*.

P. K. Maithy and Rupendra Babu

Specimens of *Fermoria* Chapman from Ramapura, Suket Shale Formation, Madhya Pradesh have been critically restudied and it has been found similar to *Chauria* Walcot. The variation in the shape of *Fermoria* is due to differential preservation. Medusoid, stromatoporoid, coral, crinoidal roots and cf. *Lenaxygyrion* have also been recorded.

P. K. Maithy and Manoj Shukla

Solitary spheroidal cells, cells enclosed in enveloping sheath and cells arranged in the form of a colony have been recorded from the stromatolite-stratifera belonging to Marwar Supergroup.

P. K. Maithy

Algae and cryptarchs have been recorded from the Calc-zone, Pithoragarh. Stromatolites *Collenia* and *Stratifera* have been found.

Manoj Shukla

*Project* : Resolution of gymnosperms and pteridophytes in Glossopteris Flora

*Objective* : To study the morphology of different elements in the Permian Flora of the Indian Peninsular region and their stratigraphical significance

Two new species of *Australoxylon*, one new species of *Araucarioxylon* and a new species of *Kakoxylon* have been recognized in the Barakar Formation in Jharia, South Karanpura and Singrauli coalfields, Iron Stone Shale and Raniganj formations in the Raniganj Coalfield.

Usha Bajpai and P. K. Maithy

Completed study of megafossils from Tattitola, Alubera, Amjhari and Bargo and of miospores from Bansloi River, Bishnupur Nala and Karwa Nala sections in Pachwara Coalfield, Bihar.

Bijai Prasad and P. K. Maithy

The study of *Gangamopteris* from the Karharbari Formation in the Giridih Coalfield, Bihar shows that *G. cyclopteroides* is a heterogeneous species. Two new species of the genus have been recognised in addition to the earlier recorded species.

Rajni Tiwari and P. K. Maithy



A paper on sterile and fertile remains of the Filicales from the Raniganj Formation of Selected Searsole Colliery in the Raniganj Coalfield has been submitted for publication. *Leleopteris* gen. nov. is proposed for fronds having contiguous pinnules in which the lateral veins are always once dichotomous. Three species, viz., *L. raniganjensis*, *L. ovata* and *L. srivastavae* have been recognized. Besides, *Neomariopteris polymorpha*, *N. hughesii*, *Dichotomopteris major*, *D. lindleyi* and *Dizeugetheca phegopteroides* have been reported. Structural details of 4 types of seeds from the Ghansyam Colliery, Raniganj Coalfield have been studied.

A. K. Srivastava and Shaila Chandra

Morphological and cuticular observations on 9 species of *Glossopteris* have been completed. The midrib of the leaves is striated, sometimes median region is occupied by parallel strands. In most of the leaves, midrib cuticle and laminar cuticle are well-differentiated. The cuticle of the midrib is comparatively thick. Vein and mesh areas are also distinguishable on the laminar cuticle. Most of the leaves show papillate epidermal cells. Papillae are common on the upper cuticle. Leaves are hypostomatic, stomata are irregularly distributed. Usually the subsidiary cells have prominent papillae.

A. K. Srivastava

*Glossopteris* leaves collected from Handappa, Dhenkanal District, Orissa have been classified in three groups and their venation pattern is under investigation by the "grid" method.

Kamaljeet Singh and Shaila Chandra

*Project* : *Morphotaxonomy and palynostratigraphy of Lower Gondwana spores*

*Objective* : *To study in detail the morphology of Lower Gondwana spores and their importance in biostratigraphy*

Five palynological assemblage zones have been recognized in the Lower Gondwana Formation in the Hutar Coalfield, Palamau District, Bihar. These are, *Plicatipollenites-Parasaccites* Zone

(assigned to Barakar Formation), and *Densipollenites-Scheuringipollenites-Faupollenites* Zone. The last palynozone indicates the presence of Barren Measure Formation in the Hutar Coalfield.

Manoj Shukla

### Department of Mesozoic Palaeobotany

*Project : Middle-Upper Triassic floras of India*

*Objective : To carry out morphological studies of Middle to Upper Triassic floras of India and to understand their botanical and stratigraphical significance*

A paper on *Leleaconus pennatus* gen. et sp. nov., a possible coniferalean microstrobilus, from the Triassic of Nidhpuri has been submitted for publication. *L. pennatus* has spirally arranged microsporophylls, the expanded base of each microsporophyll bearing an abaxially embedded ovoid sporangium which contains non-striate-bisaccate pollen grains. A pteridospermous leaf belonging to a new genus has also been discovered and is being worked out. Cuticular preparations from some fructifications and coniferous shoots, camera lucida sketches of 137 fruiting bodies and some photodrawings have been prepared. The seed structure of *Nidia ovalis* is being reinvestigated from fresh cuticular slides. On re-examination of specimens and slides of *Lepidopteris indica* it is observed that there exist two different species of the genus.

Shyam C. Srivastava

Descriptions and comparisons of 4 species of *Dicroidium*, *Lepidopteris* sp. and a new species each of *Pagiophyllum* and *Desmiophyllum* from the Tiki Formation have been completed. A number of leaves and a few megaspores have been recovered from bulk maceration of the samples.

P. K. Pal

**Project** : *Fossil flora from the Jurassic-Lower Cretaceous of Rajmahal, India*

**Objective** : *To carry out morphological and anatomical studies of the fossil plants from the Rajmahal Hills and to find out their botanical and stratigraphical importance*

Investigations including descriptions of *Lycopodites gracilis*, *Lycoxylon indicum*, *Marattiopsis macrocarpa* and some new ferns have been completed. Some more observations on *Hepaticites* sp. and *Equisetum rajmahalense* have been made.

M.N. Bose and P.K. Pal

**Project** : *Morphological and cuticular studies of fossil plants from the Jabalpur Formation of Madhya Pradesh*

**Objective** : *To carry out detailed studies on the fossil flora of Jabalpur Formation from botanical and stratigraphical view point*

A number of plant megafossils from Jabalpur and Narsinghpur districts, belonging to the genera *Cladophlebis*, *Sphenopteris*, *Pterophyllum*, *Ginkgoites*, *Brachyphyllum*, *Pagiophyllum*, *Elatocladus* and *Araucarites*, etc. have been partly investigated.

Sukh Dev

There is yet no unanimity about the age of the Jabalpur in the Satpura Gondwana Basin. Therefore to re-examine the whole issue afresh, new collections were made for palynological investigations. The palynomorphs from Morand River do not provide a definite clue for the age. Palynological investigations from the Hard River near the Hard-Sukker confluence have been taken in hand. A number of palynomorphs have been identified. Some of the important taxa are *Cyathidites*, *Matonisorites*, *Boseisorites*, *Cicatricosisporites*, *Contignisorites*, *Couperisorites*, *Callialasporites*, *Araucariacites*, and *Podocarpidites*. A preliminary survey made so far has not shown the presence of critical marker taxa.

H.K. Maheshwari and Asha Gupta

*Project* : Fossil flora from the Lower Cretaceous of the South Rewa Gondwana Basin

*Objective* : To carry out morphological and cuticular studies

Descriptions and comparisons of *Gleichenia rewahensis*, *Hausmannia dichotoma*, *Dictyophyllum indicum*, *Cladophlebis* sp., *Cycadopteris brauniana*, *Pterophyllum princeps*, *Brachyphyllum regularis*, *Elatocladus longifolia*, *Araucarites fibrosa* and *A. tarnetarensis* have been written.

M. N. Bose Sukh, Dev and Rashmi Srivastava

*Project* : Fossil flora from Kachchh-Kathiawar and Rajasthan

*Objective* : To investigate the fossil flora from the Mesozoic of Kachchh-Kathiawar and Rajasthan and its bearing on stratigraphy of the region

Revision of the Kachchh pteridophytic remains is almost complete. A few specimens of *Thallites*, *Equisetites*, *Hausmannia* and *Dictyophyllum* have been described. *Phlebopteris minutifolius* Banerji and *Matonidium cingulatum* Zeba-Bano & Bose have been redescribed. Among pteridospermous remains, species of *Linguifolium* and *Sagenopteris* have been described. Four species of *Pachypteris* have been recognised. A large number of cuticular slides have been prepared to study morphological and cuticular variations in this genus. Preliminary descriptions have been written. The genera *Taeniopteris*, *Pseudoctenis*, *Ctenozamites*, *Pterophyllum*, *Anomozamites*, *Nilssoniopteris* and *Ptilophyllum* have been partly worked out.

M. N. Bose and Jayasri Banerji

*Project* : Palynostratigraphy of the Jurassic-Lower Cretaceous beds of Kachchh Basin

*Objective* : To study morphotaxonomy of the palynomorphs and their application in the stratigraphy of the basin

Identification and quantitative estimation of palynological assemblages recovered from the productive samples from Kachchh

have been started. Some of the productive samples from Hajipir and Jhuran River Section (Jhuran Formation) have been worked out. The characteristic features of these assemblages are the overwhelming dominance of the genus *Araucariacites* (87-95%) with a few trilete, monosaccate and bisaccate genera like *Cyathidites*, *Concavissimisporites*, *Klukisporites*, *Densoisporites*, *Callialasporites*, *Podocarpidites*, *Abiespollenites*, etc.

In the dinoflagellate cyst assemblage some more genera have been provisionally identified, e. g. *Cyclonephelium*, *Gtenidodinium*, *Rhynchodiniopsis*, *Pareodinia*, *Endoscrinium*, *Lithodinia*, *Meiourogonyaux*, *Nannoceratopsis*, *Egmontodinium*, *Scriniodinium*, *Cribroperidinium* and *Systematophora*. Nannofossils belonging to the genus *Cyclogelosphaera* have been found at one more locality.

A large number of megaspores have been sorted out from the samples of Walkamota, Gadhsisa, Dharsi, Pur River and Chawad River. Gradational maceration and photomicrography of a number of megaspores have been done. Finalization of the work has been started with the critical reinvestigation of species belonging to the genera *Banksisporites*, *Hughesisporites* and *Bacutritetes*.

H. K. Maheshwari, Jayasri Banerji and B. N. Jana

*Project : Fossil floras from the Mesozoic rocks of Pranhita-Godavari Valley*

*Objective : To study the Mesozoic floras of the area and their importance in stratigraphy*

A large number of plant megafossils collected from some Mesozoic formations from Pranhita-Godavari Valley have been tentatively identified.

Sukh Dev and A. Rajni Kanth

**Project** : Fossil floras from the east coast of India

**Objective** : To investigate the Mesozoic floras from the east coast and to determine their role in stratigraphy

Plant fossils from Cuttack and Vemavaram area have been tentatively identified. Preliminary descriptions of the species of *Gladophlebis* and *Sphenopteris* have been written.

Sukh Dev and A. Rajni Kanth

Epidermal features of some specimens, from a well near Naicolam, Tiruchirapally District, Tamil Nadu, apparently resembling *Thinnfeldia indica* Feistmantel have been studied. A detailed note has been prepared outlining the taxonomic position of the genus *Thinnfeldia* in relation to closely comparable genera, particularly *Dicroidium*.

H.K. Maheshwari

**Mesozoic from Abroad:**

*Palynological examination of samples from the Stanleyville and Loia groups, Zaire.*

Seven samples, 2 from the Stanleyville Group and 5 from the Loia Group, Zaire have yielded identifiable palynomorphs. Both the samples from the Stanleyville Group are dominated by the species of *Classopollis*, particularly *C. aquistanus* Reyre and *C. indicus* Maheshwari. The sample from Formation 4c of the Loia Group is dominated by *Equisetoporites* miospores. The sample from Formation 4b has *Clavatipollenites*. The assemblage of Formation 4a is dominated by *Classopollis* sp. cf. *C. indicus*.

H. K. Maheshwari

## Department of Cenozoic Palaeobotany

*Project* : Studies on the Deccan Intertrappean flora of India

*Objective* : To explore new exposures of the Deccan Intertrappean Series and study the plant fossils in detail for Early Tertiary vegetation and climate

Charophytic remains belonging to *Platychara*, *Peckiachara* and *Microchara* were identified from Rajahmundry. A number of charophytic fructifications recovered from the chert pieces collected from near Lalitpur (U. P.) were studied. In addition, the genera *Lithothamnium* and *Lithophyllum* were tentatively identified in the Mohgaon Kalan chert. Seven new dicotyledonous woods have been recorded from Nawargaon.

M. B. Bande

Two papers describing *Palmoxylon shahpurenensis* sp. nov. and *Palmoxylon silthrensis* sp. nov. from near Shahpura in Mandla District were finalized and submitted for publication. A chart listing all the fossil palms of the Deccan Intertrappean beds referred to the genus *Palmoxylon* was prepared for critical evaluation of palaeoecological significance of fossil palms. In order to identify the fossil palm stems and petioles and to know the variability in anatomical characters among the same species, serial sections of the stems of *Ptychosperma macarthuri* (measuring 6 m from base to apex) and *Areca catechu* (measuring 4 m from base to apex), and the petioles of *Livistona australis* (40 cm long) and *Elaeis guenensis* (about 3 m long) were prepared.

Krishna Ambwani

Out of a large number of petrified fruits found in chert collected from near Shahpura, 40 show close resemblance with the fruits of the family Euphorbiaceae and three belong to some palms. A draft manuscript has been prepared. Besides, from

the same locality, six new dicotyledonous woods have been tentatively identified with the woods of the family Annonaceae, Burseraceae, Meliaceae and Euphorbiaceae.

Fungal remains found in the Mohgaon Kalan chert were also studied, and tentatively identified up to family level.

R. C. Mehrotra

A paper on "Palaeoclimate and palaeogeography of Central India during the Early Tertiary" has been submitted for publication. This flora of Deccan Intertrappean beds indicates a warm tropical climate with heavy rainfall, a long duration of rainy season and a uniform temperature throughout the year as against a comparatively dry, subtropical climate at the present time. Presence of such a humid climate may be attributed to the almost equatorial position of peninsular India and the sea-shore conditions near Nagpur-Chhindwara area during the Palaeocene-Eocene times.

The manuscript of a paper on "Evolutionary trends in the secondary xylem of woody dicotyledons from the Tertiary of India" has been prepared. Starting from the Palaeogene, it has been observed that there is a gradual increase in the percentage of woods with advanced types of characters, especially wood parenchyma and xylem rays, in the successively younger floras. An attempt has also been made to use these studies to divide the Deccan Intertrappean flora in smaller florules and to know the relatively primitive or advanced status of the various Indian Tertiary floras.

M. B. Bande and U. Prakash

*Project : Investigation of the Tertiary plants of western India*

*Objective : To build up a floristic succession for study of the palaeoenvironments and the plant migrations in the region*

Fossil woods from near Jaisalmer belong to 10 different types of dicotyledons and 2 of gymnosperms. Among the dicotyledons,



*Millettia-Pongamia* of Leguminosae and *Mangifera* of Anacardiaceae were identified. The gymnospermous woods belong to the genera *Podocarpoxyton* and *Araucarioxyton*.

Fossil woods resembling *Gluta* of Anacardiaceae and *Lagerstroemia* of Lythraceae have been recorded from near Santalpur in Banaskantha District, Gujarat.

A paper describing six fossil woods from Kachchh belonging to *Dipterocarpoxyton* (2 spp.), *Sterculinium* (1 sp.), *Terminalioxyton* (8 spp.) and *Palmoxyton* (1 sp.) was submitted for publication. Another paper describing six leguminous woods resembling *Albizia*, *Afzelia-Intsia*, *Cynometra*, *Dialium*, *Isobertinia* and *Millettia-Pongamia* from the Pliocene of Kachchh was also submitted for publication.

J. S. Guleria

A paper on "A preliminary appraisal of the Tertiary megafloora of district Kachchh, Gujarat, western India" was prepared. It deals with the Lower Eocene, Lower Miocene and Pliocene megafloora comprising 38 species belonging to 26 genera and representing 10 dicotyledonous, 2 monocotyledonous and one gymnospermic families. These also include some African and Arabian elements.

The overall vegetation, though maintaining certain degree of uniformity, underwent periodic changes in response to changing climatic conditions since Lower Eocene. In view of the occurrence of moist evergreen as well as deciduous taxa, the flora can be placed under the category of 'moist tropical semi-evergreen to deciduous forests'. The study shows that the vegetation of Kachchh during the Tertiary period was more luxuriant than the modern scrubby vegetation. The present xeric conditions in this area are presumably due to post-Pliocene changes in the climatic conditions. The environment of deposition seems to have been mainly lacustrine and fluvial.

R. N. Lakhnupal and J. S. Guleria

*Project : Studies on the Tertiary plants of South India*

*Objective : Critical studies on the fossil woods and other plant remains from the Neogene of South India to unravel the vegetational complexes, palaeoecology and phytogeography of this region during the Upper Tertiary.*

Some new forms showing close resemblance with the woods of *Albizia*, *Dialium*, *Cynometra*, *Terminalia* and those of Malayan *Anisoptera* and *Shorea* have been recorded from the Cuddalore Series near Pondicherry. *Anisopteroxylon coromandalense* Navale described from near Pondicherry was re-investigated and found to possess all the characters of *Vateria* rather than those of *Anisoptera*.

A large number of specimens of carbonised woods from Neyveli were cut and studied. Only two types could be recognised, showing close similarity with *Corallia* of Rhizophoraceae and *Diospyros* of Ebenaceae.

Nilambar Awasthi

A carbonised monocot axis from Neyveli was studied and compared with axes of *Dracaena*, *Yucca* and *Pandanus*. The fossil axis was identified with *Dracaena* of Agavaceae. A manuscript describing the same was submitted for publication.

Detailed study of palynological assemblages from lignite and clay samples from Neyveli, Payangadi, Varkala and Padappakkara has been undertaken.

Krishna Ambwani

Carbonised woods from Varkala on the Kerala coast were identified with the modern woods of *Catophyllum*, *Dryobalanops*, *Swintonia*, *Cynometra*, *Terminalia*, *Diospyros* and *Litsea-Cinnamomum*. A manuscript on these woods has been submitted for publication.

Nilambar Awasthi and Madhu Ahuja

*Project : Studies on the plant fossils from the Himalayan foot-hills*

*Objective : To build up a floristic succession of the Siwalik Group*

A collection of leaf-impressions from the Lower Siwalik beds of Koilabas was studied. About 35 types of leaves were recognised. Some of these were tentatively identified as *Dillenia*, *Dipterocarpus*, *Zizyphus* and *Terminalia*.

Of the dicotyledonous woods from the Lower Siwalik beds of Kalagarh, a few appear to be new for the area and show close resemblance with the woods of extant genera *Dipterocarpus*, *Diospyros* and *Cynometra*.

Mahesh Prasad

Fossil woods from the Lower Siwalik beds belong to *Acrocarpus*, *Ormosia*, *Adenantha*, *Koempassia*, *Afzelia-Intsia*, *Dipterocarpus*, *Anisoptera* and *Aglaia*. Studies of xylotomic variability in some of the taxa were also carried out. The descriptions of fossil woods of *Dipterocarpus*, *Anisoptera* and *Afzelia-Intsia* have been revised.

Uttam Prakash & R. R. Yadav

*Project : Investigation of the Tertiary plant megafossils of northern India*

*Objective : To build up Tertiary vegetation of north-eastern India*

Some dicotyledonous woods from the Namsang River beds at Deomali show close resemblance with modern species of *Shorea*, *Gluta-Melanorrhoea*, *Terminalia* and *Lagerstroemia*. These are quite different from the fossil species already known from this region.

U. Prakash and Nilambar Awasthi

*Project* : Studies on plant megafossils from the Karewa beds of Kashmir

*Objective* : To investigate leaf-impressions and other plant megafossils from the Karewas for floristics and climatic oscillation in the Kashmir Valley during the Plio-Pleistocene period.

A paper describing leaf-impressions of *Rosa*, *Viburnum*, *Salix* and *Potamogeton* from the Lower Karewa of Hirpur, Kashmir was submitted for publication.

Some more leaf-impressions from Hirpur were examined and provisionally identified. A number of carbonised woods collected from the Lower Karewa of Dubjan, Hirpur, Karchipathra and Raithan were cut and studied. One of them was identified as *Fraxinus excelsior* of the family Oleaceae.

Nilambar Awasthi and J. S. Guleria

### Department of Quaternary Palynology

*Project* : Studies in the morphology of pollen grains seeds and fruits

*Objective* : To prepare modern comparative data base to identify corresponding plant remains

The paper on "Pollen flora of north-west Himalaya", comprising description and phytogeographical details of pollen of about 1000 species of pteridophytes, gymnosperms, and angiosperms was completed and submitted for publication.

H. P. Gupta and Chhaya Sharma

Pollen morphological studies on 12 species of *Toona* were undertaken. No conclusive evidence has turned up for separating all the species palynologically. The study is in progress.

Chhaya Sharma and M. S. Chauhan

Seventy taxa from Kumaon Himalayas, mainly belonging to families Anacardiaceae, Acanthaceae, Betulaceae, Balsaminaceae, Combretaceae, Caprifoliaceae, Juglandaceae, Lythraceae, Myricaceae, Oleaceae, Sapindaceae, Tiliaceae, Typhaceae, Ulmaceae and Pinaceae, etc. have been investigated for pollen morphology.

Asha Khandelwal

Pollen slides of 70 taxa distributed in north-west and central India, 54 taxa distributed in the Silent Valley and 170 taxa distributed in the south Indian mountains were studied.

P. M. Rao

Pollen slides of 20 plant species belonging to 14 natural orders were prepared. The pollen morphological studies of 350 taxa distributed in north-west and central India were carried out. A pollen key based upon 200 plant species was also prepared.

M. S. Chauhan

Prepared and studied pollen slides of 62 plant species distributed in the western Himalaya.

S. K. Bera

Detailed statistical analysis and graphic representation of the statistical data of 30 spikelets of different species of *Oryza* reveal overlap between the wild and cultivated strains. Scan microscopy of the husks of 11 specimens of *Oryza nivara*, *O. rufipogon* and *O. sativa* and of the ornamentation pattern on seeds of *Eleusine* spp. has been completed and morphological differences observed. Studies have also shown that some of our own collections of *Eleusine* specimens belong to *E. coracana* subsp. *africana* not reported from India so far. Metroglyph graph has been prepared showing character association pattern in world species of *Eleusine*.

Vishnu-Mittre and Aruna Sharma

*Project : Pollen zonation scheme for western Himalaya, western India and south Indian mountains*

*Objective : To work out the history of Quaternary flora and the factors determining it*

A critical appraisal has been made of the new litho-, chrono- and bio-stratigraphic schemes for Quaternary deposits, particularly Karewas, in the Kashmir Valley. These schemes, reportedly based upon measured sections and aided by fresh palaeontological data and/or palaeomagnetic and isotopic determinations etc., reveal a confusing situation when the fresh data from the adjoining upper Siwaliks is considered. New palynological and palaeobotanical data have also produced misleading results. A manuscript on these observations is under preparation.

Vishnu-Mittre

Eleven modern surface samples from Ladakh from localities between 3,300 to 5,320 m were analysed and pollen spectra constructed. A pollen diagram from the 52 m deep bore core TSDI from Tsokar Lake, Ladakh was completed. The pollen diagram shows alternations between alpine steppe and Juniper expansion, and seems to date from the last interglacial to the later part of last Glacial.

Vishnu-Mittre & A. Bhattacharya

Two-fold vegetational development, the Chirpine-oak phase and the oak-chirpine phase, has been recognised in the Sat Tal pollen profile. Land occupation and Landnam phases have also been recognised. Three samples from a 3.5 m deep marginal profile from Naukutchiya Tal were pollen analysed. The pollen of *Quercus* and *Pinus* show more or less similar behaviour. The other arboreal elements, such as *Cedrus*, *Picea*, *Larix*, *Abies*, *Salix*, *Alnus*, *Corylus* are poorly represented.

H. P. Gupta and Asha Khandelwal

Four local pollen assemblage zones have been recognised in pollen diagram from Parasram Tal, Himachal Pradesh. The 5 m deep pollen profile is radiometrically dated to  $3,140 \pm 100$  years. The vegetational history begins with high values of *Pinus roxburghii* and *Quercus* which show a declining trend in the subsequent zone. The third zone is marked by overall increase in most of the gymnosperms whereas uppermost part of the pollen diagram registers a steep decline in gymnosperms and maximum values of *Peperomia*.

Prepared a manuscript on "Recent pollen spectra from Garhwal Himalaya". Pollen analysis of 43 surface samples (moss cushions and soil samples) collected from Dehradun, Kala Gad, Kempti Falls, Sahastradhara, Gola Tapper, Chakrata, Deoban, Kalsi, etc. has been done.

Chhaya Sharma

The draft of Ph.D. Thesis entitled "Studies of vegetational history of the alpine region of the north-west Himalaya" has been completed. The vegetational history and climatic changes during later part of last interglacial to late part of last glaciation have been discussed.

Amlav Bhattacharya

Counting of the pollen content of 2 samples from Digana (Rajasthan desert) has been completed. Investigated forest types in the moist and dry Sal deciduous forest belt in district Sidhi, M. P. and also the vegetation of the swamps. A general study of the Pleistocene sections along Son River and Palaeolithic to Neolithic sections in district Sidhi was carried out. Trial samples from these sections were found to be palynologically barren.

Vishnu-Mitre and M. S. Chauhan

The draft of Ph.D. Thesis on "Vegetational and climatic history of the south-western region of the Rajasthan desert" has been completed.

A. K. Saxena

*Project : Quaternary vegetational history of Central Himalaya, Kathmandu Valley, Nepal*

*Objective : To work out the history of Quaternary flora and the factors determining it*

Constructed fresh pollen diagrams from Manihara, Kalimatti, Sankhu and Thimi and a map too. A paper on "studies in the vegetational history of Kathmandu Valley" was completed. The pollen analytical studies at Sankhu, Manihara, Kalimatti and Thimi and stratigraphical observations in the Kathmandu Valley suggest that from pre-40,000 radiocarbon years to possibly the end of last Glacial period the valley was occupied by lake(s) and marshes. These had fluctuated in the expanse and in deep and shallow water conditions in response to alterations in climate or hydrology. The valley was repeatedly inundated by a former river system possibly due to tectonic activities.

During the pre-40,000 radiocarbon years, the Oak-Pine woods occurred under warm and humid climate. They succumbed subsequently to the cold and dry climate, the lakes and marshes shrank and the grasslands expanded. The amelioration of climate around 20,000 radiocarbon years re-established them but thereafter they were replaced by grasslands under the impact of cold and dry climate which lasted until 17,500 radiocarbon years.

Possibly during the later part of the last Glaciation, Oaks and Pine-Oak woods had expanded again but the extensive grasslands had continued to occur owing to shrinkage of lake(s) and marshes due possibly to hydrological changes rather than to climate. The oak woods thereafter declined and the grasslands expanded on the onset of cold and dry climate causing shrinkage in lake(s) and marshes.

Vishnu-Mittre and Chhaya Sharma



*Project : History of the Silent Valley forests*

*Objective : To work out the antiquity of these forests through pollen analysis*

Data on present biogeography, ecology and diversity of the Silent Valley forests have been collected. A sketch map showing the general distribution of the various forest types and the tribal communities in the Silent Valley has been prepared.

Vishnu-Mittre

*Project : History of ancient plant economy of India*

*Objective : To trace the palaeobotanical history of crops and other economic plants*

Based upon the archaeobotanical data, presently available, a manuscript on the history of millets in South India has been prepared.

Vishnu-Mittre

Imprints of plant remains from five Neolithic sites, viz., Mahagara (Belan Valley, Allahabad), Baraunha and Manigara (Adva Valley, Mirzapur), Lahura-Deva (Basti) and Sohgaure (Gorakhpur) have been found to belong to wild *O. nivara*, *O. rufipogon* and cultivated (*O. sativa*) species of *Oryza*. Compressed fruits of *Ischaemum* and carbonised barley have also been identified at Mahagara. *O. rufipogon* and *O. sativa* have also been identified at the Chalcolithic sites of Kakoria (Varanasi) and Magha (Adva Valley, Mirzapur). The other remains identified at the latter site include *Paspalum scrobiculatum*, *Echinochola crusgalli* and *Ischaemum rugosum*. Besides, imprints of wild and cultivated rices (*O. rufipogon* and *O. sativa*), imprints of *P. scrobiculatum* and *I. rugosum* have also been identified at the late historical site Dadupur near Lucknow.

Vishnu-Mittre and Aruna Sharma

Six charcoals from the Harappan site Kalibangan, 11 from the Neolithic site Burzahom, 25 from Gufkral (Neolithic to historical pd.), 13 from Ropar (Iron Age site) and 31 from Diamabad (Late Harappan to Jorwe) were investigated. Some Gufkral and Burzahom charcoals have been provisionally identified as of *Pinus*, *Picea* and *Ulmus*. The charcoals at Diamabad have been identified as of *Acacia* sp., *Dalbergia* sp., charcoals of conifers and broad-leaved trees have been recognised at the Ropar site. Three maps, one each for pre-Harappan and Harappan, Neolithic-Chalcolithic and Iron Age cultures, have been prepared showing distribution in space and time of the taxa identified so far from India.

Vishnu-Mittre and Chanchala

*Project* : *Studies on the ethnobotany among the Indian tribes drought-prone areas*

*Objective* : *To gather information on the mechanism of destruction of vegetation by man, and on the early methods of primitive crops to understand the significance of archaeobotanical and palaeopalynological data*

The material collected from the Adva Valley was studied and a manuscript prepared on the wild plants used by the tribals. The Baigas, Gonds and Kols use seeds, fruits and leaves of 10 wild plants in their food. Some plants are also used by them for other purposes. Oil extracted from the seeds of *Schleichera oleosa* is used for hair dressing and lighting purposes. Red dye is obtained from the flowers of *Woodfordia fruticosa* and shades of brown from bark of *Bauhinia variegata*. Poison to kill the fishes is obtained from the roots of *Careya arborea*. The fibres are obtained from the bark of *Ventilago maderspatana* for cordage, etc. Besides, several wild plants are of medicinal importance to them. A transitional change has been observed among these tribals. Many of them have taken to cultivation of maize, rice, barley and sugarcane though millets are also cultivated.

Vishnu-Mittre and Chanchala

A manuscript of 'Ethnobotany of the tribals of the Adva Valley, district Mirzapur' was prepared from materials and observations collected in the field.

Vishnu-Mittre, Aruna Sharma and Chanchala

### Department of Coal Palaeobotany

*Project : Palynostratigraphy of the Indian coal deposits*

*Objective : Stratigraphic delimitation and correlation of coalseams*

*Subproject : Palynostratigraphic studies of the Lower Gondwana sediments in Jharia Coalfield, Bihar*

The outstanding results of this work are presence of chitinozoa and acritarch type of bodies in the Talchir assemblage indicating the marine influence; confirmation of the presence of Karharbari Formation; pattern of microfossil changes through Barakar, Barren Measures and Raniganj successions; and possibility of the presence of Panchet in the Mahuda Oval.

A bore-core (MD-8) from Madhuban area yielded miospore assemblages broadly correlatable with the other Damodar Valley Barakar assemblages. The fair representation of *Densipollenites* well before the commencement of lithological Barren Measures, indicates a relatively early deterioration of the climate in the provenance responsible for sedimentation in the central part of Damodar Basin.

R. S. Tiwari, Suresh C. Srivastava, Archana Tripathi  
and Vijaya Singh

*Subproject : Palynological studies of Son-Valley coalfields*

A re-appraisal of the age of Jhingurdah seam, Singrauli Coalfield has been done on the basis of recent palynological data.

It has been concluded that the age of this thickest coal-deposit of the country is Raniganj (Upper Permian).

R. S. Tiwari and Suresh C. Srivastava

*Subproject : Palynostratigraphy of the Lower Gondwana sediments in Godavari Valley*

The lower part of the sediments (up to 750 m) in bore-hole G GK-27 (851.15m) from Ramagundum area is marked by the abundance of striate-disaccate pollen with very few triletes. *Faunipollenites* + *Striatopodocarpites* dominate the assemblage while *Eupunctisporites*, *Gondisporites*, *Verticypollenites*, although rare, occur persistently. In the younger part, *Striatopodocarpites* is dominant followed by *Faunipollenites* and *Densipollenites*. The older assemblage pertaining to Lower Kamthi Formation compares with the Raniganj miofloras of the Damodar Valley.

Samples from Bhopapalli area have been studied and a radial-monosaccate assemblage consisting of *Parasaccites*, *Cannanoropollis*, *Divarisaccus*, *Faunipollenites* and *Potonieisporites*, comparable with known Talchir miofloras, has been recorded.

Samples from Jaipuram (B.H. GJPI), Mantheni (SC.Co. B.H.1), Sattupalli (GSPI & 2) and Chintalpudi areas (GCH4) have yielded miofloras comparable to that of bore-hole G GK-27 from Ramagundum area. Samples from bore-hole GJ3 from Chelpure area have been studied and lower and middle miofloras resembling the one encountered in G GK-27 from Ramagundum area have been recorded.

Suresh C. Srivastava and Neerja Jha

*Subproject : Palynostratigraphy of the Lower Gondwana sediments in West Bokaro Coalfield, Bihar*

Statistical analysis of all the samples from different areas has been done. Palynological succession from Talchir-Raniganj

Formation has been studied. Stratigraphy, correlation and dating have also been done.

Suresh C. Srivastava and Rakesh Saxena

*Subproject : Palynological studies of Raniganj coals, West Bengal*

With the counting of dispersed pollen and spores from the 16 coal samples of bore-holes C.M.P.-304/G.R.T. OV/79, C.M.P.-302/D.M.M.-OV/79 and M.E.C.-296/S.S.-OV/79 in the Raniganj Coalfield, the palynological study has been completed. *Brevitriletes*, *Horriditriletes*, *Lophotriletes*, *Striatites*, *Scheuringipollenites*, *Vesicaspora*, *Fa uipollenites*, etc. represent the dominant forms. Some characteristic forms, like *Indospora*, *Densipollenites*, *Lahirites*, *Hindipollenites* and *Crescentipollenites* are also present. The assemblage indicates that the samples belong to the Raniganj Stage.

G.K.B. Navale, Anand Prakash and B.K. Misra

*Subproject: Mesozoic palynology of the Satpura Gondwana Basin*

A paper on "Palynology of Jabalpur Stage in subsurface at Pat-Baba Ridge, Jabalpur, Madhya Pradesh" has been submitted for publication. The assemblage has the prominence of gymnospermic trisaccate pollen genus *Podosporites tripakshi* followed by pteridophytic elements such as *Cyathidites* and *Callispora*. It closely resembles the mioflora of Cauvery Basin, South India and microflora IIb from western Australia. This assemblage has been dated as Lower Cretaceous.

The miofloral assemblages from Hathidoba, Ranikamar and Devi-Toria in Narsinghpur District, show the prominence of *Callialasporites* followed by *Araucariacites*. Pteridophytic miospores, viz., *Cyathidites*, *Boseisporites*, *Contiguiporites*, *Callispora*, *Matonisporites*, *Laevigatosporites*, etc. are poorly represented. These assemblages indicate an Upper Jurassic age.

Pramod Kumar

*Project : Litho-palynopalaeobotany of Gondwana in Damodar Son-Mahanadi, Satpura, Godavari [Basin and sub-Himalayan region*

*Objective : Stratigraphic and palynological delimitations and correlation of various lithological units*

*Subproject: Palynostratigraphic studies of the Gondwana sediments in South Rewa Gondwana Basin*

In search of plant microfossils from Talchir, Barakar and Supra-Barakar sequences in Birsinghpur-Pali Coalfield a number of bore-cores as well as out-crop successions have been analysed for their miospore contents. The Talchir sediments are rich in *Parasaccites*, *Plicatipollenites* and *Callumispora* while the Barakar exhibits the presence of zonate-cingulate and striate-disaccate genera. The Supra-Barakar did not yield any miospore.

R. S. Tiwari, Archana Tripathi and Ram Awtar

*Subproject : Palynological study of Permo-Triassic sediments in Damodar Valley*

In bore-hole RAD-2, Raniganj Coalfield was analysed and assemblages were recognised. The change at Raniganj-Panchet boundary is abrupt in this region suggesting thereby a depositional gap. Species distribution through Raniganj Formation is being worked out.

R. S. Tiwari and Vijaya Singh

*Subproject : Palynostratigraphy of the Gondwana sediments in Palar Basin, Chingleput District, Tamil Nadu*

Palynostratigraphy of the Lower and Upper Gondwana sediments in 734 m profile of the bore-hole PBK2, Kancheepuram area in Palar Basin has been studied. Samples pertaining to the Talchir Formation proved barren whereas samples between

723.30—20 m representing Sriperumbudur Formation contain a rich mioflora characterised by the gymnospermous pollen, viz., *Araucariacites*, *Classopollis*, *Callialasporites*, *Laricoidites*, *Podocarpidites*, etc; pteridophytic spores are comparatively few. It compares with the mioflora recorded earlier in bore-hole PBK1.

Suresh C. Srivastava

*Project* : *Morphotaxonomic study of living and fossil spores and pollen*

*Objective* : *To study the morphographic characters of spore-pollen taxa and to circumscribe them for taxonomic purposes*

The protosaccate nature (saccus filled with alveolar network) of Gondwana saccate pollen has been established on the basis of SEM studies. Their occurrence in Permian-Triassic times is significant. Similarly, the nature of taeniae and striations in Gondwana pollen has been determined on the basis of SEM analysis.

R. S. Tiwari

A few miospores have been studied under interference contrast microscopy for detailed morphotaxonomic studies and one of them is a new taxon, *Arasporites* gen. nov.

Suresh C. Srivastava and Rakesh Saxena

*Project* : *Biopetrology of the Indian coal deposits*

*Objective* : *Evaluation of coals for classification and utilization*

Petrological and rank studies on all the 36 Raniganj coal samples have been completed. Based on the overall petrological data and rank evaluation of the coal samples from the three bore holes, it has been found that the samples of bore-hole C.M.P.—304/G.R.T./OV/79 are the best suited from utilization point of view, by virtue of their high rank as well as high vitrinite/vitrite

contents and rather low fraction of mineral matter. The coals from C.M.P. 302/D.M.M. OV/79 are next in rank and suitability. In comparison to other two bore-holes the samples from M.E.C.-296 /S.S./OV/79, being lowest in rank and in vitrinite/vitrite contents, appear to be the poorest for industrial purposes because of their highest proportion of associated mineral matter.

G.K.B. Navale, Anand Prakash and B.K. Misra

The study of coal pellets representing various coal seams of the Giridih Coalfield indicates in general the dominance of vitrinite and inertinite macerals. These coals show high incidence of vitrite and intertite microlithotype groups followed by carbominerite.

Anand Prakash

Coal pellets from bore-holes CMPJ14, CMK107 and CMKJ2 have been studied for petrological characteristics, evaluation of West Bokaro coals and the possible correlation of coal seams on petrological characteristics. Histograms exhibiting the nature of maceral, microlithotypes and mineral matter have been plotted to show their behaviour in space and time. Microphotometric studies have been completed and various graphs and reflectograms have been prepared to infer the possible rank of coals and their genesis. Draft writeup regarding the characteristic nature and association of coal ingredients has been prepared.

D.C. Bharadwaj, G.K.B. Navale and Rakesh Saxena

The maceral and microlithotype analyses and reflectance studies of all the twelve coal samples collected from various sections of Kachchh, Gujarat have been completed. The study indicates the prominence of inorganic mineral matter and vitrinite and inertinite macerals. Like macerals the microlithotypes are also characterised by the dominance of carbomi-



nerite and vitriate microlithotype groups. In general the mineral matter is mainly represented by finely disseminated clay fraction, pyrite, siderite and other carbonate minerals. The vitrinite/vitrite group is represented by both collinite and tellinite macerals. Intertinite group is represented by the presence of fusinite, semifusinite and inertodeterinite fractions. The high representation of mineral matter, presence of siderite and inertinite maceral groups indicate a fairly rapid deposition in a basin affected by fluctuating water level and occasional drier conditions. The reflectance values taken on the vitrinites vary from 0.40% to 1.40% showing variable maturation conditions in the Kachchh Basin.

Anand-Prakash

A large number of coal seam samples from Bokaro and Giridih coalfields have been examined for typological and rank analysis. The brights, semibright, dull and intermediate types constitute the banded nature of coals. Microscopic examination of brights and semibright reveals that they are composed of anthraxylous coal entities whereas dull and intermediate types constitute attrital and mixed organic coal constituents.

G.K.B. Navale

Palynostratigraphical, geological and biopetrological data on Tertiary coals of the Makum Coalfield have been finalized and submitted in the form of a Ph.D. Thesis. The investigation carried out reflects on the nature and type of source material, typology, correlation and rank of the coal seams present in the area together with their stratigraphical position. An attempt has also been made to decipher palaeogeographic, palaeotectonic and depositional conditions.

D.C. Bharadwaj, G.K.B. Navale and B.K. Misra

To ascertain the prospect of vitrinite inertinite ratio in distinguishing Karharbari, Barakar and Raniganj coals the petrological data of Lower Gondwana coals were utilized.

Proximate analysis (evaluation of moisture, volatile matter, fixed carbon and ash contents) of 36 Raniganj coal samples was carried out and the results show that the ash content in these samples (from three bore-holes) range from 10.43 to 32.12%, 15.73 to 35.71% and 14.98 to 27.60% and volatile matter from 25.82 to 37.66%, 27.64 to 34.11% and 26.59 to 33.52% respectively.

G.K.B. Navale and B.K. Misra

*Project : Palynopetrographic study of organic remains of coastal and upcountry lignites*

*Objective : Stratigraphic delimitation, correlation and petrographic evaluation of lignite deposits of India*

From Neyveli Lignite field, Tamil Nadu 18 samples of Ist lateral section 580/2125, 8 of Ist lateral section 775/2275 and 13 of IInd lateral section 1125/2375 were macerated. All the samples yielded except two. Since the percentage yield of samples was very poor, 18 samples of Ist A section were remacerated by Staplin's standard method.

G.K.B. Navale, B.K. Misra and A. Agarwal

Five particulate pellets of lignite from New Mine area of Neyveli Lignite-field were prepared and polished. Two lignite pellets were quantitatively assessed for their microconstituents alongwith rank determination. Selective photomicrography was also done.

G.K.B. Navale and B.K. Misra

### Department of Oil Palynology

**Project** : *Palynostratigraphy of Tertiary sediments of Lower Assam*

**Objective** : *To study palynoflora of the Tertiary sediments of the region and its application in stratigraphy*

The systematic description and identification of palynomorphs recovered from the Palaeocene-Eocene sediments exposed along the road between Jowai (Meghalaya) and Badarpur (Assam) were completed. The palynoflora consists of 59 genera assignable to 92 species. Two genera and 14 species are new. Based on the qualitative and quantitative analyses of the palynoflora, five palynozones have been instituted. Lateral validity of the palynozones has been established. The palynoflora has been compared with the known comparable assemblages, both from India and abroad. Botanical affinities of many palynomorphs and age and environment of deposition of the sediments have also been worked out.

H. P. Singh and S. K. M. Tripathi

The critical morphological study of *Cyathidites*, *Lygodiumsporites*, *Todisporites* and *Biretisporites* from the Oligocene-Miocene sediments exposed along the Jowai-Badarpur Road section in Meghalaya and Assam, has been completed. A new spore genus *Surmaspora* has also been proposed.

H. P. Singh and M. R. Rao

A systematic description, based on morphotaxonomical study of the dinoflagellate cysts ( 5 genera and 7 species), gymnospermous pollen (4 genera and 6 species) and angiospermous pollen (17 genera and 25 species) recovered from the Barail-Surma groups (Oligocene-Miocene) has been written. Seven species are new.

R. K. Saxena and M. R. Rao

*Project* : *Palynostratigraphy of the Lower Tertiary sediments of Simla Hills, North India*

*Objective* : *To carry out the morphotaxonomical investigations of palynomorph assemblages and to determine their botanical and stratigraphical significance*

Palynostratigraphical investigations of Subathu sediments collected from four measured sections around Banethi and Bagthan, Sirmur District, Himachal Pradesh have been completed. The assemblage consists of 59 genera and 115 species belonging to spores, pollen grains, microplankton, fungal spores and fungal bodies. One new genus has been instituted. Based on the qualitative and quantitative analyses of the assemblages, five palynozones have been identified. The palynozones of Banethi-Bagthan and Kalka-Simla areas have been correlated. The age, environment of deposition and palaeoclimatic conditions during the Subathu sedimentation in Banethi-Bagthan area have also been discussed.

A well-preserved palynofloral assemblage has been recovered from the Kasauli sediments of Banethi-area. The assemblage consists of 16 genera and 20 species belonging to fungi, pteridophytes, gymnosperms and angiosperms. Some samples register abundance of sponge spicules.

H. P. Singh and Samir Sarkar

*Project* : *Palynostratigraphy of the Siwalik sediments of Bhakra-Nangal and adjoining areas*

*Objectives* : *To study palynoflora of the Tertiary sediments of the area and its importance in stratigraphy*

The Upper Siwalik palynoflora recovered from the Hoshiarpur-Una Road section in Punjab and Himachal Pradesh consists of 25 genera and 31 species. Fungal remains, pteridophytic spores

and gymnospermous and angiospermous pollen grains constitute the assemblage. Two genera, viz., *Quadrangulosaccites* and *Siwalikiathyrites* and 5 species are new. Two distinct biozones have been recognised. Palaeoclimate and depositional environment have been interpreted. The manuscript has been submitted for publication.

R. K. Saxena and H. P. Singh

Identification and study of the palynomorphs recovered from the Siwalik Group exposed in Bhakra-Nangal area of Himachal Pradesh have been done. The palynomorphs belonging to the families—Cyatheaceae, Parkeriaceae, Schizaeaceae, Polypodiaceae, Pinaceae, Palmae, Poaceae, Oleaceae, Chenopodiaceae, Sapotaceae, Cruciferae, Meliaceae and Lentibulariaceae, have been recognized.

R. K. Saxena and Samir Sarkar

The palynoflora of Nalagarh Formation, Himachal Pradesh has been assigned to 18 genera. Palynomorphs belonging to fungi, pteridophytes and angiosperms have been identified. The fungal elements dominate the assemblage.

H. P. Singh and Samir Sarkar

*Project : Marine microplankton biostratigraphy of Mesozoic and Cenozoic sediments of India*

*Objective : To study morphotaxonomy and distribution of phytoplanktons of the marine Mesozoic and Cenozoic sediments of India and their utilisation in biostratigraphy*

The dinoflagellate cyst assemblage recovered from Vriddhachalam (Gopurapuram) area includes 16 genera and 38 species. Representation of *Apectodinium* in the assemblage is significant. It supports Upper Palaeocene age for the assemblage determined

earlier on the basis of nannofossils (*Discoaster multiradiatus*) NP-9 Zone. Taxonomic aspect of *Areoligera-Glaphyrocysta* and *Systematophora* complex has been discussed.

The dinocyst assemblage described by Salujha and Kindra (1981) from the Langpar Formation exposed along South Shillong Front, Meghalaya has been reinvestigated and revised. The five new species proposed therein by the original authors, viz., *Homotryblium giganteum*, *H. disjunctum*, *Achomosphaera microreticulata*, *Hystrichokolpoma indica* and *H. robusta* are rejected or restricted to the holotype only. Further, significance of *Dinogymnium* is discussed with the comment that a part of the section might represent the topmost Upper Cretaceous. The paper has been completed.

Another paper on the taxonomic status of *Cleistosphaeridium mikirii* Mehrotra, 1981, from the Mikir Formation, Meghalaya has also been completed.

K. P. Jain and Rahul Garg

Morphotaxonomic study of the dinoflagellate cysts recovered from an exploratory bore-hole at Pudukoyal, Chingleput District, Tamil Nadu has been undertaken. The sample at a depth 441-44.2 m of the bore-hole shows the common occurrence of *Mudero-gonia*, *Discorsia* and *Dingodinium*. These taxa indicate Lower Cretaceous age (Pre-Aptian) and have geographical significance.

K. P. Jain and Khowaja Ateequzzaman

*Project* : *Palynostratigraphy of Neogene sediments in Kachchh*

*Objective* : *To carry out morphotaxonomical investigations of palynomorph assemblages and to determine their botanical and stratigraphical significance*

The following genera and species have been provisionally identified: *Glaphyrocysta pastielsii*, *Hystrichokolpoma rigaulae*, *Aptiodinium* sp. cf. *A. australiense*, *Spiniferites ramosus*, *Cleistosphaeridium* sp., *Lingulodinium* sp. cf. *L. macherophorum* and *Tuberculodinium vancampoae*.

*Striatriletes*, *Malvaceaeumpollis*, *Pinuspollenites*, *Lygodiumsporites* and *Bombacacidites* are commonly found in the Mepasa and Koiari assemblage.

A paper on "Fossil *Pediastrum* from the Khari Nadi Formation (Lower Miocene) of Kachchh, Gujarat" has been sent for publication.

Palynological zonation of the Matanomadh Formation (Palaeocene) and Panandhro lignite (Eocene) was completed. Palynological succession in Panandhro lignite-field shows the *Inapertusporites kedvesii*, *Meliapollis ramanujamii* and *Proxapertites microreticulatus* Cenozones. The other dominant species are *Biretisporites bellus*, *Lygodiumsporites lakiensis*, *Palmaepollenites kutchensis*, *Couperipollis kutchensis*, *Lakiapollis ovatus*, *Triorites dermatus*, *Tricolpites reticulatus*, *Dandotiaspora plicata* and *Botryococcus palanaensis*.

R. K. Kar

Miospores assignable to *Lycopodiumsporites* were studied from Kachchh and Assam and compared with the spores of modern *Lycopodium*. It was observed that the reticulate type of miospores were more dominant than the foveolate-fossulate type from the beginning of the Tertiary period. Evolutionary tendencies of the spore morphology of *Lycopodium* in the light of fossil spores have been discussed.

R. K. Kar and J. Mandal

A paper on "Taxonomical study of the polycolpate pollen grains from the Indian Tertiary sediments with special reference to nomenclature" was submitted for publication.

R. K. Saxena

*Project* : *Palynostratigraphy of Deccan Intertrappean beds from Rajahmundry to Bombay*

*Objective* : *To locate palynological productive horizons for morphotaxonomical study*

In the so-called Infratrappian beds of Lalitpur District, Uttar Pradesh identified the genera: *Todisporites*, *Lygodiumsporites*, *Cyathidites*, *Lycopodiumsporites*, *Podocarpidites*, *Palmaepollenites*, *Tricolpites*, *Stephanocolpites* and *Polycolpites*. Microthyriaceous ascostromata mostly represented by *Phragmothyrites* are also quite common.

R. K, Kar

*Project* : *Nannoplankton biostratigraphy of marine sedimentaries of Narmada Valley, Kachchh and Rajasthan, western India*

*Objective* : *To study various lithounits of sedimentary basins in western India for erecting fine biozonation*

The Eocene samples from Babia Hill, Kachchh District proved barren due to heavy diagenesis. The Jurassic-Lower Cretaceous exposed in Patcham Island, Bhuj-Mandavi Road, Lakhapar Dome, Amiu-Kateshwar Nala, Kheera Dome, Jumara Dome, Ghuneri and Ler sections, revealed several barren horizons. The Upper Patcham, entire Chari and Lower Katrols contained excellent to badly preserved nannofossils. A detailed study of species belonging to *Axopodorhabdus*, *Watznaueria* and *Stephanolithion* was undertaken.

S. A. Jafar, Rajesh K. Saxena and Jyotsna Rai

A manuscript on "Significance of Late Triassic nannoplankton from Austria and southern Germany" was sent for publication. In all, 4 genera belonging to 10 species of nannoplankton are described. Besides, the abundant remains of possible calcareous bacteria have also been reported.

S. A Jafar



*Project : Palynostratigraphical investigation of the grab and core samples from the Indian Ocean*

*Objective : Interpretation of distribution of palynomorph complexes, biozonation, correlation of different strata and deciphering the environment of deposition*

The palynological assemblage from the deep core samples from the Bengal Fan is represented by various species belonging to about 52 genera of miospores, fungal spores and phytoplankton. In general, the phytoplankton are poorly represented.

Anil Chandra

A paper on the pollen /spores recovered from grab samples from the Gulf of Kachchh (Cruise II, R. V. Gaveshani) has been submitted for publication. The quantitative analysis shows higher percentage of the pollen/spores in the mouth than in the head region of the Gulf of Kachchh.

Another paper on palynological investigation of the bottom (grab) samples from the continental Shelf off Bombay (Cruise II, R. V. Gaveshani) was also submitted for publication. The pollen analysis of these sediments shows mixed pollen spectrum which is the reflection of the adjoining mangroves, tropical evergreens and the mixed deciduous type of vegetation. The quantitative analysis shows higher frequency of pollen/spore yield in the samples collected from near the coast.

Different types of thyrtothecia were found in a few grab samples from the Arabian Sea (Cruise II and Cruise 17, R. V. Gaveshani). These specimens were studied and a manuscript was prepared.

Ram Ratan Yadav and Anil Chandra

Palynological investigation of Bombay and Karnataka offshore grab samples has been carried out and pollen spectra constructed. Pollen spectra dominate in pollen/spores of herbaceous plants and pteridophytes which grow along the shores. The mangrove pollen is well represented. The arboreal taxa from the forests are poorly represented. Pollen grains of Rhizophoraceae, Chenopods and *Pinus* occur more profusely in sediments further from the coast. In the fine grained marine sediments 136 km offshore, pollen concentration has been found to be higher than in the coarse sediments. No pollen was found in sediments one thousand or more km off the shore. The calcareous oozes and clays were found devoid of pollen.

Ram Ratan Yadav

### Geochronology Laboratory

*Project : Radiocarbon dating*

*Objective : Age determination of Quaternary deposits by C-14 method in relation to palynological investigations and associated studies and dating of geological and archaeological materials*

The laboratory has processed 109 samples for dating; dates for 87 samples have been communicated to submitters. Five radiocarbon standards (NBS Oxalic acid) and seventeen anthracite background samples have been processed and counted. More than 70% of the samples dated pertain to Quaternary studies and the rest to archaeological investigations.

*Ladakh*—The sample of peat at 30 cm depth in the swampy area of Soltag Lake was dated to  $1170 \pm 80$  yrs B. P. giving a sedimentation rate of 2.6 cm per 100 years. This is much higher than the sedimentation rate of 0.7 cm/100 yrs obtained for Tsokar Lake.

*West Bengal*—Wood samples from two profiles of rich organic deposits each nearly 7 m in thickness, from Calcutta have been dated. The deposition interval of this thickness of material

is 3000 yrs yielding a value of 2.3 mm/yr for the average rate of sedimentation. This is higher by about a factor of three compared to other deposits in the eastern region.

*Silent Valley*—One reddish sandy clay sample from a profile was dated to  $1770 \pm 130$  yrs B. P. The sample (depth 15-25 cm) dates much older than the two profiles of 1 m depth investigated earlier.

*Tripura*—The C-14 dates confirm the Holocene age for the sediments from Laltila and Kunjaben.

*Arabian Sea*—The dates of grab samples from water depths 36 to 92 m in the continental shelf off Bombay coast ranging in ages from 4400 to 9800 yrs B. P. have ascertained the position of shoreline in the area during the low stand of sea level in Late Pleistocene period. The samples which are from the vicinity of coral reefs have confirmed that the reefal masses are of Holocene age. One sample from Narbada Basin gave anomalously very high age indicating the river load of limestone content in the grab sediment.

*Miliolite*—Fourteen samples of miliolites (granular calcareous rocks) from the coastal tract of Saurashtra have C-14 ages ranging from 9000 to 38,000 yrs. The younger ages clearly indicate the isotopic exchange of atmospheric  $\text{CO}_2$  with these rocks.

A report containing 93 dates with description of sample, locality, concerned investigations and brief comment on the measurement has been sent for publication.

G. Rajagopalan, B. Sekar and T. K. Mandal

*Project : Fission track dating*

*Objective : To establish fission track dating method and to develop techniques to apply the method for dating various rock types with special reference to fossiliferous strata*

*Calibration*—An interlaboratory check sample (apatite and zircon concentrates from the tuff of Fish Canyon, Colorado, U.S.A.) has been analysed. The age and U concentration of the apatite concentrate was measured to be  $27 \pm 3$  Ma and 12 ppm agreeing well with Prof. Nasser's determinations.

*Track etching characteristics*—Etching condition for fission track development in glauconite was found to be  $\text{H}_2\text{SO}_4$  (98%), HF (48%) and distilled water in the ratio 1:2:4 (by volume) at room temperature. The optimum etch time interval has been found to be 35 minute. Etching characteristics of fission track in glauconite as function of etch time have been studied. Fossil and induced tracks in some of the glauconite samples have been scanned.

*Dating*—The F-T dates of samples nos. BSFT5/44, BSFT6/54 and BSFT17/128 of Apatite mineral concentrates from the Siwalik sediments are  $1.07 \pm 0.123$  Ba,  $810 \pm 90$  Ma and  $238 \pm 38$  Ma respectively. The results indicate that the samples have not been heated after deposition even up to  $130^\circ\text{C}$  and that the ages obtained are of source rock.

Kyanite sample pH 22/75 from Pooh, a tectonically active zone known as Sumdoh fault zone, Central Himalaya has been dated to  $10 \pm 0.8$  Ma. Sample no. BSFT24pH2/75, BSFT25pH9/75, BSFT26pH7/76 and BSFT27pH9/76 from the Spiti River in the Lahul Spiti Valley, Pooh District, higher Himalaya have been dated as  $9 \pm 2$ ,  $10 \pm 2$ ,  $17 \pm 3$ ,  $17 \pm 2$  Ma respectively. The age data significantly contribute to the history of cooling the tectonic uplift events of the Sumdoh Fault Zone. The low ages for kyanite confirm the earlier conclusions that there had been active movements along the fault, about 7 Ma ago. A kyanite sample no. BSFT28 from Assam has been dated to be  $321 \pm 29$  Ma. As the blocking temperature of FT system in kyanite is  $80 \pm 20^\circ\text{C}$ , the age points to the end phase of the cooling stages of the Hercynian activity which prevailed in the Himalaya around 350 Ma ago.

The glauconite sample from Lameta Series has been dated to  $87 \pm 8$  Ma, agreeing well with the geological age (Turonian). Another glauconite sample from the Precambrian beds of Newari, Mirzapur has been dated to  $680 \pm 125$  m.y.

G. Rajagopalan, H. S. Saini and A. P. Srivastava

## Research in Collaboration

### Delhi Supergroup

The study of microbiota recovered from the samples of Kushalgarh Formation was completed. The assemblage comprises 9 genera and 14 species belonging to filamentous and coccoid blue-green algae (with G.S.I., Western Circle, Palaeontology Laboratory).

### Precambrian-Cambrian Boundry

Cyanophycean algae and cryptarchs have been isolated from the rock samples of Shundi Lada and Wanner sections of Lolab Valley, Kashmir (with G. S. I., Northern Region Himalayan Geology Division, IGCP-29).

### Lower Gondwana

A review paper on the systematic position of the Lower Gondwana species of *Sphenophyllum* and *Trizygia* from India, Australia, Africa and South America along with a proposed new reconstruction for *Gondwanophyton* was sent for publication (with Queensland Geological Survey, Australia).

*Glossopteris* species from Australia have been studied and reconstructions of different species have been drawn. A fertile organ, *Nesowalesia peltata*, from Katoombo, New South Wales, and fossil plants from the Permian of Bacchus Marsh and Tasmania have also been studied (with Queensland Geological Survey and Maharashtra Association for the Cultivation of Science).

### **Fossil wood from the Coalsack Bluff, near Beaudwore Glacier, Antarctica**

The age of the specimen is either Late Permian or Early Triassic. The chalcedonic preservation of the float specimen is very similar to that of known Early Triassic age found *in situ* in the Fremouw Formation across the Walcott Nive. The wood shows very clearly developed annual rings, and the primary xylem is very well-preserved. The paper is under finalization (project started in collaboration with the late Professor James Morton Schopf).

### **Kashmir**

March  
1982  
A paper on "A fossil fan-palm from the Liyan Formation of Ladakh (Jammu & Kashmir)" was submitted for publication (with G. S. I., Northern Circle).

A manuscript describing 13 fossil woods from the Tertiary of Zaire, resembling modern woods of *Albizia*, *Isobertinia*, *Pentaclethra*, *Cynometra* and *Craibia* of Leguminosae, *Chrysophyllum* and *Tridesmostemon* of Sapotaceae, *Antiaris* of Moraceae, *Byrsocarpus* of Connaraceae, *Stereospermum-Markhamia* of Bignoniaceae, *Entandophragma* of Meliaceae and those of Palmae is being finalised (with Muscé Royal, de l'Afrique Centrale, Tervuren, Belgium).

A manuscript describing "A petrified palm wood from the Deccan Traps exposed near Mahi Bajaj Sagar Dam in Banaswara District, Rajasthan" is being prepared (with G. S. I., Northern Region).

A 180 m thick exposure of Lower Karewas located at Hirpur (Loc. III) was investigated palynologically. Pollen diagram constructed has been divided into fifteen pollen zones depicting the climatic cycles. A paper on these investigations has almost been completed. Of the 18 samples from Dubjan (Lower Karewas) some revealed the dominance of arboreals, and some proved barren. Four samples from Hokar Sar Lake profile were found palynologically rich both qualitatively and quantitatively.

Diatoms have been found very poor both qualitatively and quantitatively in 54 samples from Hirpur Loc. III. Of the 16 samples the diatoms belong to Pennales (*Cyclotella*, *Melosira*, *Synedra*, *Fragillaria*, etc.). Permanent preparations from Pampur (Upper Karewa) were also studied (with Physical Research Laboratory, Ahmedabad).

### **Son Valley, Madhya Pradesh**

Pollen analysis of the Quaternary exposures along and around the Son Valley in district Sidhi, Madhya Pradesh has been taken up. Quite a few sections are implementiferous. These along with the other Pleistocene sections were studied and samples collected. Of them, two samples were analysed but proved barren. (with Allahabad University and University of California, Berkeley).

### **Oceanic Cores**

Pollen spectra from the recent Arabian sediments from Bombay and Karnataka offshores have been constructed and interpreted in terms of vegetation in the near shore or around it. The problem of their transport through fluvial and marine currents and the factors determining their deposition are being investigated (with National Institute of Oceanography, Goa).

The studies on the phytoplanktons recovered from the 45 core samples, collected by the R/V Oceanographer from the Arabian Sea have been completed. A draft manuscript incorporating these findings was prepared (with National Institute of Oceanography, Goa).

### **Kalidhang District, Himachal Pradesh**

Pollen analysis of about 12 samples from Kalidhang profile was done. Except stray occurrence of pollen of Poaceae, *Pinus* and *Alnus*, the samples were almost barren (with G. S. I., Himachal Pradesh Circle).

### **Permo-Triassic boundary in Damodar Basin**

Study of bore-cores from the Damodar basin is in progress (with G. S. I., Coal Division).

### **Permo-Triassic palynology of West Germany**

Study of palynological succession in Hessen representing Rotliegendes and Buntsandstein is in progress (with Senckenberg Museum).

### **Gondwanas of Arunachal Pradesh**

The Lower Gondwana sediments exposed around Elephant, Kameng District, Arunachal Pradesh have been investigated palynologically. The mioflora is characterised by the dominance of *Callumispora* and *Parasaccites* and is comparable to the Lower Karharbari miofloras known from Gondwanas of Peninsular India (with Department of Applied Geology, Dibrugarh University).

The Tipam sandstone and Girujan Clay sediments of Assam and Arunachal Pradesh have been studied. The genus *Striatriletes* is more dominant in the former than in the latter. *Lygodiumsporites*, *Osmundacidites*, *Podocarpidites* and *Malvacearumpollis* are found occasionally (with Dibrugarh University, Dibrugarh).

Out of 22 coal pellets from various localities of Assam, Meghalaya and Arunachal Pradesh, the ranks of 15 coal pellets have been determined. These coals have high vitrinite content with biogenic pyrite as mineral matter and range in rank from sub-bituminous to high volatile bituminous stage (with Dibrugarh University, Dibrugarh).

### **Cauvery Basin**

Investigations on the well-cutting samples of Karikal Well-9 are in progress. Most of the samples proved productive and contain reworked Cretaceous nannoflora at certain levels. Nannoflora coupled with sedimentologic data suggests high potential of hydrocarbons (with O. N. G. C., Dehradun).

### **Malla Johar**

The study of dinoflagellate cysts and miospores from Upper Jurassic Spiti (Formation) is in progress. The miospore genera have been recognized. Text-figures showing palaeoecological



model of the Jurassic Spiti Shale Formation were prepared (with Geology Department, Lucknow University).

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### Field Work

During the year, members of the scientific staff of the Institute visited a number of areas for field studies and for collection of plant megafossils and palynological samples.

1. Rock samples from Iron Ore Supergroup, Bailadila, and stromatolites from the Chattisgarh Supergroup, Jagdalpur, Madhya Pradesh (P.K. Maithy).
2. Organo-sedimentary structures and palynological samples from the Semri and Kaimur groups around Chopan, Dala, Gurma and Markudi, Uttar Pradesh; Bhandar Supergroup and fossil woods from Barakar Formation, Singrauli Coalfield, Madhya Pradesh (P. K. Maithy, Bijai Prasad and Rupendra Babu).

3. Palynological samples and stromatolites from Calczone, Pithoragarh, Uttar Pradesh (Manoj Shukla).
4. Plant fossils from the Barakar and the Raniganj formations in the Raniganj Coalfield and the Karharbari Formation in the Giridih Coalfield (P. K. Maithy, A. K. Srivastava, Usha Bajpai, Kamaljeet Singh and Rajni Tiwari).
5. Tertiary, Lower Cretaceous and Late Palaeozoic areas of southern Victoria (Shaila Chandra).
6. Petrological specimens and more than 600 palynological samples from various Jurassic-Cretaceous formations exposed in Kachchh Mainland Basin have been collected. During the field work trace fossils have also been seen in the Jumara Formation (near Kotae and Dhrang) and in the Jhuran Formation (Pat River Section). Atleast 2 *Trigonia* beds were observed in the Photwari Nala section between Amiyu and Khari (H. K. Maheshwari, Anand-Prakash and B. N. Jana).
7. Plant fossils were collected from a number of localities in Gujarat (M. N. Bose, J. Banerji and B. N. Jana).
8. Plant fossils from various Mesozoic formations in Pranhita-Godavari Basin and East Coast (Sukh Dev and A. Rajnikanth).
9. Geological observations regarding Triassic deposits exposed in Shahdol District have been made. Plant fossils and samples for bulk maceration have been collected (Sukh Dev and P. K. Pal).
10. Leaf-impressions and carbonised woods from the Lower Karewa of Dubjan, Hirpur, Karchipathra and Raithan, Kashmir (N. Awasthi and J. S. Guleria).

11. Siwalik leaf-impressions from the Himalayan foot-hills of Tanakpur (Uttar Pradesh), Koilabas (Nepal), Bhikhnathoree (Bihar) and petrified woods from Kalagarh, Uttar Pradesh (U. Prakash, N. Awasthi, J. S. Guleria and Mahesh Prasad).
12. Megafossils (leaves and woods) from the various Tertiary localities of Rajasthan and Kachchh (J. S. Guleria).
13. For collection, comparison of material and consultation the research staff visited Geology Department, Chandigarh University (M. B. Bande); M.A.C.S Pune, Botany department University of Pune and Ramnarain Ruia College, Bombay (K. Ambwani).
14. Archaeological sites in the Belon and Adva Valley in Ganga Plains; and potsherds and ethnobotanical material from Allahabad (Vishnu-Mittre and Aruna Sharma).
15. Pollen analytical and ethnobotanical materials from Pleistocene and Holocene sections, archaeological sites and from the tribals in district Sidhi, Madhya Pradesh (Vishnu-Mittre, Aruna Sharma, Chanchala and M. S. Chauhan).
16. A large number of samples from Karewas and Holocene deposits in Kashmir Valley (Chhaya Sharma and H. P. Gupta).
17. Modern specimens of higher plants and mosses from Ladakh (A. Bhattacharya).
18. Palynological samples and modern plants from Sidhi District (M. S. Chauhan and Samir Bera).
19. Palynological rock samples and bore-cores from Johilla (Birsinghpur-Pali) Coalfield (R. S. Tiwari, Ram Awatar and K. L. Meena).



20. Palynological samples of the Talchir and Sriperumbudur formations of the bore-hole PBK2 near Sambarampakkam near Kancheepuram, Chingleput District, Tamil Nadu (Suresh C. Srivastava).
21. Palynological samples of the Talchir and Barakar formations from the Satpura Gondwana Basin (Suresh C. Srivastava, Anand Prakash and O. S. Sarate).
22. Palynological samples of the Lower Gondwana sediments from Siang District, Arunachal Pradesh (Suresh C. Srivastava).
23. Bore-core samples from Simra Bara, Lalmatia and Simlong collieries in Rajmahal area, Bihar (Pramod Kumar).
24. Palynological samples from the Singrauli Coalfield and Son-Mahanadi Basin; and tentative studies of geological succession of Talchir, Barakar, Barren Measures, Raniganj and Mahadeva formations (Suresh C. Srivastava, Anand Prakash and B. D. Singh).
25. Palynological samples from measured sections representing the type localities of Jadukata/Gumaghat, Mahadek, and Langpar, and also from the Jenam, Laisong, Renji, Bhuban and Bokabil sediments (R. K. Kar, M. R. Rao and R. S. Singh).
26. Palynological samples from Lakhpat bore-core, Panandhro lignite, Bararia and coastal region of Saurashtra (R. K. Kar).
27. Palynological samples from the Cauvery Basin (K. P. Jain and Rahul Garg).

28. Samples for nannofossils from well known sections of Jurassic-Lower Cretaceous and Eocene of Kachchh (S. A. Jafar).
29. Palynological samples from the Subathu, Dagshai and Kasauli sediments exposed along the road and stream sections in Kalka-Simla area (H. P. Singh and Samir Sarkar).

### **Group Discussions**

During the Session 1981-82, eight group discussions were held on the following selected topics. Scientists from within the Institute discussed the problems assigned to them. The other staff also took active interest in these discussions.

#### **1. Stromatolite morphology and biostratigraphy—**

P.K. Maithy (Convener), Manoj Shukla, J. Mandal and Rupendra Babu.

Stromatolites are organo-sedimentary structures formed by the activities of bacteria and algae (commonly blue-green) by trapping, binding and/or precipitation of sediments and occur in Precambrian to modern sediments. Study of modern stromatolites has shown that microbial community plays a vital role in their morphology. Besides, the climate, local ecology and depth of the sea are also important in the formation of stromatolites.

In recent years, much emphasis has been laid to the morphology of Precambrian stromatolites and their significance in stratigraphy. Important contributions have been made to demonstrate the Precambrian biota responsible for the formation of stromatolites. They have been successfully used in stratigraphy of the Precambrian sediments of Russia, Australia and Canada. However, the picture for the intercontinental correlation is not clear.

In India, the stromatolites are well known from the Precambrian rocks of peninsular and extra-peninsular regions; in most cases informations on their fabric, microstructure and biota are lacking. A painstaking work on the significance of stromatolites in Indian stratigraphy is required.

**2. Palaeobotany and stratigraphy of Talchir Formation**—Suresh C. Srivastava (Convener), P. K. Maithy and Anand Prakash.

The Talchir Formation represents the basal stratigraphic unit of the Lower Gondwana sequence of India. It lies unconformably over the peninsular shield and is overlain by the Karharbari Formation. This Formation also connotes the widespread Upper Palaeozoic Gondwana glaciation in the southern hemisphere with more or less synchronous and similar glacial deposits in Africa, Australia, Antarctica and South America.

The base of the Talchir Formation is generally typified by a tillite. The tillite is greenish-grey, unstratified and is composed of argillaceous matrix, pebbles, cobbles and boulders of various sizes. The boulders often exhibit facets and striae indicating their glacial or fluvioglacial origin. Overlying the tillite are siltstone, laminated shales, occasional varves and sandstone member.

Plant fossils associated with the Talchir Formation are: *Gangamopteris* (12 species), *Glossopteris* (3 species), *Vertebraria*, *Noeggerathiopsis*, *Cordaicarpus*, *Samaropsis*, *Arberia* and *Paranocladus*.

Palynologically the Talchir Formation is characterised by the abundance of trilete-bearing radial monosaccate pollen and on the basis of their quantitative distribution two assemblages have been distinguished. The older one is marked by the dominance of *Plicatipollenites* and subdominance of *Parasaccites*. In the younger sediments *Parasaccites* rises to dominance while *Plicatipollenites* is subdominant. The other genera are: *Potoniis-*

*porites*, *Cannanoropollis*, *Vestigisporites*, *Microbaculisporites*, *Quadrisporites*, etc.

### 3. Genesis and diagenesis of Indian Gondwana coals—

G. K. B. Navale (Convener), A. K. Srivastava, Archana Tripathi and B. K. Misra.

The coal forming Lower Gondwana period coincided, more or less, with the dwindling phase of the Permian Ice Age. Geological and palaeobotanical evidences suggest that temperate condition existing then in the peninsular India was responsible for the development of special flora dominated by *Gangamopteris*, *Glossopteris* and their allies which served as source material for the formation of Lower Gondwana coals.

The extent of variable transformation in the vegetal source material during diagenesis and catagenesis, inferred from biopetrological and rank investigations, reveals that the coal seams of the Karharbari Formation experienced highly oxidative conditions resulting to excessive fusinization probably due to rapid sedimentation, shallow basin condition and extensive microbial action. Thus the coalseams of the Karharbari Formation comprise chiefly inerto-durite genetic coal type. From Barakar onwards to Raniganj, progressive amelioration of the climate, from temperate to humid tropical, resulted into diversification and prolific growth of the existing flora.

This shift in climatic condition was also accompanied by the change in topographical features and sedimentation pattern. All these factors were apparently responsible for the gradual change in the course of diagenetic and catagenetic processes. The initial highly oxidative milieu during the Karharbari sedimentation, progressively, became oxidative to partially reducing in the Barakar and ultimately of reducing condition during Raniganj period. The latter condition is characterized by extensive vitrification of the vegetal source material forming coal seams of the Raniganj Formation. The coal seams thus formed in the Barakar Formation are rich in trimacerite genetic coal type

whereas those of the Raniganj Formation are chiefly vitro-clarite type. It has also been surmised that the geothermal gradient during the Gondwana sedimentation was low throughout and the resulting coal seams attained only low rank. However, in Damodar and Satpura Gondwana basins where igneous intrusion occurred during later phase of the Lower Gondwana sedimentation an abnormal increase in the rank of coal seams has been evidenced.

**4. Mesozoic and Cenozoic micropalaeobotany of the coastal sediments of India**—K. P. Jain (Convener), H. K. Maheshwari, R. K. Kar, Anil Chandra and S. A. Jafar.

In geologic time the Mesozoic and Cenozoic were significant eras from view point of major tectonic, volcanic and upheaval activities causing world-wide marine transgressions and regressions and formation of coastal basin structures. The concept of epicontinental seas during past holds good for the Indian subcontinent too.

The region of marine and continental interaction is treated as coastal region and the sediments thus deposited are coastal sediments. In India the sedimentary basins are distributed along the present coastal areas in peninsular part, e.g. east coast, Western Ghats, Andaman and Nicobar, north-eastern India, Rajasthan, Kachchh, Kathiawar, and Cambay. In the extrapeninsula, these are developed in Tethyan Himalayan facies and Himalayan facies. The former includes Karakoram, Kashmir, Zaskar, Bhallesh, Bibhada, Byans, Sikkim and Bhutan, whereas the latter is represented by lesser Himalaya, Krol, Tal and Subathu deposits.

The evolution and diversification of microflora during these two eras had been very rapid. Many marine phytoplanktonic groups, viz., diatoms, coccolithophorids, dinoflagellates, silicoflagellates, and angiosperms evolved only in Mesozoic.

The coastal areas are blessed with the accumulation of both marine and non-marine vegetal organic matter (terrestrial plant

micro-remains, e.g. spores, pollen, cuticle, wood tracheids, fungal bodies) and large amount of sediments. They possess well-developed source and reservoir rocks. The excess of organic detritus helps in the transformation of petroleum which is considered to be of marine organic origin due to consistency of carbon isotope data and molecular size distribution of the Porphyrines.

The micropalaeobotanical studies are significant in basinal correlation, age determination and environment interpretation. These aspects of biostratigraphy are some of the essential ingredients of Petroleum exploration.

**5. Permo-Triassic transition in peninsular India—Palaeobotanical evidence**—H. K. Maheshwari (Convener), R.S. Tiwari, Shaila Chandra, Shyam C. Srivastava and P.K. Pal.

The boundary between Permian and Triassic systems has usually been regarded, though not unopposed, as marking one of the biological "crises". The continuity of deposition in Permian through Triassic is more favourably seen in non-marine strata. In India this situation obtains in peninsular India. After analysing the whole gamut of available palaeobotanical and palynological evidences, it becomes apparent that no evolutionary 'crisis' as such affected the vegetation during Permian-Triassic transition in India. Though the Upper Permian flora is the richest in the Gondwana sequence, the flora of the uppermost Permian is rather impoverished and continues right into the basal Triassic with the incoming of two new forms, viz., *Cladophlebis concinna* and *Cyclopteris pachyrhachis*. There are certain Upper Permian holdovers in the upper part of the Lower Triassic, e.g., *Trizygia speciosa*, *Neomariopteris hughesii*, etc. The transition, however, saw the emergence of two new plant groups, viz., Corystospermaceae and Peltaspermaeae. Microfloristically, the transition saw an appreciable decline in disaccate-striate pollen, proliferation of taeniate pollen and emergence of some new forms, e.g., *Playfordiaspora*. The continuity of many taxa of both macro-and micro-plant fossils across the Permian-Triassic boundary apparently does not support the concept of a Middle Gondwana. It seems that the environ-

ment during the transition was not as unfavourable as has been usually made out. There, of course, was a definite deterioration in the climate as compared with that of the coal-forming period.

**6. Fossil flora of Satpura Basin**—Sukh Dev (Convener), Pramod Kumar and R. S. Singh.

The sediments of the Satpura Basin, situated in the Indian peninsular region, constitute the Gondwanas which are classified into Talchir, Damuda, Mahadeva and Jabalpur groups.

The Talchir Group has yielded a palynoflora which has the dominance of radial monosaccate pollen grains, e.g. *Parasaccites*, *Plicatipollenites*, etc. The Damuda Group is characterised by the dominance of *Glossopteris* leaves and striate-disaccate pollen. The Sukh-Tawa Formation of Permo-Triassic affinity contains *Striatopodocarpites*, *Densipollenites*, *Corisaccites-Guttulapollenites* complex, *Klausipollenites*, *Alisporites*, *Polypodites*, etc. From the Mahadeva Group only a few megafossils are reported; so far no palynological work has been done. The Jabalpur Group has three megafloral assemblages, the lower first two are characterised by the dominance of cycadophytes, e.g. *Dictyozamites*, *Pterophyllum*, *Ptilophyllum* and *Ctenozamites*, etc. and the uppermost by conifers, e.g., *Araucaria*, *Allocladus*, *Brachyphyllum*, *Pagiophyllum*, *Elatocladus*, etc. The palynoflora of the group indicates dominance of conifers only, e.g. *Podocarpidites*, *Callialasporites*, *Araucariacites*, etc.

In conclusion, the mega—and micro-floras are so far inadequately known from the Satpura Basin, with the resultant controversies regarding the age of the various formations. Therefore, extensive collections and thorough investigations on both mega—and micro-floras are needed for reliable and effective floristic and stratigraphic interpretations.

**7. The flora and ecology of South India during the Late Cenozoic**—N. Awasthi (Convener), H.P. Gupta and K. Ambwani.

The Late Cenozoic flora of South India includes the plant remains from the Upper Tertiary (Miocene-Pliocene) of East and West Coasts and from the Late Quaternary sediments of the tropical mountains around Ootacamund.

On the East Coast rich deposits of petrified woods occur in the Cuddalore Sandstones near Pondicherry. Systematic studies of these woods have revealed an assemblage of about seventy species belonging to several families of dicotyledons, palms and conifers (Podocarpaceae). The huge deposits of lignites at Neyveli contain carbonised woods, leaf impressions and compressions, and palynofossils. The Warkalli and Quilon beds on the West Coast have similar plant fossils. Palynological studies of these lignites have brought to light rich assemblages of pollen and spores referable to several families of angiosperms, pteridophytes and fungi. Recent investigations of carbonised woods from all the lignite deposits have indicated the presence of some significant Indo-Malayan elements.

From the collective evidence of megafossils and microfossils, it is broadly inferred that the climate in South India during Late Cenozoic was distinctly tropical with plenty of rainfall. The occurrence of quite a number of Malayan elements in this flora has further suggested that this part of the country and Malaya enjoyed the same climatic conditions. Further, considerable decrease in the annual precipitation seems to have been one of the reasons for the total disappearance of the wet evergreen forests from the East Coast of South India since the close of Pliocene.

The knowledge of the Quaternary flora of South India is mainly based on the pollen analytical investigations of the lake and swamp sediments around Ootacamund. The vegetational history of this region has depicted the change in the vegetational cover in this region during the past 30,000 or 40,000 years.

**8. Floristic and ecology of the Cenozoic Himalaya—**  
VishnuMittre (Convener), U. Prakash, H. P. Singh, A. Bhattacharya and Madhu Ahuja.



The origin of the Himalaya took place subsequent to the Eocene during the Tertiary as a part of the great and fascinating palaeogeographical change from the oceanic to the fresh water regime including the gradual migration of the Indian Plate from south of Equator during the early Cenozoic to its present position during the later part of the Tertiary. In mid-Miocene wet tropical forests in the western Himalaya were constituted by *Dipterocarpus*, *Cynometra*, *Millettia*, etc. indicating montane topography, wet, warm and humid climate. However, there were some deciduous elements too. Temperatures were equable and the average precipitation was about 2000 mm. The pollen evidence, howsoever meagre both qualitatively and quantitatively, has revealed predominance of pteridophytes succeeded by predominance of gymnosperms with *Betula*, *Careya*, *Alnus*, *Quercus* assemblage which indicates temperate climate prior to the beginning of the Quaternary.

The early Quaternary was characterised by mixed oak woods but the pollen evidence has revealed replacement of oak woods by the immigration of blue pine, the formation of pine woods and later the formation of mixed conifer-oak woods. This succession was interrupted thrice by steppe vegetation indicating cool oscillations. At Toshmaidan at a lower altitude the immigration of birch into the steppe and at still lower altitude in the Kathmandu Valley the invasion by oak or oak-pine woods into the steppe comprised the pattern of floristic development during the last glaciation. The fluctuations in floristics during the last glaciation are indicative of cold and warm oscillations.

The post-Glacial has shown fluctuations between conifer and broad-leaved oak mixed forests. The absence of oaks and alders from the Kashmir Valley today which were present in the valley in the past is noticeable. The floristic scenario in the Himalaya has since been changing fast, during the last 5,000 years under the impact of gradual expansion of agriculture, use of forest produce for timber and fuel and the effect of grazing animals

leading to shrinkage of the forested area, large-scale erosion, loss of useful germ plasm and ushering in change in climate.

The establishment of biospheres, to protect the remaining forests, and the social forestry programmes have been undertaken. Plantation of quick growing plants of Australian, European and Mexican origin are changing the indigenous floristic scenario into an exotic one, in many parts of the Himalaya.

### **Papers read at Symposia/Conferences/ Meetings, etc.**

- N. Awasthi and Madhu Ahuja—Investigation of some carbonised woods from Neogene of Varkala in Kerala Coast. IV Indian Geophytological Conference, Lucknow.
- M. B. Bande and U. Prakash—Palaeoclimate and palaeogeography of Central India during the Early Tertiary. IV Indian Geophytological Conference, Lucknow.
- D. C. Bharadwaj, Suresh C. Srivastava and R. Saxena—*Arasporites* gen. nov., a new acavate miospore from Barakar Formation of West Bokaro Coalfield, Bihar, India. IV Indian Geophytological Conference, Lucknow.
- H. P. Gupta, Chhaya Sharma, Rekha Dodia, Chetna Mandavia & A. B. Vora—Palynostratigraphy and palaeoenvironments of Kashmir, Hirpur Loc. II, Lower Karewas Kashmir. Conference of the Indian Archaeological Society, Waltair.
- R. K. Kar—Fossil *Pediastrum* from the Khari Nadi Formation (Lower Miocene) of Kachchh, Gujarat. IV Indian Geophytological Conference, Lucknow.
- R. N. Lakhanpal and J. S. Guleria—A preliminary appraisal of the Tertiary megaflora of district Kachchh, Gujarat, western India. IV Indian Geophytological Conference, Lucknow.

- G. K. B. Navale, B. K. Misra and Anand Prakash—On microconstituents of Godavari coals, South India. IV Indian Geophytological Conference, Lucknow.
- G. K. B. Navale and B. K. Misra—Petrographic evaluation of certain imported coals for the Steel Industry of India. IV Indian Geophytological Conference, Lucknow.
- Pramod Kumar—Observations on evolution of some nonsaccate-non-aperturate pollen. III Indian Palynological Conference, Haryana Agriculture University, Hissar.
- Pramod Kumar—Palynostratigraphy of Jabalpur Formation, Satpura Basin, M. P., India. IV Indian Geophytological Conference, Lucknow.
- V. Singh & R. S. Tiwari—Pattern of miofloras through Permian-Triassic transition in bore-hole RAD-2, East Raniganj Coalfield, West Bengal. IV Indian Geophytological Conference, Lucknow.
- A. K. Srivastava and Shaila Chandra—Lower Gondwana seeds from the Raniganj Coalfield, West Bengal, India. IV Indian Geophytological Conference, Lucknow.
- Suresh C. Srivastava and R. S. Tiwari—Palynological dating of Jhingurdah Seam, Singrauli Coalfield: A reappraisal. IV Indian Geophytological Conference, Lucknow.
- R. S. Tiwari—Nature of striations and taeniae in Gondwana saccate pollen. IV Indian Geophytological Conference, Lucknow.
- R. S. Tiwari and M. S. Rawat—Palynological studies of Jatraj Seam, Korba Coalfield, M. P., India. IV Indian Geophytological Conference, Lucknow.
- A. Tripathi and R. S. Tiwari—Barakar mioflora from Jharia Coalfield. IV Indian Geophytological Conference, Lucknow.

- Vishnu-Mittre and Aruna Sharma—Neolithic-Chalcolithic food economy of eastern Uttar Pradesh. Indo-Soviet Joint Seminar, Allahabad.
- R. R. Yadav and A. Chandra—Isolated *Thyriothecia* from the Arabian Sea bottom sediments. IV Indian Geophytological Conference, Lucknow.

### Lectures given outside the Institute

- K. P. Jain—Introduction to micropalaeobotany and its significance in geologic exploration. Department of Applied Geology and Geophysics, Roorkee University, Roorkee.
- P. K. Maithy—Precambrian life. Geological Survey of India, Training Camp, Aishmuqam.
- G. K. B. Navale—Coal microscopy techniques. Executive Development Programme Course lecture at Indian School of Mines, Dhanbad.
- G. K. B. Navale—Application of coal petrology in exploration of coal and oil. E. D. P. Course lecture at Indian School of Mines, Dhanbad.
- G. Rajagopalan—Method of dating with special reference to Radiocarbon dating. IV UNESCO sponsored training course in Conservation of Cultural Property.
- R. S. Tiwari—Surface structure of fossil spores. The Electron Microscopy Group of Lucknow.
- R. S. Tiwari—Coal palynology—Aspects and application. Botany Department, Garhwal University, Srinagar.
- Vishnu-Mittre—Recent advances in palaeoanthropological research and importance in teaching of palaeoanthropology. VIII Conference of Ethnographic and Folk Culture Society, Lucknow.

Vishnu-Mittre—Food gathering to food production: Palaeobotanical history of crops. Department of Ancient History, Culture and Archaeology, University of Allahabad.

### **Training Provided to Outsiders**

Shrimati Kavita Goswami (Department of Applied Geology, Dibrugarh University, Assam) was given training in preparation and polishing of coal pellets, maceration techniques and reflectance measurements on the Microphotometric Unit.

Shrimati Anusuya Bhattacharya (Geological Survey of India, Lucknow) was imparted training in pollen analytical investigations of Quaternary samples.

Kumari Tuk Tuk Ghosh (Department of History, Delhi University) was imparted training on archaeobotanical investigations.

Shri B. P. Sharma and Shri G. S. Rawat (Geology Department, Garhwal University) were helped in pollen morphology and pollen analysis of surface sediments.

Dr A. B. Vora (Gujarat University) was imparted training in modern and Quaternary palynology.

### **Technical Assistance to Outsiders**

#### **1. Archaeological Department, Sri Lanka**

Charred grain samples from Bani Lena Cave dwelling have been dated to shed light on early domestication in Sri Lanka.

#### **2. Archaeological Survey of India**

Charcoal samples from dwelling pits in Burzahom, Neolithic sites at Gufkral, Kashmir, Ramapuram, Andhra Pradesh were dated.

**3. Archaeological Survey of Sri Lanka**

Mesolithic carbonised materials from Patirajawala and Henagalapugala, Sri Lanka were investigated.

**4. Birla Archaeological and Cultural Research Institute, Hyderabad**

Charcoal sample from a Megalithic site at Veerapuram, Andhra Pradesh was dated.

**5. Bose Institute, Calcutta**

Wood samples from Bhawanipur and Rashbehari Av. were dated in relation to Quaternary vegetational history and biostratigraphy of Bengal Basin.

**6. Central Mining, Planning and Designing Institute of Coal India Limited, Ranchi**

Based on biopetrological and rank data of all the 36 Raniganj coal samples from three bore-holes the economic potentiality is being assessed.

A bore-core sample from the Bokaro Coalfield was palynologically analysed and dated to be Barakar in age.

**7. Deccan College, Pune**

Peat, wood, charcoal and shell samples from different sites of archaeological and geomorphological interest were dated.

**8. Department of Ancient Indian History, Culture and Archaeology Punjabi University**

Charcoal samples from Singh-Bhagwantpur were dated to determine the chronology of cultures at the site.

**9. Geological Survey of India**

Several bore-core and out crop samples from Sohagpur and Mand River coalfields were palynologically dated.

The samples from the Permian-Triassic transition were studied and successions built.

Wood, peat and sediment samples from Tripura, Kerala and Himachal Pradesh were dated.

Samples from bore-hole PBK2 from Palar Basin were analysed and Upper Gondwana mioflora was recorded. The samples of bore-hole GGK 27 from Ramagundam Area, GJ3 and GJ6 from Chelpur Area and several bore-cores from Jaipuram, Bhopal-Palli, Jillapalli, Bhimavaram, Chintalpudi, Singravaram, Sattupalli, Manthani and Sitampet areas were dated palynologically.

#### **10. Geology Department, Lucknow University**

Molluscan shell from Kachchh, Gujarat was dated in relation to Pleistocene history of Kachchh.

#### **11. National Institute of Oceanography, Goa**

Dredge core samples of clay and corals from Bay of Bengal were dated to provide data on the history and age of Bassas de Pedro and other Banks.

#### **12. Neyveli Lignite Corporation**

Biopetrological and rank evaluation of some samples from New Mine area of Neyveli Lignite Field was done in order to ascertain their typology and suitability for utilization purposes.

#### **13. Oil and Natural Gas Commission, Dehradun**

Shri S. V. Rao was assisted in identifying some leaf-impressions from the Siwalik Group and also from Mesozoic of Spiti Valley.

Grab and core samples of sea sediments from continental shelf off Bombay coast were dated.

#### **14. Society for Environmental Archaeology, Lucknow**

Wood charcoal samples from excavation at Dadupur Village and Moosanagar were dated for age determination of Neolithic to NBP war period.

### 15. Wadia Institute of Himalayan Geology, Dehradun

Calcium carbonate precipitates from hot springs at Chumathang, Leh were dated to determine the depositional history of such deposits.

## Deputation/Training/Study Abroad

Shaila Chandra—Attended XIII International Botanical Congress at Sydney from 25th to 28th August, 1981, visited fossil localities in southern Victoria and studied a number of plant fossil specimens from Tasmanian Museum at Hobart, Geology Department of Hobart University, Bureau of Mineral Resources at Canberra and Geological Survey of Queensland at Brisbane.

## Publication & Information Section

### Publication

During the year, Volume 27 (3 nos.) and Volumes 28-29 (in one) of *The Palaeobotanist* were printed. The latter, comprising 42 invited articles, has about 470 pages.

Numbers 1 and 2 of Volume 30 of *The Palaeobotanist* were processed and sent for printing.

The twentyeighth Sir Albert Charles Seward Memorial Lecture 'Present trends in ecological studies' delivered by Professor P. Legris, the tenth Birbal Sahni Memorial Lecture 'The Palms', delivered by Professor M. S. Chennaveeraiah and the tenth Silver Jubilee Commemoration Lecture 'Application of experimental taxonomy to horticultural botany' delivered by Dr T. N. Khoshoo were also printed.



The last volume of IV International Palynological Conference Proceedings was also published during the year. This volume, comprising all the symposia and nonsymposia papers of Divisions IV, V and VI, has about 525 pages.

Both Hindi and English versions of the Annual Report for the year 1980-81 were compiled and published.

During the year an income of Rs. 96,521.06 was registered from the sales proceeds of the Institute publications. This sum includes the following foreign exchange earnings.

US \$=7,607.94

£= 712.64

DM= 70.00

### Library

#### 1. Stock:

Sl. No.	Details	Position on 31.1.81	Additions during 1981-82	Total
1.	Books	3558	112	3670
2.	Journals	7207	—*	7207
3.	Reprints	26431	1278	27709
4.	Microfilms/fiche	243	4	247
5.	Thesis	34	4	38
6.	Reports	41	3	44
7.	Maps & Atlas	43	2	45
8.	Reference Books	118	7	125

\* Due to some technical reasons, a very large number of journals and periodicals have not been hard bound and hence not shown here, though procured.

In addition to this 85 current periodicals were also subscribed.  
Total registered numbers of borrowers=120

2. *Exchange Programme :*

(i) Number of papers whose reprints were purchased for exchange	25
(ii) Total number of reprints sent out on exchange	4470
(iii) Number of Institutions on exchange	75
(iv) Number of individuals on exchange	415
(v) Sets of papers of Prof. Sahni distributed	8
(vi) Number of periodicals received on exchange	67
(vii) Sets of Institute publications (formerly priced) distributed	43

3. *Current Awareness Service :*

The monthly list of new additions to the Library, e.g., books, reprints and journals as well as titles culled from the journals was continued in order to keep readers in touch with the latest acquisitions. A copy of each issue was distributed to every Department.

4. In addition to the staff of the Institute, the Library services were availed by a number of scientists from various organisations/institutions. Some of the important universities/institutions/organisations are: Saugar University—M. P.; Lucknow University—Lucknow; Shivaji University—Kolhapur; Delhi University—Delhi; Gujarat University—Ahmedabad; Physical Research Laboratory—Ahmedabad; Banaras Hindu University—Varanasi; National Botanical Research Institute—Lucknow; Botanical Survey of India—Dehradun; Botanical Survey of India—Calcutta.

## Museum

### Exhibition Halls

All the panels and show cases were renovated and rearranged. A few better and new specimens were also added in the panels.

A new wall-panel in the Entrance Hall of the Institute has been set up in which the fossils from India and abroad have been displayed along with some photographs of the important events in the Institute's history. Some more fossils were also displayed in the gallery.

### **Fossil Store Hall**

In this hall fossil impressions, compressions and palynological samples have been rearranged. Petrified wood and chert specimens have now been stored in the basement.

The older collections of fossils have been sorted out and broadly categorised into: (i) specimens those need further investigations, and (ii) specimens which can be sent in exchange or gift.

### **Type and Figured specimens/slides**

Specimens, slides and negatives pertaining to 29 research papers were submitted to the Museum. The position of type and figured specimens as on 31st March, 1982 is as follows :

Type and Figured specimens=2066

Type and figured slides=7482

Negatives of type/figured specimens/slides=6556

### **New collections from India:**

During the year about 290 localities were visited by the Institute staff for collection of megafossils and palynological samples. The details of the collection made by various departments are as under :

Department of Precambrian Biology and Palaeozoic Palaeobotany	=	279 specimens + 71 samples
Department of Mesozoic Palaeobotany	=	1694 specimens + 452 samples

Department of Cenozoic Palaeobotany	=	1752 specimens + 173 samples
Department of Coal Palaeobotany	=	885 samples
Department of Oil Palynology	=	1090 samples
Department of Quaternary Palynology	=	616 samples

### **New collections from abroad**

Fossil specimens were received from the followings :

- |  |             |
|--|-------------|
| 1. Prof. T. M. Harris, Reading, U. K.          | 3 specimens |
| 2. Dr W. V. Preiss, Eastwood, South Australia  | 4 specimens |
| 3. Dr Ulrich Weiss, Bethesda, Maryland, U.S.A. | 5 specimens |
| 4. Dr H. Knappe, East Berlin, G. D. R.         | 4 specimens |

### **Presentation of fossils**

1. British Museum of Natural History, London, U. K.
2. Cleveland Museum, Cleveland, Ohio, U.S.A.
3. Dr M. F. Glassener, Department of Geology, Australia.
4. Dr Ulrich Weiss, National Institute of Health, Bethesda, Maryland, U.S.A.
5. Prof. J. Grant Mackie, Auckland, New Zealand.
6. Dr Knappe, Harz Museum, German Democratic Republic.
7. A delegation from USSR.

### **Presentation of fossils to various institutions in the country**

1. Botany Department, Lucknow University.
2. Botany Department, D.A.V. College, Kanpur.
3. Botany Department, Bipin Bihari College, Jhansi.
4. Botany Department, Feroze Gandhi College, Rae-Bareli.
5. Botany Department, Acharya Narendra Dev Mahila Mahavidyalaya, Kanpur.
6. Geology Department, Ashutosh College, Calcutta.

7. Department of Botany, Presidency College, Calcutta.
8. Geology Department, University of Lucknow.
9. Botany Department, University of Garhwal, Srinagar (Pauri Garhwal).
10. Maharani Laxmibai Girls College, Budhwara, Bhopal.
11. Director, National Botanical Research Institute, Lucknow.
12. Prof. T. S. Mahabale, Maharashtra Association for the Cultivation of Science, Pune.
13. Department of Botany, Bangalore University, Bangalore.
14. Botany Department, Saifabad Science College, Osmania University, Hyderabad.
15. Department of Geology, Punjab University, Chandigarh.
16. Department of Earth Sciences, University of Roorkee, Roorkee.
17. Botany Department, Kalyani University, Kalyani.
18. Botany Department, Rana Shiksha Sivr Degree College, Pilkhwa.
19. Botany Department, S. M. M. Town Post Graduate College, Ballia.
20. Botany Department, P. P. N. College, Kanpur.
21. Department of Botany, North-Eastern Hill University, Shillong.
22. Narajola Raj College, Narajola, Midnapur.
23. Department of Geology, University of Nagpur, Nagpur.
24. Department of Geology, Utkal University at Ravenshaw College, Cuttak.
25. Brahmananda Kesab Chandra College, Calcutta.
26. Government Science College, Raipur.
27. Maharaja College, Arrah.
28. Guruvayurappan College, Kozikode.
29. Department of Geology, Sri Guru Ram Rai College, Dehradun

30. Budha Post Graduate College, Kushinagar, Deoria.
31. Ramniranjan Jhunjhunwala Arts & Science College, Bombay.
32. Geology Department, M. S. University, Baroda.
33. Botany Department, School of Science, University of Gujarat, Ahmedabad.
34. Botany Department, Bareilly College, Bareilly.
35. Geology Department, Aligarh Muslim University, Aligarh.
36. Geological Survey of India, Sri Nagar.
37. Botany Department, Poona University, Poona.
38. P. G. Department of Geology, D. B. A. College, Dehradun.
39. Botany Department, Kumaon University Campus at Almora.
40. Botany Department, School of Basic Science & Humanities, University of Udaipur, Udaipur.
41. Botany Department, M. S. University of Baroda, Baroda.
42. Department of Applied Geology, Indian School of Mines, Dhanbad.
43. Botany Department, Utkal University, Bhubaneshwar, Orissa.
44. Botany Department, Darjeeling Science College, Darjeeling.
45. Department of Biosciences, Himachal Pradesh University, Simla.
46. Head, Department of Geological Sciences, Jadavpur University, Calcutta.
47. Department of Geology, Kumaon University, Nanital.
48. I. T. College, Lucknow.
49. Shia College, Lucknow.
50. Mahila Mahavidyalaya, Lucknow.
51. B. S. N. Vocational Degree College, Lucknow.

#### **Visitors during the year**

About 300 persons including nationals of USA GDR, Sweden, Maldives, New Calidonia, Burma, USSR and Japan and

delegates to the 4th Indian Geophytological Conference visited the Museum.

Students from the following 12 colleges/universities of the country visited the Museum.

1. D. A. V. College, Kanpur.
2. A. N. D. Mahila Mahavidyalaya, Kanpur.
3. Osmania University, Hyderabad.
4. Cotton College, Gauhati.
5. Nalanda College, Bihar.
6. Bangalore University, Bangalore.
7. Govt. Science College, Jabalpur.
8. Science College, Kohima.
9. Govt. P. G. College, Pithoragarh.
10. Lucknow Christian College, Lucknow.
11. Shivaji University, Kolhapur.
12. University of Rajasthan, Udaipur.

### Herbarium

Following additions were made during the year.

Details	Position on 31.3.81	Additions during the year	Total as on 31.3.82
Herbarium sheet	10,561	20	10,581
Fruits and seeds	1,824	11	1,835
Wood specimens	3,218	118	3,336
Wood slides	3,007	588	3,595
Pollen slides	10,167	127	10,294

The routine work of identification, label writing, indexing registration and incorporation, poisoning and re-stitching, etc. was done. The sorting and rearrangement of plant specimens has been started. Pollen slides of different regions in the sporothek were examined and re-arranged. A set of 225 pollen slides of Nepal collection was sorted out and fresh labels were pasted. Besides, a list of polleniferous material of the genus *Toona* was prepared for the Quaternary Palynology Department.

#### Material received from:

- |  |                    |
|--|--------------------|
| 1. The Commissioner,<br>Forest Commission, Victoria                    | —20 wood specimens |
| 2. Wood Technologists,<br>Forest Research Centre Sabah,<br>E. Malaysia | —53 wood specimens |
| 3. Institute of Systematic Botany,<br>Utrecht, Netherlands             | —57 wood specimens |
| 4. The National Museum of Wales,<br>Cardiff                            | — 4 wood specimens |
| 5. Department of Botany,<br>Marida, Venezuela                          | —41 wood specimens |
| 6. French Research Institute<br>Pondicherry                            | —54 pollen slides  |

#### Material sent to:

- |   |                    |
|---|--------------------|
| 1. Wood Research Institute, Japan               | —41 wood specimens |
| 2. Department of Medicinal Plants,<br>Kathmandu | —225 pollen slides |

### Garden

The lawns were maintained by mowing, cleaning and watering regularly. The hedges were cut, pruned and unwanted plants removed. The 'Chakra' was also beautified. The *Bougainvillea* around the fences were also pruned. Twenty plants of *Bougainvillea*, 15 plants of *Jatropha* and 5 plants of *Hibiscus* were donated.



to the Institute garden by Dr M. N. Bose. The rose plants around the Samadhi of Prof. Sahni were replaced by the new ones. The Samadhi and the campus were also decorated on 10th April and 14th November, 1981.

### **Founder's Day Celebrations**

On 14th November, 1981 the Birthday of Professor Birbal Sahni, F. R. S. was celebrated. In the morning at 9.00 a.m. wreaths and flowers were placed on the Samadhi of Prof. Birbal Sahni by Shrimati Savitri Sahni, staff of the Institute and several other persons.

In the evening at 5.30 p.m. the function started and the 11th Birbal Sahni Memorial Lecture 'Status and position of hornworts' was delivered by Shri R. S. Chopra, Department of Botany, Punjab University, Chandigarh.

On 15th November at 5.30 p.m. Prof. G. V. Joshi, Botany Department, Shivaji University, Kolhapur delivered the 29th Sir Albert Charles Seward Memorial Lecture 'The mangroves'.

Dr Cecil J. Saldanha, Centre for Taxonomic studies, St. Joseph's College, Bangalore delivered the 11th Silver Jubilee Commemoration Lecture titled 'Vegetation dynamics in Karnataka' on 16th November, 1981 at 5.30. p.m.

### **Distinguished Visitors**

1. Shri V. K. Bhaskaran Nair, Director of Research, Rubber Products Institute of India, Kottayam, Kerala.
2. Shri Mervyn Ruggles, UNDP, New Delhi.
3. Dr H. Knappe, Harz Museum, G.D.R.
4. Dr Mrs Annie Skarby, Department of Geology, University of Stockholm, Sweden.
5. Dr Ibrahim Nallu, Maldives.
6. Shri D. Ferret, New Caledonia.

7. Shri U. Than Swe, Archaeological Officer, Department of Archaeology, Burma.
8. Yoshinichi Enoto, Director, Department of Conservation Science, Tokyo National Research Institute of Cultural Properties, Tokyo, Japan.
9. Prof. James D. Howard, U.S.A.
10. Dr C. B. Cooper, Fairchild, Palo Alto, California, U.S.A.
11. Dr Janice McOmber, Intel, Santa Clara, California, U.S.A.
12. Professor, T. M. Harris, Reading, U.K.
13. Mr George Newman, Director, German Academic Exchange Service, New Delhi.
14. Shri Vinay Shankar, Joint Secretary, Department of Science & Technology, Government of India, New Delhi.
15. A delegation from U.S.S.R.

### **The Staff**

(as on 1.4.1981)

#### **Director**

Dr M. N. Bose, M.Sc., Ph.D., F.Pb.S., Correspondent de la Arsom, F.A.Sc., F.N.A.

#### **Deputy Directors**

Dr R. N. Lakhnupal, M.Sc., Ph.D., F.B.S., F.Pb.S., F.N.A.Sc., F.A.Sc., F.N.A.

Dr D. C. Bharadwaj, M.Sc., Ph.D. (Lucknow), Dr. rer. Nat. (Bonn), F.B.S., F.Pb.S.

#### **Department of Precambrian Biology and Palaeozoic Palaeobotany**

Dr P. K. Maithy, M.Sc., Ph.D. (S.S.O.)

Dr Shrimati Shaila Chandra, M.Sc., Ph.D., F.L.S. (S.S.O.)

Dr A. K. Srivastava, M.Sc., Ph.D. (J.S.O.)

- Dr Manoj Shukla, M.Sc., Ph.D. (S.S.A.)  
 Dr J. Mandal, M.Sc., Ph.D. (S.S.A.)  
 Shri Bijai Prasad, M.Sc. (J.S.A.)  
 Shri Rupendra Babu, M.Sc. (J.S.A.)  
 Shri Kamaljeet Singh, M.Sc. (J.S.A.)  
 Shrimati Rajni Tiwari, M.Sc. (Research Scholar)

#### **Department of Mesozoic Palaeobotany**

- Dr Sukh-Dev, M.Sc. (Hons.), Ph.D. (Lucknow), Ph.D. (Reading) (S.S.O.)  
 Dr H. K. Maheshwari, M.Sc., Ph.D. (S.S.O.)  
 Dr Shyam C. Srivastava, M.Sc., Ph.D. (S.S.O.)  
 Dr Kumari Jayasri Banerji, M.Sc., Ph.D. (J.S.O.)  
 Dr Shrimati Zeba Bano, M.Sc., Ph.D. (S.S.A.)  
 Dr B. N. Jana, M.Sc., Ph.D. (S.S.A.)  
 Shri P. K. Pal, M.Sc. (J.S.A.)  
 Shri R. S. Singh, M.Sc. (J.S.A.)  
 Shrimati Rashmi Srivastava, M.Sc. (J.S.A.)

#### **Department of Cenozoic Palaeobotany**

- Dr U. Prakash, M.Sc., Ph.D., F.Pb.S. (Assistant Director)  
 Dr N. Awasthi, M.Sc., Ph.D. (S.S.O.)  
 Dr M. B. Bande, M.Sc., Ph.D. (J.S.O.)  
 Dr K. Ambwani, M.Sc., Ph.D. (J.S.O.)  
 Dr J. S. Guleria, M.Sc., Ph.D. (S.S.A.)  
 Dr Shrimati V. Lalitha, M.Sc., Ph.D. (S.S.A.)  
 Dr S. D. Bonde, M.Sc., Ph.D. (J.S.A.—on foreign service term)  
 Dr Kumari Madhu Ahuja, M.Sc., Ph.D. (J.S.A.)  
 Shri R. C. Mehrotra, M.Sc. (J.S.A.)

#### **Department of Quaternary Palynology**

- Dr Vishnu-Mittre, M.Sc., Ph.D. (Lucknow), Ph.D. (Cantab)-  
 (Assistant Director)  
 Dr H. P. Gupta, M.Sc., Ph.D. (S.S.O.)  
 Dr Shrimati Chhaya Sharma (J.S.O.)  
 Shri A. Bhattacharya, M.Sc. (S.S.A.)

- Dr Shrimati Asha Khandelwal, M.Sc., Ph.D. (J.S.A.)  
 Shri R. R. Yadav, M.Sc. (J.S.A.)  
 Kumari Aruna Sharma, M.Sc. (J.S.A.)  
 Kumari Chanchala, M.Sc. (J.S.A.)  
 Shri S. K. Bera, M.Sc. (J.S.A.)  
 Shri M. S. Chauhan, M.Sc. (J.S.A.)

#### **Department of Coal Palaeobotany**

- Dr G.K.B. Navale, M.Sc., Ph.D., F.G.S., B.G.M.S., F.I.A.S.  
 (S.S.O.)  
 Dr R. S. Tiwari, M.Sc., Ph.D. (S.S.O.)  
 Dr Anand Prakash, M.Sc., Ph.D. (S.S.O.)  
 Dr Suresh C. Srivastava, M.Sc., Ph.D. (S.S.O.)  
 Dr Shrimati Archana Tripathi, M.Sc., Ph.D. (J.S.O.)  
 Shri B. K. Misra, M.Sc. (S.S.A.)  
 Dr Shrimati Vijaya Singh, M.Sc., Ph.D. (S.S.A.)  
 Shri Rakesh Saxena, M.Sc. (J.S.A.)  
 Shrimati Neerja Jha, M.Sc. (J.S.A.)  
 Shri Ram Awatar, M.Sc. (J.S.A.)  
 Kumari Alpana Agarwal, M.Sc. (J.S.A.)  
 Shri O. S. Sarate, M.Sc. (J.S.A.)  
 Shri K. L. Meena, M.Sc. (J.S.A.)

#### **Department of Oil Palynology**

- Dr H. P. Singh, M.Sc. (Hons.), Ph.D. (Assistant Director)  
 Dr K. P. Jain, M.Sc., Ph.D. (S.S.O.)  
 Dr R. K. Kar, M.Sc., Ph.D. (S.S.O.)  
 Dr Anil Chandra, M.Sc., Ph.D. (S.S.O.)  
 Dr R. K. Saxena, M.Sc., Ph.D. (J.S.O.)  
 Shri S. K. M. Tripathi, M.Sc. (S.S.A.)  
 Shri Rahul Garg, M.Sc. (S.S.A.)  
 Shri M. R. Rao, M.Sc. (S.S.A.)  
 Shri Samir Sarkar, M.Sc. (S.S.A.)

#### **Geochronology Laboratory**

- Dr G. Rajagopalan, M.Sc., Ph.D. (Germany) (Geophysist)  
 Dr H. S. Saini, M.Sc., Ph.D. (J.S.O.)  
 Shri A. P. Srivastava, M.Sc. (J.S.A.)

### **Publication and Information Section**

- Shri Jaswant Singh, M.Sc. (Joint Editor)  
 Shri S. B. Verma, M.A., B.Com., D.P.A. (Publication Incharge)  
 Shri J. N. Nigam, B.A., B.Lib.Sc. (Librarian)  
 Shri G. K. Gupta, B.Sc., B.Lib.Sc. (Library Assistant)  
 Kumari Kavita Sangal, B.Sc., B.Lib. Sc. (Library Assistant)

### **Museum**

- Shri G. P. Srivastava, M.Sc. (Curator)  
 Shri N. C. Saxena, B. A. (Museum Assistant)  
 Shri B. D. Mandaokar (Junior Museum Assistant)

### **Herbarium**

- Dr H. A. Khan, M.Sc., Ph.D. (Curator)  
 Shri J. C. Srivastava, M.Sc. (Herbarium Incharge)  
 Shri Diwakar Pradhan, B.Sc. (Herbarium Assistant)  
 Shri A. K. Singh Rathore, B.Sc. (Herbarium Assistant)

### **Laboratory Services**

- Shri H. N. Boral, B.Sc. (S.T.A.)  
 Shri B. Sekar, B.Sc., A.I.C. (S.T.A.)  
 Shrimati Asha Guleria, B.Sc. (J.T.A.)  
 Shrimati Madhabi Chakraborty, B.Sc. (J.T.A.)  
 Shrimati Indra Goel, B.Sc. (J.T.A.)  
 Shri D. C. Joshi, B.Sc. (J.T.A.)  
 Kumari Kamla Amaralal, B.Sc. (J.T.A.)  
 Shri N. K. Khasnavis, B.Sc., LL.B. (J.T.A.)  
 Shri I. J. Mehra, B.A. (Lab Assistant)  
 Shri A. K. Ghosh (Electrician)  
 Shri T. K. Mandal, B.Sc. (J.T.A.)  
 Shri Vijay Singh Panwar (Glass Blower)  
 Shri P. S. Salujha (Mechanic)  
 Shri E. G. Khare, B.Sc. (J.T.A.)  
 Shri K. B. Gupta, B.Sc. (J.L.A.)  
 Kumari Sangita Rastogi, B.Sc. (J.L.A.)  
 Shri A. K. Srivastava, B.Sc. (J.L.A.)  
 Kumari Reeta Chatterji, B.Sc. (J.L.A.)

Shri Keshav Ram, B.Sc. (J.L.A.)

Shri Gandra Pal, B.Sc. (J.L.A.)

Shri Prem Prakash, B.Sc. (J.L.A.)

### **Photography and Drawing**

Shri P. C. Roy (Photographer)

Shri P. K. Bajpai (Artist)

### **Stores**

Shri Harjeet Singh, B.A. (Store Keeper)

Kumari G. Omanayamma (Stenotypist)

### **Accounts Section**

Shri Ghanshyam Singh, B.Com. (Accounts Officer)

Shri T. N. Shukla, B.A. (Senior Accountant)

Shri B. K. Jain, B.A. (Junior Accountant)

Shri N. N. Joshi (U.D.C)

Shri R. K. Takru, B.A. (U.D.C.)

Shri Dhoom Singh, B.A. (L.D.C.)

Shri S. K. Bagchi (L.D.C.)

### **Administration**

Shri Gurcharan Singh, M.A., LL.B. (Registrar)

Shri V. P. Gulati (Deputy Registrar)

Shri S. D. Mehtani (Deputy Registrar)

Shri S. K. Suri (Stenographer)

Shri S. P. Chadha, B.A. (P. A. to Director)

Shri H. S. Srivastava, B.Com. (Office Assistant)

Shri Bhagwan Singh (Assistant)

Shrimati P. K. Srivastava (Receptionist)

Shri I. J. S. Bedi (U.D.C.)

Shri Ramesh Chandra (U.D.C.)

Shri R. K. Kapoor (L.D.C.)

Shrimati V. Nirmala (L.D.C.)

Kumari Ruchita Bagchi, B.A. (L.D.C.)

Shrimati Usha Chandra (Telephone Operator)

Shrimati P. Thomas (L.D.C.)

Shri Joseph George (L.D.C.)

Shri S. K. Srivastava (L.D.C.)  
 Shrimati Lalitha Nair (L.D.C.)

### Drivers

Shri Hanuman Prasad  
 Shri Lallan  
 Shri Balbir Singh

### General Help

Shri Bhim Singh (Mechanic-cum-Section Cutter)  
 Shri Danpat (Mechanic-cum-Section Cutter)  
 Shri Mahipal Singh (Mechanic)  
 Shri Mathura Dutt (Museum Attendant)  
 Shri Sarju Prasad (Daftari)  
 Shri Roop Chand (Lab Attendant)  
 Shri Raja Ram (Lab Attendant)  
 Shri Satruhan (Lab Attendant)  
 Shri Sant Ram Yadav (Peon)  
 Shri Sunder Lal (Peon)  
 Shri Bashir (Peon)  
 Shri Prem Chand (Peon)  
 Shri Ram Singh (Peon)  
 Shri Rajendra Kumar (Peon)  
 Shri K. C. Chandola (Peon)  
 Shri Sri Ram (Peon)  
 Shri Haradhan Mahanti (Peon)  
 Shri Prem Shanker (Chowkidar)  
 Shri Ram Dhari (Chowkidar)  
 Shri Vishnu Kumar (Chowkidar)  
 Shri Ram Deen (Chowkidar)  
 Shri Kesho Ram (Chowkidar)  
 Shri Bishnu Dutt (Chowkidar)  
 Shri Ram Sahai (Mali-skilled)  
 Shri Bipat (Mali-skilled)  
 Shri Chaitu (Mali-skilled)  
 Shri Rameshwar Prasad Pal (Mali-unskilled)  
 Shri Chhange Lal (Safaiwala)

Shri Nanhoo (Safaiwala)  
Shri Mewa Lal (Safaiwala)  
Shri Ram Kishan (Safaiwala)  
Shri Munni (Safaiwali)

### **Appointments and Promotions**

Dr R. N. Lakhanpal, Deputy Director, appointed as Distinguished Scientist w.e.f 14th November, 1981.

#### **Department of Precambrian Biology and Palaeozoic Palaeobotany**

1. Dr Shrimati Usha Bajpai, M.Sc., Ph.D., appointed as Senior Scientific Assistant w.e.f. 6th October, 1981.
2. Kumari Rajni Misra, Research Scholar appointed as J. S. A. w.e.f. 12th December, 1981.
3. Dr J. Mandal, S. S. A., appointed as Junior Scientific Officer w.e.f. 15th December, 1981.
4. Shri Bijai Prasad, J. S. A., appointed as Senior Scientific Assistant w.e.f. 26th March, 1982.

#### **Department of Mesozoic Palaeobotany**

1. Shri B. N. Jana, S. S. A., appointed as Junior Scientific Officer w.e.f. 15th October, 1981.
2. Shri P. K. Pal, J. S. A., appointed as Senior Scientific Assistant w.e.f. 12th December, 1981.
3. Dr (Kumari) Asha Gupta, M.Sc., Ph.D., appointed as Junior Scientific Assistant w.e.f. 16th October, 1981.
4. Shri A. Rajnikanth, M.Sc., appointed as Junior Scientific Assistant w.e.f. 9th November, 1981.
5. Shri R. S. Singh, J. S. A., appointed as Senior Scientific Assistant w.e.f. 26th March, 1982.
6. Kumari Neeru Pandya, M.Sc., appointed as Junior Scientific Assistant w.e.f. 20th March, 1982.



**Department of Cenozoic Palaeobotany**

1. Dr Uttam Prakash, Assistant Director, was given a Special Grade w.e.f. 16th November, 1981.
2. Dr J. S. Guleria, S. S. A., appointed as Junior Scientific Officer w.e.f. 26th October, 1982.
3. Shri Mahesh Prasad, M.Sc., appointed as Junior Scientific Assistant w.e.f. 1st May, 1981.
4. Dr (Kumari) Madhu Ahuja, M.Sc., Ph.D., appointed as Senior Scientific Assistant w.e.f. 26th March, 1982.
5. Shri B. D. Mandaokar, M.Sc., appointed as Junior Scientific Assistant w.e.f. 29th March, 1982.
6. Dr Anil Agarwal, M.Sc., Ph.D., appointed as Senior Scientific Assistant w.e.f. 30th March, 1982.

**Department of Quaternary Palynology**

1. Dr Shrimati Asha Khandelwal, J. S. A., appointed as Senior Scientific Assistant w.e.f. 6th October, 1981.
2. Shri S. K. Bera, M.Sc., appointed as Junior Scientific Assistant w.e.f. 6th October, 1981.
3. Kumari Aruna Sharma, J. S. A., appointed as Senior Scientific Assistant w.e.f. 26th March, 1982.
4. Kumari Chanchala, J. S. A., appointed as Senior Scientific Assistant w.e.f. 27th March, 1982.
5. Shri M. S. Chauhan, M.Sc., appointed as Research Scholar w.e.f. 14th April, 1981 and then as Junior Scientific Assistant w.e.f. 27th March, 1982.

**Department of Coal Palaeobotany**

1. Dr Shrimati Vijaya Singh, S. S. A., appointed as Junior Scientific Officer w.e.f. 14th October, 1981.
2. Shri Rakesh Saxena, J. S. A., appointed as Senior Scientific Assistant w.e.f. 6th October, 1981.
3. Shri K. L. Meena, M.Sc., appointed as Junior Scientific Assistant w.e.f. 9th November, 1981.

4. Shrimati Neerja Jha, J.S.A., appointed as Senior Scientific Assistant w.e.f. 26th March, 1982.
5. Shri B. D. Singh, M.Sc., appointed as Research Scholar w.e.f. 8th April, 1981 and then as Junior Scientific Assistant w.e.f. 27th March, 1982.

#### **Department of Oil Palynology**

1. Dr S. A. Jafar, M.Sc., Ph.D., appointed as Senior Scientific Officer w.e.f. 11th August, 1981.
2. Shri R. R. Yadav, J.S.A., appointed as Senior Scientific Assistant w.e.f. 6th October, 1981.
3. Dr Shrimati Jyotsna Rai, M.Sc., Ph.D., appointed as Junior Scientific Assistant w.e.f. 10th October, 1981.
4. Shri Madhav Kumar, M.Sc., appointed as Junior Scientific Assistant w.e.f. 20th October, 1981.
5. Shri Khowaja Ateeqzamman, M.Sc., appointed as Junior Scientific Assistant w.e.f. 22nd October, 1981.
6. Shri Rajesh Kumar Saxena, M.Sc., appointed as Junior Scientific Assistant w.e.f. 12th November, 1981.

#### **Geochronology Laboratory**

Dr G. Rajagopalan, S.S.O., appointed as Assistant Director w.e.f. 16th November, 1981.

#### **Publication and Information Section**

Shri Jagannath Prasad, B.A., appointed as Lower Division Clerk w.e.f. 1st January, 1982.

#### **Museum**

Shri Sant Ram Yadav, Peon, appointed as Museum Attendant w.e.f. 25th August, 1981 and then as Fossil Cataloguer w.e.f. 27th January, 1982.

#### **Laboratory Services**

Shri Chandrabali was appointed as Section Cutter w.e.f. 20th April, 1981.

**Accounts Section**

Shri A. K. Agarwal, B.Com., appointed as Lower Division Clerk w.e.f. 14th July, 1981.

**Administration Section**

1. Shri R. B. Kukreti appointed as Care Taker w.e.f. 15th June, 1981.
2. Shri Hari Lal appointed as Lower Division Clerk w.e.f. 23rd December, 1981.

**General Help**

1. Shri Bashir, Peon, promoted as Lab Attendant w.e.f. 13th July, 1981.
2. Shri Bam Singh appointed as Peon w.e.f. 21st October, 1981.
3. Shri Kedar Nath appointed as Peon w.e.f. 22nd October, 1981.
4. Shri Lalta Prasad appointed as Peon w.e.f. 22nd October, 1981.

**Retirements**

1. Dr D. C. Bharadwaj, Deputy Director, retired on 31st July, 1981.
2. Shri Mathura Dutt, Museum Attendant, retired on 31st July, 1981.
3. Shri Dhanpat, Mechanic-cum-Section Cutter, retired on 31st October, 1981.
4. Shri V. P. Gulati, Deputy Registrar, retired on 31st December, 1981.
5. Shri Tulsi Ram, Herbarium Attendant, retired on 31st January, 1982.

## Committees

### Finance and Building Committee

#### CHAIRMAN

Prof. A. K. Sharma, F.N.A.,  
Botany Department,  
Calcutta University,  
Calcutta 700 009

#### MEMBERS

Secretary,  
Department of Science & Technology,  
Technology Bhavan,  
New Mehrauli Road,  
New Delhi 110 029

Joint Secretary (Finance),  
Department of Science & Technology,  
Technology Bhavan,  
New Mehrauli Road,  
New Delhi 110 029

Superintending Engineer,  
25th Circle, U. P., P.W.D.,  
Lucknow

Shri Arun Kumar,  
Architect,  
118, Cantonment Road,  
Lucknow 226 001

Prof. B. S. Trivedi,  
Botany Department,  
Lucknow University,  
Lucknow 226 007

Dr M. N. Bose  
Director,  
Birbal Sahni Institute of Palaeobotany,  
Lucknow 226 007

**Scientific Programming and Evaluation Committee (till  
17.8.1981)**

**CHAIRMAN**

Dr M. N. Bose,  
Director,  
Birbal Sahni Institute of Palaeobotany,  
Lucknow 226 007

**MEMBERS**

Prof. F. Ahmad, F.N.A.,  
Commissioner for Geology & Mining, J. & K.,  
Srinagar 190 001

Prof. A. R. Rao,  
No. 2, XI Main Road, 3rd Block, East Jayanagar,  
Bangalore

Prof. Rama,  
Tata Institute of Fundamental Research,  
Bombay 400 005

Dr Sunirmal Chanda,  
Bose Institute,  
Calcutta 700 009

Dr R. N. Lakhanpal,  
Deputy Director

Dr D. C. Bharadwaj,  
Deputy Director

Dr Vishnu-Mittre,  
Head, Quaternary Palynology Department

Dr Uttam Prakash,  
Head, Cenozoic Palaeobotany Department

Dr H. P. Singh,  
Head, Oil Palynology Department

Dr G. K. B. Navale,  
Head, Coal Palaeobotany Department

Dr Sukh-Dev,  
Head, Mesozoic Palaeobotany Department

Dr P. K. Maithy,  
Head, Precambrian Biology & Palaeozoic  
Palaeobotany Department

Dr G. Rajagopalan,  
Head, Geochronology Laboratory

**Research Advisory Council (w.e.f. 81.8.1981)**

Prof. A. K. Ghosh,  
Botany Department,  
Calcutta University,  
Calcutta

Dr Sunirmal Chanda,  
Bose Institute,  
Calcutta

Prof. F. Ahmad,  
IV/37, Trikuta Nagar,  
Jammu

Prof. B. S. Trivedi,  
Botany Department,  
Lucknow University,  
Lucknow

Dr S. C. D. Sah,  
Wadia Institute of Himalayan Geology,  
Dehradun

Dr G. Thanikaimoni,  
French Institute,  
Pondicherry

Dr D. C. Bharadwaj,  
Mahanagar,  
Lucknow

Prof. D. D. Pant,  
Botany Department,  
Allahabad University,  
Allahabad

Deputy Director General,  
Geological Survey of India,  
Calcutta

Dr M. N. Bose,  
Director,  
Birbal Sahni Institute of Palaeobotany,  
Lucknow

Dr R. N. Lakhanpal,  
Distinguished Scientist,  
Birbal Sahni Institute of Palaeobotany,  
Lucknow

#### **Building and Garden Committee**

Dr R. K. Kar  
Dr A. K. Srivastava  
Dr Manoj Shukla  
Shri S. D. Mehtani

#### **Dark Room Committee**

Dr R. S. Tiwari  
Dr Jayasri Banerji  
Dr Archana Tripathi

#### **Herbarium Committee**

Dr N. Awasthi  
Dr H. P. Gupta  
Dr Pramod Kumar  
Dr H. A. Khan

**Incharge Vehicle and Guest House Maintenance**

Dr Anand Prakash

**Maintenance Committee**

Dr K. P. Jain, Convener

Dr Shyam C. Srivastava

Dr K. Ambwani

Dr R. K. Saxena

Shri V. P. Gulati

**Museum Committee**

Dr P. K. Maithy, Convener

Dr H. K. Maheshwari

Dr R. S. Tiwari

Dr N. Awasthi

Dr Anil Gandra

Shri G. P. Srivastava

**Procurement and Quality Control Committee**

Dr G. K. B. Navale, Convener

Dr Shaila Chandra

Dr Anand Prakash

Shri Ghanshyam Singh

Shri V. P. Gulati

**Publication and Information Committee**

Dr H. K. Maheshwari, Convener

Dr R. S. Tiwari

Dr Suresh C. Srivastava

Shri J. S. Antal

Dr M. B. Bande

Dr Chhaya Sharma

**Canteen Committee**

Dr Sukh-Dev, Chairman

Dr Anand-Prakash

Shri N. K. Khasnavis

Kumari Indra Kumari

Shri S. K. Suri

Shri Bhagwan Singh



R. N. KHANNA & COMPANY,  
*Chartered Accountants*

3, Kabir Marg,  
Clay Square,  
Lucknow 226 001

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**AUDITOR'S REPORT**  
**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, 1982 and also the relevant Income and Expenditure Account and Receipt and Payment Account for the year ended on that date with the help of account and vouchers relating thereto.

We report that to the best of our information and according to the explanations given to us, in our opinion, the Balance Sheet read with notes thereon, shows a true and correct state of affairs of the Institute as at 31st March, 1982 and the Income & Expenditure Account gives a true and fair view of income over expenditure.

For R. N. KHANNA & COMPANY,-  
*Chartered Accountants*

(Sd.)  
(P. K. KHANNA)  
*Partner*

**Seal**

R. N. KHANNA &amp; COMPANY

*Chartered Accountants*3, Kabir Marg,  
Clay Square,  
Lucknow 226 001

**NOTES ON BALANCE SHEET OF BIRBAL SAHNI  
INSTITUTE OF PALAEOBOTANY, LUCKNOW  
AS AT 31ST MARCH, 1982**

1. Accounts of the Institute is maintained on Cash basis.
2. No depreciation are provided on fixed assets. The fixed assets are shown at cost in the Balance Sheet.
3. The following Capital were created out of the recurring grants received during the year:

Books & Journals	16,459.11	
Maps & Toposheets	189.27	
Works & Building	21,918.15	38,566.53
	Total	38,566.53

For R. N. KHANNA & COMPANY  
*Chartered Accountants*

(Sd.)

(P. K. KHANNA)

*Partner*

*Place:* Lucknow

**Seal**

*Date:* 19/7/1982

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*Statement of Accounts*  
*for the year*  
*1981-82*

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**Birbal Sahni Institute****Balance Sheet as on**

LIABILITIES	AMOUNT Rs.	AMOUNT Rs.	AMOUNT Rs.
<b>Capital Fund:</b>			
Balance as per last Year's Balance sheet		70,40,596.07	
<i>Add:</i> Government of India Grants on Capital Account ..		15,25,000.00	
Amount refunded by State Bank of India, Lucknow against Letter of Credit ..		8,000.00	
Misc. Receipt : In- terest from Savings Bank A/C ..		6,666.67	
Recurring Expendi- ture used for creating fixed assets :			
Books & Journals	16,459.11		
Maps & Toposheets	189.27		
Works & Building	21,918.15	38,566.53	
	<hr/>	<hr/>	
		86,18,829.27	
<i>Less:</i> Amount refun- ded to Government		1,003.03	86,17,826.24
		<hr/>	
<b>Reserve and Surplus:</b>			
Excess of Revenue Grant over Revenue Expenditure ..			2,42,529.74

## of Palaeobotany, Lucknow

31st March, 1982

ASSETS	AMOUNT Rs.	AMOUNT Rs.
<b>Fixed Assets:</b>		
Land (Donated by Govt. of U. P.) .. ..		32,292.00
<b>Works &amp; Building :</b>		
As per last year's Balance Sheet .. ..	17,26,652.04	
Addition during the year :		
Out of Capital Account ..	4,56,612.63	
Out of Revenue Account ..	21,918.15	22,05,182.82
	-----	
<b>Research Apparatus &amp; Equipments :</b>		
As per last year's Balance Sheet .. ..	16,06,015.19	
Additions during the year ..	2,75,831.63	18,81,846.82
<b>Workshop Equipment :</b>		
As per last year's Balance Sheet .. ..	67,374.85	67,374.85
Additions during the year ..	Nil	
	-----	
<b>Office and Miscellaneous Equipments:</b>		
As per last year's Balance Sheet .. ..		1,27,922.06

LIABILITIES	AMOUNT Rs.	AMOUNT Rs.	AMOUNT Rs.
<b>Donated Funds/Grants:</b>			
Cost of Land donated by U. P. Govt.		32,292.00	
Founder's Donation		1,52,500.00	
C. D. Pant Memorial Fund .. ..		1,926.88	
C. L. Katiyal Memorial Fund .. ..		3,911.08	
P. C. Bhandari Memorial Fund ..		2,948.05	
A. C. Seward Memorial Fund		10,683.58	
Other Misc. Donations .. ..		10,721.29	
M. G. T. Scheme (C. S. I. R.) ..		8,100.79	
Coal Scheme (C.S.I.R.)		7,784.66	
Palynological Scheme (C.S.I.R.) ..		5,207.87	
UNESCO Aid Fund		10,629.75	
Burmah Oil Co. Donation ..		1,900.00	
Rajasthan Scheme (Sponsored by Univ. of Wisconsin) ..		23,009.15	

ASSETS	AMOUNT Rs.	AMOUNT Rs.
Additions during the year (Photography) .. ..	4,530.00	1,32,452.06
<b>Establishment of C-14 Radio- metric Laboratory :</b>		
As per last year's Balance Sheet .. ..	8,11,833.61	
Additions during the year ..	4,71,331.95	12,83,165.56
<b>Plant and Machinery:</b>		
As per last year's Balance Sheet .. ..	3,61,031.92	
Additions during the year ..	33,284.56	3,94,316.48
<b>Apparatus and Equipment (Donated):</b>		
M. G. T. Scheme (C.S.I.R.)	7,155.79	
Burmah Oil Co. ..	700.00	
Founder's Donation ..	2,500.00	
Coal Scheme (C.S.I.R.) ..	6,645.29	
Palynological Scheme (C.S.I.R.)	5,207.87	
Rajasthan Scheme (Spon- sored by Univ. of Wisconsin	21,138.90	
UNESCO Aid Equipment	19,629.75	
Humboldt Foundation (West Germany) .. ..	75,091.50	1,38,069.10





ASSETS	AMOUNT Rs.	AMOUNT Rs.
<b>Vehicles :</b>		
As per last year's Balance Sheet .. ..	1,74,688.07	
Additions during the year ..	1,01,361.00	2,76,049.07
	<hr/>	
<b>Furniture and Fixtures :</b>		
As per last year's Balance Sheet .. ..	6,54,143.53	
Additions during the year ..	21,283.37	6,75,426.90
	<hr/>	
<b>Furniture &amp; Fixtures (Donated) :</b>		
Burmah Oil Company ..	1,200.00	
M. G. T. Scheme (C.S.I.R.)	945.00	
Coal Scheme (C.S.I.R.)	1,139.37	
Rajasthan Scheme (Sponsored by University of Wisconsin)	979.70	4,264.07
	<hr/>	
<b>Books and Journals :</b>		
As per last year's Balance Sheet .. ..	3,36,467.52	
Additions during the year:		
Out of Capital Account ..	45,163.68	
Out of Revenue Account ..	16,459.11	3,98,090.31
	<hr/>	

LIABILITIES	AMOUNT Rs.	AMOUNT Rs.	AMOUNT Rs.
Total B/F ..			1,08,50,349.08
Grand Total ..			1,08,50,349.08

ASSETS	AMMOUNT Rs.	AMMOUNT Rs.
<b>Founder's Library (Donated):</b>		50,000.00
<b>Founder's Fossil Collection (Donated):</b>		50,000.00
<b>Maps and Toposheets :</b>		
As per last year's Balance Sheet .. ..	12,780.82	
Additions during the year ..	189.27	12,970.09
<b>Investments (Donation Account):</b>		45,000.00
<b>UNESCO Book Coupons:</b>		793.02
<b>Cash and Bank Balance:</b>		
Cash in Hand (Imprest Account) .. ..	347.10	
Current Account with State Bank of India .. ..	10,70,870.41	10,71,217.51
<b>Loans and Advances:</b>		
Unsettled Advances—Plan Revenue Account ..	26,566.07	
Unsettled Advances—Plan Capital Account .. ..	4,44,289.60	
Unsettled Advances Non-Plan Revenue Account ..	75,554.75	5,46,410.42
<b>Advances to Employees:</b>		
House Building Advance ..	3,22,258.00	
Festival Advance ..	14,740.00	
Conveyance Advance ..	73,916.00	4,10,914.00

LIABILITIES	AMOUNT Rs.	AMOUNT Rs.	AMOUNT Rs.
Total B/F			1,08,50,349.08
Grand Total	..		1,08,50,349.08

(Sd.) Ghanshyam Singh  
*Accounts Officer*

(Sd.) Gurcharan Singh  
*Registrar*

(Sd.) M. N. Bose  
*Director*

ASSETS	AMOUNT Rs.	AMOUNT Rs.
<b>General Provident Fund/Contributory Provident Fund:</b>		
Investments ..	9,00,000.00	
Advances out of G. P. F. ..	1,81,290.00	
Insurance out of G. P. F. ..	27,931.00	
With State Bank of India ..	65,293.00	11,74,514.00
	<u>                    </u>	
Grand Total ..		1,08,50,349.08

### Auditor's Report

As per our attached report of even date.

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

(Sd.) P. K. KHANNA  
*Partner*

*Place:* Lucknow

*Dated:* 19th July, 1982

## Birbal Sahni Institute

### Income and Expenditure Account for the

EXPENDITURE	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
<b>Academic Expenses:</b>			
To pay & Allowances of Academic staff ..	2,04,750.35	10,41,760.27	12,46,510.62
To Field Excursion	53,485.13	15,462.11	68,947.24
To Remuneration of Birbal Sahni Pro- fessor ..	—	—	—
To Sponsoring & Participation in Conference & Sym- posia, etc. ..	7,755.70	—	7,755.70
<b>To Honourarium to Lecturers:</b>			
For Birbal Sahni Mem. Lecture	—	350.00	350.00
For Silver Jubilee Comm. Lecture ..	—	350.00	350.00
<b>To International Programme:</b>			
Deputation Abroad	—	11,639.25	11,639.25
Honourarium for Visiting Scientist ..	—	700.00	700.00
<b>To Expenses of Services Ancillary to Research:</b>			
To Pay & Allowances of Auxil. Technical Staff .. ..	93,208.23	3,47,349.17	4,40,557.40

## of Palaeobotany, Lucknow

Year ending on 31st March, 1982

INCOME	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
<b>Balance of last year's grant of Revenue Account allowed for Expenditure during Current Year ..</b>	25,510.37	1,36,891.49	1,62,401.86
<b>By Grants from Govt. of India on Revenue Account</b>	7,00,000.00	27,00,000.00	34,00,000.00
<b>By Grants from U. P. Govt. on Revenue Account</b>	—	5,000.00	5,000.00
<b>By Sale Proceeds of priced Publications:</b>			
“The Palaeobotanist” ..	—	88,234.39	88,234.39
The Monograph ..	—	4,067.55	4,067.55
Symposium & Spl. Publication ..	—	908.32	908.32
Seward Memorial Lecture ..	—	675.10	675.10
Birbal Sahni Memorial Lecture ..	—	580.30	580.30
Silver Jubilee Comm. Lecture ..	—	329.15	329.15

EXPENDITURE	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
To Chemicals & Glassware, Photo- goods & Small Apparatus, etc. ..	84,222.75	1,24,524.32	2,08,747.07
To Library Require- ment .. ..	—	12,397.55	12,397.55
To Museum Re- quirements ..	1,111.78	5,005.18	6,116.96
To Maintenance of Apparatus and Equipment & Work- shop Machinery ..	16,689.93	—	16,689.93
<b>To Publication Ex- penses:</b>			
“The Palaeobo- tanist” ..	—	22,189.78	22,189.78
Birbal Sahni Memo- rial Lecture ..	—	—	—
Annual Report ..	—	8,372.25	8,372.25
Seward Memorial Lecture ..	—	—	—
Silver Jubilee Lecture ..	—	—	—
Publication of I.P.C. Proceedings	—	34,745.31	34,745.31



INCOME	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Picture Post Cards	—	356.35	356.35
Catalogue of Indian Fossil Plants ..	—	1,142.10	1,142.10
Aspects & Appraisal of Indian Palaeobotany .. ..	—	584.15	584.15
IVth I.P.C. Proceedings	—	23,203.75	23,203.75
<b>By Miscellaneous Receipts and Recoveries:</b>			
Vehicle Charges ..	—	30.40	30.40
By Telephone Charges ..	—	2,104.05	2,104.05
By V. S. Room Charges ..	—	625.00	625.00
By Application Fees	—	2,830.00	2,830.00
Miscellaneous Receipts and Recoveries ..	—	7,621.00	7,621.00
Recovery of Conveyance Adv. ..	—	16,355.00	16,355.00
Interest on Conveyance Advance ..	—	2,805.77	2,805.77

EXPENDITURE	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
<b>Travelling &amp; other Allowances:</b>			
For Governing Body, Scientific Programming & Evaluation Committee and Selection Committee Meetings ..	5,567.92	13,933.97	19,501.89
For attending Scientific meetings & Conferences in India and for other purposes	10,391.01	33,753.51	44,144.52
For Reimbursement of Medical Expenses	2,374.36	14,181.47	16,555.83
For over time Allowances ..	321.60	1,210.70	1,532.30
For Leave Travel Concession ..	1,853.00	22,632.07	24,485.07
For Reimbursement of Tuition Fees ..	327.00	757.25	1,084.25
For Children Edu. Allowance ..	—	140.00	140.00
Funds for Training of Staff in India ..	—	1,160.55	1,160.55
Total	4,82,058.76	17,12,614.71	21,94,673.47

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INCOME	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Recovery of Festival Advance ..	—	16,020.00	16,020.00
Recovery of House Building Advance ..	—	19,182.00	19,182.00
Pension Contribution	—	1,176.00	1,176.00
Interest on House Building Advance ..	—	—	—
Employees Insurance Scheme ..	1,193.50	5,986.50	7,180.00
Deposit Account ..	155.00	—	155.00
Total ..	7,26,858.87	30,36,708.37	37,63,567.24

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EXPENDITURE	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
<b>To Pensionary Ex-</b>			
<b>penses:</b>			
To Superannuation Allowance & Pension .. ..	—	1,93,047.12	1,93,047.12
Payment under Insurance Scheme ..	109.00	765.00	874.00
G.P.F. Interest ..	—	60,052.64	60,052.64
C.P.F. Contribution ..	—	2,280.00	2,280.00
<b>To General Expenses:</b>			
To Pay & Allowances of Administrative Staff ..	72,918.02	4,33,926.93	5,06,844.95
To Telephone & Trunk Call Charges	—	24,883.50	24,883.50
To Postage ..	—	22,346.50	22,346.50
To Advertisement Charges ..	23,883.45	35,641.75	59,525.80
To Hot & Cold Weather Charges ..	4,000.00	4,058.80	8,058.80
To Petrol & Mobil Oil .. ..	2,448.69	6,850.86	9,299.55

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INCOME	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Total B/F	7,26,858.87	30,36,708.37	37,63,567.24

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Grand Total .. 7,26,858.87 30,36,708.37 37,63,567.24

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EXPENDITURE	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
To Electricity Charges ..	13,094.53	42,190.33	55,284.86
To Municipal Taxes	—	11,500.00	11,500 00
To Insurance of Vehicle & Library	—	3,963.60	3,963.60
To Uniform to Class IVth Staff	2,030.67	9,204.61	11,235.28
To Printing & Stationery ..	24,318.77	29,952.25	54,271.02
To Custom Duty & Port Trust Charges	—	—	—
To Railway Ft. & Carriage ..	—	2,900.45	2,900.45
To Entertainment All. to Director ..	—	3,122.66	3,122.66
To Miscellaneous & Unforeseen ..	19,456.00	40,743.91	60,199.91
<b>To Maintenance Expenses:</b>			
To Building ..	—	9,983.84	9,983.84
To Garden ..	—	4,679.31	4,679.31
To Vehicle ..	6,355.67	5,958.03	12,313.70
To Repairs & Renewals ..	—	8,706.76	8,706.76
To Petty Construction — ..	10,377 13	11,534.13	21,911.26
<b>To other Expenses:</b>			
To Deposits Refunded ..	—	—	—



EXPENDITURE	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
To Medical Advice	—	288.00	288.00
To Audit Fees ..	—	2,000.00	2,000.00
To Legal Advice ..	—	70.00	70.00
<b>To Welfare Expenses:</b>			
To Financial Assistance to Departmental Canteen ..	—	4,379.42	4,379.42
To Festival Advance	—	21,200.00	21,200.00
To Conveyance Advance ..	—	30,900.00	30,900.00
To House Building Advance ..	—	99,600.00	99,600.00
<b>To Govt. of India Scholarship Expenses:</b>	—	20,641.70	20,641.70
<b>To Account transferred to C.N.R. Account:</b>			
Excess of Income over Expenditure ..	65,808.18	1,76,721.56	2,42,529.74
<b>Grand Total ..</b>	<b>7,26,858.87</b>	<b>30,36,708.37</b>	<b>37,63,567.24</b>

### Auditor's Report

As per our report on the Balance Sheet of even date.

For R. N. Khanna & Co.

Chartered Accountants

(Sd.) P. K. Khanna

Partner



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INCOME	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Toral B/F ..	7,26,858.87	30,36,708.37	37,63,567.24

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Grand Total .. 7,26,858.87 30,36,708.27 37,63,567.34

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(Sd.) Ghanshyam Singh  
*Accounts Officer*

(Sd.) Gurcharan Singh  
*Registrar*

(Sd.) M. N. Bose  
*Director*

**Birbal Sahni Institute of****Receipt and Payment for the**

RECEIPTS	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
<b>To Opening Balance:</b>			
<i>Bank Account:</i>			
Non-Plan Revenue Account ..	—	1,23,911.32	1,23,911.32
Plan Revenue Account ..	25,510.37	—	25,510.37
Plan Capital Account ..	8,31,194.87	—	8,31,194.87
Donation Account	—	1,070.88	1,070.88
IVth I.P.C. Account	—	12,735.77	12,735.77
<i>Cash Account:</i>			
Non-Plan Revenue Account ..	—	244.40	244.40
<b>To Govt. of India grant on Capital Account:</b>	15,25,000.00	—	15,25,000.00
<b>To Govt. of India Grant on Revenue Account: ..</b>	7,00,000.00	27,00,000.00	34,00,000.00
<b>To Govt. of U.P. Grant on Recurring Account: ..</b>	—	5,000.00	5,000.00
<b>To Sale Proceeds of Publications:</b>			
The Palaeobotanist	—	88,234.39	88,234.39

## Palaeobotany, Lucknow

period from 1.4.1981 to 31.3.1982

PAYMENT	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
<b>Capital Account:</b>			
<b>By Works &amp; Building</b> ..	4,26,512.63	—	4,26,512.63
<b>By Res. App. &amp; Equipments</b> ..	4,10,668.83	—	4,10,668.83
<b>By Equipt. for Services Ancillary to Research:</b>			
Library ..	60,070.43	—	60,070.43
Photography ..	2,500.00	—	2,500 00
G-14 Laboratory ..	3,63,949.75	—	3,63,949.75
Plant & Machinery	63,384.56	—	63,384.56
<b>By Furniture &amp; Fixture:</b> ..	21,283.37	—	21,283.37
<b>By Vehicles:</b> ..	99,361.00	—	99,361.00
<b>By Refunds of Grants to Govt.:</b>			
Out of Capital Grants ..	1,003.03	—	1,003.03
<b>Revenue Account:</b>			
<b>By Pay and Allowances:</b>			
Pay (Academic) ..	1,06,206.27	6,21,537.67	7,27,743.94
Pay (Auxiliary Technical) ..	42,704.26	1,74,357.56	2,17,061.82

RECEIPTS	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Monograph ..	—	4,067.55	4,067.55
Symposium ..	—	908.32	908.32
Catalogue ..	—	1,142.10	1,142.10
Aspects & Appraisal of Indian Palaeobio- tany .. ..	—	584.15	584.15
Seward Memorial Lecture ..	—	675.10	675.10
Birbal Sahni Mem. Lecture ..	—	580.30	580.30
Picture Post Cards	—	356.35	356.35
Silver Jubilee Me- morial Lecture ..	—	329.15	329.15
IVth I.P.C. Pro- ceedings ..	—	23,203.75	23,203.75
<b>To Administrative Receipts:</b>			
Income Tax ..	265.00	27,798.00	28,063.00
Insurance Premium (S.S.Sch.) ..	3,015.18	44,155.47	47,170.65
C.T.D. Post Office	420.00	6,970.00	7,390.00
G.P.F. Subscription	17,519.00	1,81,473.00	1,98,992.00
Recovery of G.P.F. Advance ..	12,145.00	95,984.00	1,08,129.00

PAYMENT	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Pay (Administrative	36,022.32	2,17,176.06	2,53,198.38
D.A. & Addl. D.A.	1,49,808.90	6,54,265.50	8,04,074.40
House Rent Allowance ..	27,657.10	1,16,049.31	1,43,706.41
City Comp. Allowance ..	8,477.75	39,650.27	48,128.02
Children Educ. Allow. ..	—	140.00	140.00
Over Time Allowance .. ..	321.60	1,210.70	1,532.30
Medical Reimbursement .. ..	2,374.36	14,681.47	17,055.83
Reimb. of Tuition Fees .. ..	327.00	757.25	1,084.25
Leave Travel Concession ..	3,859.00	22,742.07	26,601.07
<b>By Travelling Allowance:</b>			
Governing Body & Selection Committee Meetings ..	5,567.92	13,933.97	19,501.89
For Attending meetings & Conferences in India ..	—	965.33	965.33
Funds for training of Staff in India ..	—	1,160.55	1,160.55
For other Purposes	10,549.01	32,788.18	43,337.19

RECEIPTS	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Recovery of B.S.I.P. Credit Co-op. So- ciety: ..	4,525.81	30,508.63	35,034.45
<b>To Misc. Receipts &amp; Recoveries:</b>			
Application Fees ..	—	2,830.00	2,830.00
V.S. Room Rent ..	—	625.00	625.00
Telephone Charges	—	2,104.05	2,104.05
Vehicle Charges ..	—	30.40	30.40
Pension Contribu- tion .. ..	—	1,176.00	1,176.00
Other Miscellaneous Receipts ..	—	7,621.00	7,621.00
C.D.S. From R.P.F. Commissioner Kanpur	—	6,784.14	6,784.14
<b>To Recoveries of Loans and Advances</b>			
Recovery of Festival Advance ..	—	16,020.00	16,020.00
Recovery of Con- veyance Advance ..	—	16,355.00	16,355.00
Interest on Conv. Advance ..	—	2,805.77	2,805.77

PAYMENT	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
<b>By Maintenance of Property:</b>			
For Building ..	—	9,983.84	9,983.84
For Garden ..	—	4,679.31	4,679.31
For Equipment & Apparatus ..	16,689.93	—	16,689.93
For Vehicle ..	6,355.67	5,958.03	12,313.70
For Repairs & Renewals ..	—	8,706.76	8,706.76
For Petty Constructions .. ..	10,377.13	11,534.13	21,911.26
<b>By Contingencies:</b>			
By Telephone & Trunk Call Ch. ..	—	24,883.50	24,883.50
For Postage ..	—	22,346.50	22,346.50
For Advertisement	23,883.45	35,641.75	50,525.20
For Hot & Cold Weather Charges ..	4,000.00	4,058.80	8,058.80
For Petrol & Mobil Oil .. ..	2,448.69	6,850.86	9,299.55
For Electricity Charges ..	13,094.53	42,190.33	55,284.86
For Municipal Taxes	—	11,500.00	11,500.00

RECEIPTS	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Recovery of Flood Advance ..	—	—	—
Recovery of House Building Advance ..	—	19,182.00	19,182.00
Interest on House Building Advance ..	—	—	—
<b>To Deposits:</b>			
Employees Insu- rance Sch. ..	1,193.50	5,986.50	7,180.00
Security Deposits ..	24,410.10	—	24,410.10
<b>To Donation and Endowments:</b>			
Proceeds of Interest	—	6,750.00	6,750.00
<b>To Misc. Receipts on Capital Account:</b>			
Interest earned in Savings Bank Acco- unt ..	6,666.67	—	6,666.67
Misc. Receipts on Capital A/c ..	8,000.00	—	8,000.00
Total ..	31,59,865.50	34,38,202.49	65,98,067.99



PAYMENT	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
For Insurance of Vehicle & Library	—	3,963.60	3,963.60
For Liveries to Sub. Staff ..	2,030.67	9,204.61	11,235.28
For Printing & Sta- tionery ..	24,318.77	29,952.25	54,271.02
For Railway Ft. & Carriage ..	—	2,900.45	2,900.45
For Entertainment Allowance To Dir.	—	3,122.66	3,122.66
For Misc. & Unfor- seen .. ..	19,456.00	44,013.91	63,469.91
For Chemicals & Glasswares ..	95,978.82	1,45,524.32	2,41,503.14
For Library Require- ment .. ..	—	25,354.30	25,354.30
For Herbarium Re- quirement ..	—	—	—
For Museum Re- quirement ..	1,111.78	5,005.18	6,116.96
For Legal Advice ..	—	70.00	70.00
For Medical Advice	—	288.00	299.00
For Audit Fees ..	—	2,000.00	2,000.00
<b>For Publications:</b>			
The Palaeobotanist	—	42,189.78	42,189.78

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RECEIPTS	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Total B/F	.. 31,59,865.50	34,28,202.49	65,98,067.99

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Grand Total .. 31,59,865.50 34,38,202.49 65,98,067.99

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PAYMENT	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
For Annual Report ..	—	8,372.25	8,372.25
For Birbal Sahni Mem. Lecture ..	—	—	—
For Silver Jubilee Mem. Lecture ..	—	—	—
For IVth I.P.C. Proceedings ..	—	34,745.31	34,745.31
For Special Publication by B. S. Professor .. ..	—	—	—
<b>For Academic Expenses:</b>			
For Field Excursion	66,131.13	15,462.11	81,593.24
Birbal Sahni Mem. Lecture ..	—	350.00	350.00
For Sir A.C. Seward Mem. Lecture out of Donation A/c ..	—	350.00	350.00
For Silver Jubilee Lecture ..	—	350.00	350.00
For Remuneration to B.S. Professor ..	—	—	—
Symposium & Seminar Co-sponsored & Participation ..	7,755.70	—	7,755.70

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RECEIPTS	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Total B/F	.. 31,59,865.80	34,38,202.49	65,98,067.99

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Grand Total .. 31,59,865.50 34,38,202.49 65,98,067.99

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PAYMENT	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
<b>By International Programmes:</b>			
Air Passage for members of staff proceeding on foreign fellowship or invited to attend Scientific Meetings & Conferences Abroad (Deputation Abroad) .. ..	—	29,357.25	29,357.25
Honourarium for Visiting Scientist ..	—	700.00	700.00
<b>By Welfare Expenses:</b>			
Financial Assistance to Departmental Canteen ..	—	4,379.42	4,379.42
<b>By G. P. F. Account:</b>			
G.P.F. Subscription transferred to G.P.F. Account ..	17,519.00	1,81,473.00	1,98,992.00
Recovery of Advance transferred to G.P.F. Account ..	12,145.00	95,984.00	1,08,129.00
G.P.F. Interest ..	—	60,052.60	60,052.64
Institute's Contribution to C.P.F. ..	—	2,280.00	2,280.00

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RECEIPTS	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Total B/F ..	31,59,865.50	34,38,202.49	65,98,067.99

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Grand Total .. 31,59,865.50 34,38,202.49 65,98,067.99

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PAYMENT	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
<b>By Miscellaneous:</b>			
Income Tax Re- mitted ..	265.00	27,798.00	28,063.00
Insurance Premium Remitted (S. S. Scheme) ..	3,015.18	44,155.47	47,170.65
C.T.D. Amount Remitted (Post Office) ..	420.00	6,970.00	7,390.00
B.S.I.P. Co-opera- tive Credit Society ..	4,525.81	30,508.63	35,034.44
C.D.S. from R.P.F. Commissioner Kan- pur .. ..	—	6,784.14	6,784.14
<b>By Govt. of India Senior Research Scholarships: ..</b>			
	—	20,641.70	20,641.70
<b>By Loans and Advances:</b>			
Festival Advance ..	—	21,200.00	21,200.00
Conveyance Ad- vance .. ..	—	30,900.00	30,900.00
House Building Advance .. ..	—	99,600.00	99,600.00
Security Money refunded to Con- tractor .. ..	21,395.33	—	21,395.33

RECEIPTS	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
Total B/F ..	31,59,865.80	34,38,202.49	65,98,079.29
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Grand Total ..	31,59,865.80	34,38,202.49	65,98,067.99
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<b>BALANCES</b>			
	<b>Bank</b>	<b>Cash</b>	<b>Total</b>
<b>Plan:</b>			
Central Recurring	39,242.11	—	39,242.11
Central Non-Recurring			
In cash book ..	18,321.04	—	—
In Savings Bank A/c	906,666.67	—	—
	9,24,987.71	—	9,24,987.71
<b>Non-Plan:</b>			
Central Recurring	99,625.50	347.10	99,972.60
Donation & Endow- ment ..	5,820.88	—	5,820.88
IVth I.P.C. Account	15,194.21	—	1,194.21
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Grand Total ..	10,70,870.41	347.10	10,71,217.51
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PAYMENT	PLAN Rs.	NON-PLAN Rs.	TOTAL Rs.
<b>By Investments:</b>			
Funds under Donation & Endowment Invested ..	—	1,650.00	1,650.00
<b>By Pension &amp; Superannuation:</b>			
Pension, Family Pension & Gratuity etc. .. ..	—	1,93,047.12	1,93,047.12
Payment under Insurance Scheme ..	109.00	765.00	874.00
Grand Total	21,95,635.68	33,31,214.80	55,26,850.48

(Sd.)  
Ghanshyam Singh  
*Accounts Officer*

(Sd.)  
Gurcharan Singh  
*Registrar*

(Sd.)  
M. N. Bose  
*Director*

### Auditor's Report

As per our report on the Balance Sheet of the even date.

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

(Sd. P. K. Khanna)  
*Partner*

Place: Lucknow

Date: 19th July, 1982

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