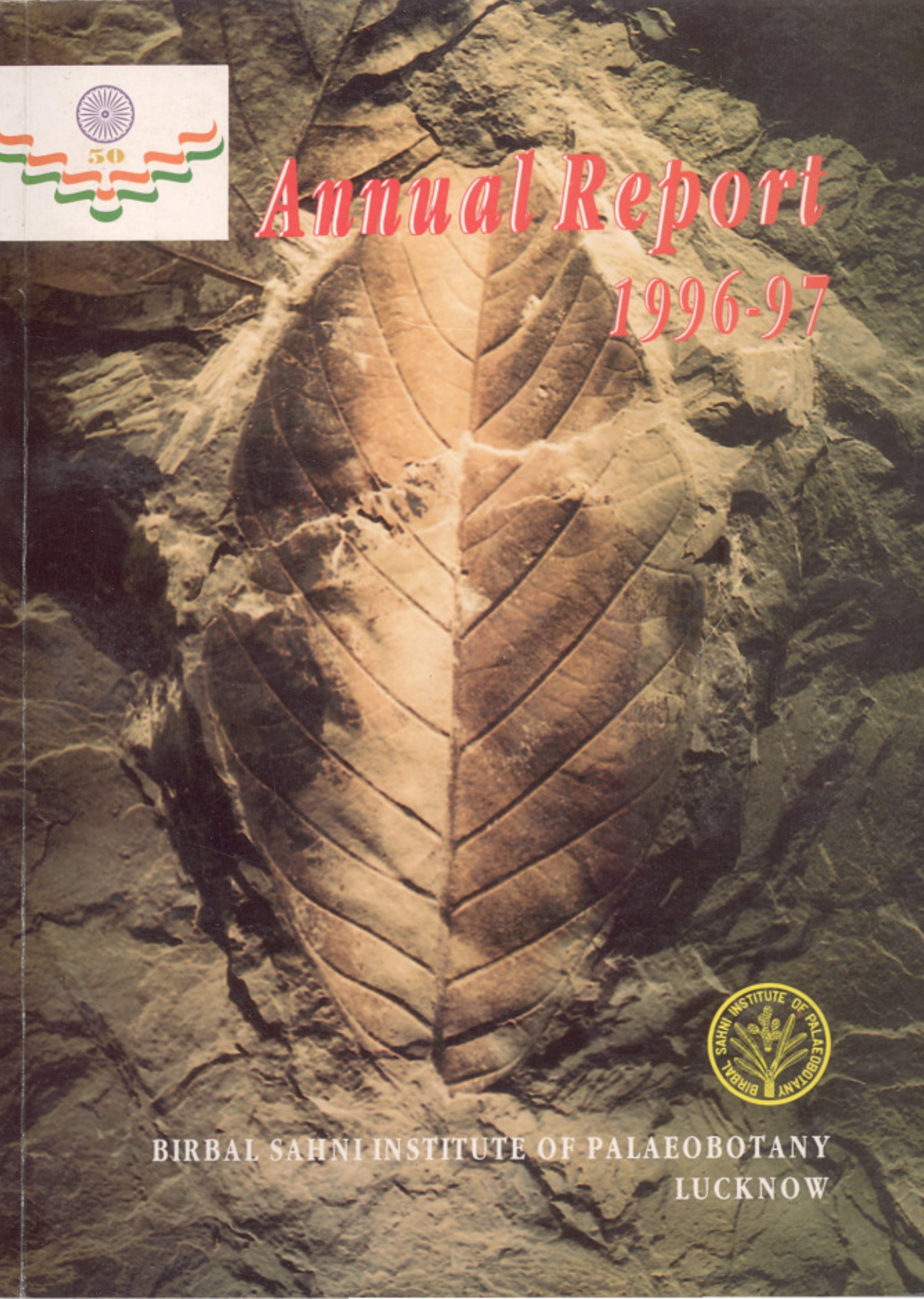
50

Annual Report

1996-97



BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY
LUCKNOW

Annual Report
1996-97

Front Cover	: Fossil leaf resembling *Artocarpus rigidus* Blume from the Siwalik sediments of Arjun Khola, Western Nepal.
Back Cover	: Natural Bridge in Neill West Coast Formation (Pliocene - Pleistocene), Neill, Andaman Islands.

Published by	: Birbal Sahni Institute of Palaeobotany, Lucknow
Produced by	: J. S. Antal
Printed at	: M.L. Bhargava & Co., Lucknow

November 1997

Acknowledgement

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

Contents

Foreword

Birbal Sahni Institute of Palaeobotany, Lucknow is a premier research organisation under the Department of Science and Technology, Government of India and is named after its Founder— the late Professor Birbal Sahni, F.R.S. On April 3, 1949 its Foundation Stone was laid by Sri Jawaharlal Nehru, the then Prime Minister of India. The Institute, started initially in a room in the University of Lucknow on 10 September, 1946, has now completed its glorious 50 years and celebrated the Golden Jubilee Year in 1995-96, in its spacious complex.

Professor Sahni's vision of this Institute was to develop it as an international centre for earth science and palaeobotanical research. He perceived that for a meaningful understanding of fossil plants, knowledge of living plants, geology and other scientific allied disciplines was absolutely essential. Palaeobotany not only allows'us glimpses into the evolutionary history of plants, but helps us more and more accurately to assign the ages of strata. Its application in earth sciences has overwhelmingly applied from fundamental research in the sphere of origin of life in our Solar System and in the exploitation of economic mineral deposit on global scale.

The Institute is committed to develop scientific knowledge and expertise on the varied aspects of earth sciences, palaeobotany and related disciplines. The main objectives of the Institute have been :

- To develop earth scientific application in palaeobotany, including palaeopalynology, in all its botanical and geological aspects.
- To constantly update the data for international interaction with allied disciplines in earth sciences.
- To co-ordinate with other knowledge centres in areas of mutual interest such as early life, exploration of fossil fuels, vegetation dynamics, climatic modelling, conservation of forests, etc.
- To publish journal, monographs, catalogues, etc. and disseminate the scientific knowledge all over the world keeping its high international standard.

The research activities of the Institute during the year 1996-97 were carried out keeping in view the objectives of the Institute. An integrated and multidisciplinary approach is adopted to complete the targets of various programmes undertaken in the VIII Five Year Plan. This year, four DST sponsored projects were completed and two new ones were initiated. Being the last year of the VIII Five Year Plan the target and objectives of various programmes have been, by and large, achieved.

During next IX Five Year Plan the research activities of the Institute have been expanded and the following revised thrust areas have been identified to steer the Institute with wider vision and perspective into 21st Century.

- Palaeoclimatology and palaeomonsoon
- Coal bed methane (CBM) investigation
- Origin of life (DNA, RNA)
- Regional geology, Terrain accretion, Plate tectonics and Gondwana configuration
- Aerobiology (medicinal aspects)
- Petroliferous Basins of India and abroad

Major scientific achievements and activities, Golden Jubilee Year celebrations, Founder's Day Function, details of scientific work carried out under each programme, collaborative projects, sponsored projects, research publications, on-going efforts for the next year and Statement of Accounts for the year 1996-97 have been given on the foregoing pages of this Report.

I am grateful to the Governing Body of the Institute and the Research Advisory Council for their valuable suggestions and advice. I am also grateful to Dr G. Rajagopalan during whose tenure as Acting Director the activities presented in this Report were accomplished. The members of Scientific Programming Committee of the Institute: Dr G. Rajagopalan, Dr Hari K. Maheshwari and Dr P.K. Maithy have greatly helped in compiling this document. Drs Suresh C. Srivastava, Archana Tripathi and B.D. Singh of Co-ordination Unit for Scientific Activities, Dr J.S. Antal of Publication Unit and Administration Unit of BSIP rendered immense help in bringing out this report. The support provided by several other colleagues in the scientific, technical and administrative staff is thankfully acknowledged.

ANSHU K. SINHA
Director

November, 1997

Major Achievements and Activities of the Institute

Some of the outstanding research achievements of the Institute during the year 1996-97 are as follows :

On the basis of biota and ichnofossils it has been opined that the Vindhyan represents the Upper part of Neoproterozoic sequence. The analysis of overall assemblages shows total absence of any of the typical Cambrian forms in the Vindhyan but presence of only Vendian forms, viz., *Sekwia* and *Polytrichoides*. It is inferred that the uppermost limit of Vindhyan is older than Precambrian/Cambrian Boundary.

For the first time species of *Sporolithon, Halimeda* and *Indopolia*, etc., are recorded from the Ariyalur and Reddipalayam localities representing Kallankurchi Formation of Maastrichtian age. The report of skeletal algae from oil-bearing limestones of Reddipalayam is significant.

The plant megafossils recovered from Madhupur area near Hinjrida Ghati, Angul District show presence of typical Kamthi species — *Glossopteris leptoneura* and *G. stricta*. The flora compares well with known Kamthi flora of Handapa beds which could be the lateral extension of the same beds of Late Permian age.

The megafloral composition of Balidih locality in Rajmahal Basin shows presence of index Neocomian species *Phyllopteroides levis* suggesting Neocomian age for the Balidih intertrappean beds. The conifer strobilii *Podostrobus* is recorded from Gangapur Formation describing the *Stachyotaxus* for the first time.

The ultrastructure of cuticular membrane studied from healthy and fungi infected leaves of *Thinnfeldia indica* shows similar structural configuration in general. The upper portion of cuticular membrane remains intact. However, precursors of cutin accretions are present at the sub-cuticular surface. It is inferred that fungi, besides edaphic factors, play a role in the cutin breakdown and thus constrains the preservation of cuticular membranes.

Palynodating of coal-bearing sediments in Damodar and Rajmahal Basins and Chintalpudi sub-basin and Talcher, Ib-River, Sohagpur, Tatapani-Ramkola Coalfields has been continued. The results add new data to the dating and correlation of outcrop and subsurface coal-bearing sequence. Several times transgressive units have been redefined and through Dubrajpur, Kamthi, Pali/Parsora sediments the Permo-Triassic Boundary has been demarcated. Benchmark palyno-events at the transition of Permian-Triassic have been tagged in the marine sequence of Tethys Himalaya with that of continental one established in Raniganj Coalfield of Damodar Basin. In the Upper Gondwana sediments of Domra sub-basin the presence of definite Late Jurassic palynoflora, *Murospora florida* zone, has been observed for the first time in non-marine sequence of peninsular India.

The petrological studies of Talcher coals under fluorescence mode indicate richness of liptinite group of macerals. High incidence of well preserved varied cross sections of

National Science Day—School children visiting the Institute's Museum.

Hindi Pakhwara Function—Dr G. Rajagopalan welcoming the Chief Guest, Sri K.P. Saxena.

leaves, seeds, sporangia together with tracheids, etc., suggests origin of coal under hypo-autochthonous condition, also supported by the typical structured inertinites. Fluorinite associated with cuticle, spores and other liptinite group of macerals at different time level indicates the presence of shallow niches over the deposited peat surface.

The Oligocene to Lower Miocene (surface samples) and palynoflora from Tertiary sediments of Kundra, Quilon and Warkalli and Eocene to Miocene (subsurface samples) Quilon, Kerala have shown several ecological communities. Out of these, the back mangrove floral community along with dinoflagellate cysts is important.

On the basis of calcareous nannofossils Miocene/Pliocene Boundary could be established in Sawai Bay Section of Car Nicobar Island based on LAD of *Discoaster quinqueramus, Triquetrorhabdulus rugosus* and FAD of *Ceratolithus acutus*.

The Palaeocene dinocyst taxa are recorded for the first time from the Subathu samples of Kalakot area, Beragua Formation. The palynoassemblage suggests that the basin was very shallow and the sediments were deposited in marine condition.

The palynological studies of the sediments exposed along Tura-Dalu Road Section in West Garo Hills have been carried out. The palaeoclimate during Palaeocene-Eocene (Tura Formation) is indicated to be tropical to subtropical climate sustaining wet evergreen forest in the vicinity of the area. The presence of dinoflagellate cysts suggests a shallow marine condition during the deposition. The palaeoclimate during Oligocene (Kherapara

Dr S.C. Rai, Mayor, Lucknow, opening the "Plant Fossils Gallery".

Concluding function of Golden Jubilee Celebrations—Sri B.N. Swaroop, Adviser to the Governor of Uttar Pradesh lighting the lamp.

Formation) also is indicated to be tropical-subtropical (warm and humid). Presence of dinoflagellate cysts (*Achomasphaera* and *Spinifera*), mangrove and back-mangrove elements (*Paleosantalaceaepites* and *Malvacearumpollis*) and coastal plants (*Spinizonocolpites*) suggests near-shore environment of deposition.

In the subsurface sequence of Lakhpat bore hole, Kutch Basin the *Nannoceratopsis* species, viz., *N. dictyoambonis, N. ambonis* and *N. plegas,* are recorded. This provides the first microfossil evidence for Late Aalenian - Early Bajocian age in India.

The study of carbonised woods from Kerala Coast has shown presence of taxa *Dipterocarpus indicus, Sapindus trifoliatus, Rhus mysorensis, Albizia amara, Artocarpus lakoocha*, etc., which are new to the area. Their modern equivalents are distributed in Indo-Malayan region and Myanmar indicating similar climate in Kerala Coast during deposition of Warkali beds.

The cloves of garlic (*Allium sativum*) are discovered for the first time in South-East

Dr S. Varadrajan releasing the BSIP Golden Jubilee Volume.

Sri B.N. Swaroop, Adviser to the Governor, Uttar Pradesh, presenting mementos to Dr S. Varadrajan (left) and Professor H.Y. Mohanram (right).

Professor S. Ramaseshan delivering the Third BSIP Golden Jubilee Lecture.

Asia (2000-1700 BC) in the Harappan cultural context of Punjab. In written records garlic is known for medicinal use in Codex Ebers, an Egyptian medical papyrus dating to about 1550 B.C.

The tree growth/climate models for climatic reconstructions have been developed and spring temperature and precipitation for the western Himalayan region for the past 818 years have been deduced using ringwidth chronology.

The sediments from Sat-Tal, Dharali and Chharka Tal, Uttarkashi, U.P., have been dated to understand the depositional environment and climate during the Quaternary period in the Himalaya. The base of Dharali sediments was dated as 1240 ± 90 yrs B.P. The C-14 date of Chharka Tal sediments at 3.65 - 3.75 m depth comes out to be 2090 ± 140 yrs B.P. The samples from Konalur River Basin, Kodaikanal have been dated as 3360 ± 110 yrs B.P. at the base (140-150 cm) to work out the history of vegetation and climate in tropical montane forest in south India.

Other Activities

During the year 117 research papers and 78 abstracts have been published and 100 papers were submitted for publication; 54 research papers were presented in the National and International Conferences. This year, 16 members including scientists, technical and administrative personnel were deputed in the conferences in the country and 12 scientists to

Founder's Day Function (from left—Dr P.K. Maithy, Professor J.S. Singh, Professor C.V. Subramanian, Professor S.Z. Qasim, Dr G. Rajagopalan and Dr H.K. Maheshwari).

International conferences abroad. Besides, 41 scientists participated in the Golden Jubilee Conference of the Institute. Eleven scientists of the Institute delivered lectures in other organisations. Prof. Afsar Abbas, Institute of Physics, Bhubaneshwar delivered a lecture on "Dark Matter of Cosmology and Periodic Mass Extinction".

During the year the Institute's scientists undertook about 35 field excursions. About 2575 fossil specimens and 2645 rock samples from 182 localities of the country were collected and deposited in the Museum.

The Institute has provided technical assistance and consultancy services to personnel from various universities and organisations in the field of electron microscopy, palynology, identification of fossil remains and radiocarbon dating. The Herbarium facilities were extended to scientists from various universities, institutes and colleges. Fossil specimens and trans-slides were gifted to 12 educational institutions. Visitors and scientists from our

Professor J.S. Singh delivering the 26th Birbal Sahni Memorial Lecture.

Distinguished guests.

Professor S.Z. Qasim delivering the 42nd Sir Albert Charles Seward Memorial Lecture.

own country as well as USA, Belgium and Australia visited the Institute and Museum. Two Doctoral degrees were awarded by the Lucknow and Kanpur Universities on the problems related with Palaeopalynology.

The Institute has published Volume 43, Number 2 and a special Birbal Sahni Institute of Palaeobotany Golden Jubilee Volume 45 of the journal *The Palaeobotanist*. The Special Volume comprises 55 contributions, out of which 20 are specially invited papers and the remaining 35 papers were presented at the International Conference on "Diversification and Evolution of Terrestrial Plants in Geological Time" held at Nanjing, China during 1995.

The continuous efforts for the use of computer in Library have enhanced the efficiency of Library work in literature circulation, documentation, data management, exchange list and report generation, etc.

The Electronic Data Processing Unit has efficiently composed and designed the Abstract Volume of BSIP Golden Jubilee Conference, a bilingual folder and invitation cards for photo offset printing. Besides, the Postal Stamp was designed which will be released by the Department of Post and Telegraph for the Golden Jubilee Year of the Institute.

During the 84th Session of Indian Science Congress at Delhi the Institute participated in the Science and Technology exhibition organised by the Department of Science and Technology, New Delhi on the theme "Computer Network in National Development". The exhibits were about the Institute Research Activities and Achievements. At this session a

bilingual folder was also distributed. The National Science Day was also celebrated and a debate competetion on the theme "India of my dreams" was organised for the School children. The Doordarshan Kendra, Lucknow gave a good coverage to the Institute's activities.

On the occasion of Hindi Pakhwara a function was organised by the Hindi Samiti of the Institute; Sri K.P. Saxena, a well known poet, was the chief guest. Other activities of this occasion included typing competetion, Prashna Manch and Kavya Goshthi by the Institute Staff.

Golden Jubilee Activities

As a part of scientific and academic activities the Golden Jubilee Conference was organised during November 15-17, 1996 just after the Founder's Day Programme. The theme of the conference was "Physical and Biological Changes Across the Major Geological Boundaries"; Prof. S.Z. Qasim, FNA, Ex-member, Planning Commission, Government of India and Vice Chairman, Society for Indian Ocean Studies inaugurated the Conference. The Conference was attended by over 140 scientists from all over the country.

Permanent gallery on "Plant Fossils" at the Regional Science Centre, Lucknow was inaugurated by Dr S.C. Rai, Mayor, Lucknow on 10 September, 1996. This was one of the important activities of Golden Jubilee Celebrations relating to popularisation of Palaeobotany.

Independence Day.

The concluding function of Golden Jubilee Celebrations was held on January 20, 1997. Sri B.N. Swaroop, Adviser to the Governor of Uttar Pradesh, Dr S.K. Misra, Director, National Centre for Medium Range Forecasting, New Delhi, Prof. H.Y. Mohanram, FNA, Former Chairman, Governing Body, BSIP; Dr S. Varadrajan, FNA, President, Indian National Science Academy, New Delhi and many other distinguished persons graced the occasion. Dr S. Varadrajan released the Golden Jubilee publications — Golden Jubilee Volume of the Journal *The Palaeobotanist*, Volume 45 and a Brochure on the Institute. Dr S.K. Misra read out the message of compliments from the Secretary, DST on the occasion. On behalf of His Excellency, The Governor of Uttar Pradesh, Sri B.N. Swaroop presented the mementos to distinguished persons for their contributions to the growth of the BSIP and to the science of Palaeobotany. Mementos were also presented to the retired and serving employees of the Institute on the occasion of Golden Jubilee celebrations.

Three Golden Jubilee Lectures were delivered during the year:

— Prof. S. Ramaseshan, F.A.Sc., F.N.A., Professor-Emeritus, Raman Research Institute, Bangalore delivered 3rd Golden Jubilee Lecture on "Shells, corals and geophysics".

— Dr Anupam Verma, F.N.A., Head, Advanced Centre for Plant Virology, Indian Agricultural Research Institute, New Delhi delivered 4th Golden Jubilee Lecture on "Plant disease management in sustainable agriculture".

— Dr S. Varadrajan, F.N.A., President Indian National Science Academy, New Delhi delivered 5th Golden Jubilee Lecture on "Science for economic and social goals of India."

Founder's Day

On November 14, 1996 Founder's Day was celebrated with great reverence by floral tributes at the *Samadhi* of the Founder by Professor C.V. Subramanian, Professor S.Z. Qasim, Professor J.S. Singh, Staff of the Institute and other distinguished persons. On this occasion two Memorial lectures were organised. Professor C.V. Subramanian presided over the Founder's Day Function. Professor J.S. Singh, FNA, Banaras Hindu University delivered 26th Birbal Sahni Memorial Lecture on "Causes and consequences of global climatic changes". The 42nd Sir Albert Charles Seward Memorial Lecture on "Exploitation and sharing the economic wealth of the Indian Ocean" was delivered by Professor S.Z. Qasim, FNA, Ex-member, Planning Commission, Government of India and Vice Chairman, Society for Indian Ocean Studies, New Delhi. The staff paid homage to the Founder, Professor Birbal Sahni on his death anniversary — the April 10, 1997 by *Pushpanjali* at his *Samadhi*.

Besides the scientific activities, the Institute celebrated the National Festivals — Independence Day and Republic Day. On the Independence Day outdoor games and cultural programmes were organised by the Staff Welfare Committee.

Our plants and the Prizes.

The total strength of the Institute staff is 178, in which 69 are scientists and the rest include technical and administrative staff, and five Birbal Sahni Research Scholars. In the Sponsored Projects there are 8 members including scientists and technical personnel. Three appointments and promotions have been made during the year. Five staff members retired after the superannuation including two scientists.

On-Going Efforts : 1997-1998

The year 1996-97 is the last year of VIII Five Year Plan. Being the last year of the VIII Plan the targets of most of the programmes by and large have been completed. The next plan, i.e., IX Five Year Plan proposed during 1997-2002 is prepared according to the guidelines and advice of the sub-committee constituted by the Research Advisory Council. It includes following projects with one to many components.

Project 1	Palaeobiology and biostratigraphy of Precambrian basins
Project 2	Floristics and biostratigraphy of Palaeozoic and Mesozoic of Himalayas
Project 3	Gondwana floristics, evolution, biostratigraphy and palaeoenvironment
Project 4	Coalification processes and depositional environment of coal and associated sediments
Project 5	Morphotaxonomy, floristics, biostratigraphy, sedimentological studies of Tertiary sediments and search for Cretaceous-Tertiary

	Boundary in marine sequences of Lesser Himalayas
Project 6	Tertiary floristics of Peninsular India
Project 7	Marine micropalaeontology of petroliferous basins
Project 8	Quaternary vegetation and palaeoenvironment
Project 9	Archaeobotany and dendrochronology
Project 10	Palaeofloristics of Andaman Islands
Project 11	Geochronometry and isotope studies
Project 12	Special activities

The projects have been formulated with multidisciplinary approach having academic as well as application value in national context. The project proposals include development of computer database as the integral part of projects. It is envisaged to have the Central Units Ancillary to Research in the IX Plan.

Research

Projects and Programmes

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

Programme 1.1 : Palaeobiology of Vindhyan Basin

P.K. Maithy & R. Babu

The cherts belonging to Nagod Limestone Formation, Bhander Group exposed at Bainkuyian in Madhya Pradesh were studied. A rich assemblage of previously unrecorded organic-walled microfossils is identified. The forms belong to algae and acritarchs. The characteristic acritarchs are *Nucellosphaeridium, Margominuscula, Pulvinomorpha, Octaedryxium, Archaeohystrichosphaeridium, Cymatiosphaeroides* and a new chlorophycean form. Oncolites from the Nagod Limestone Formation were investigated in thin section. A dominant assemblage of tubular cyanophycean forms was assigned to the form genera *Eomycetopsis* and *Gunflintia*. Possibly the septation may be due to diagenesis. Besides, the Chroococcacean forms are being represented by solitary sphaeroids *Huronispora*, paired form *Eosynechococcus* and the colonial form *Eoentophysalis*.

A systematic analysis of the biota and ichnofossils of the Vindhyan has shown that it represents the upper part of Neoproterozoic sequence. The oldest bed of the Bhander Group, Ganurgarh Shale Formation, outcroping at Mid Ghat Railway Station, Bhopal District, Madhya Pradesh is dominated by acritarchs, large sized leiosphaerids, *Nucellosphaeridium*, processed form *Cymatiosphaeroides* and tubular Vendian marker form *Polytrichoides*. The subsequent overlying Lower Bhander Limestone Formation has diversified biota. The organic-walled microfossils show predominance of *Gloeocapsomorpha, Sphaerocongregus, Caryosphaeroides* and large sheaths indicating presence of ?Vendotaenids. The oncolites show dominant presence of Eoentophysalidaceae and tubular sheaths. An important Vendian macrofossil — *Sekwia* is also now known from this formation, besides problematic trails. Occurrence of trace fossils and dubiotraces are also known from the Lower Bhander Sandstone exposed around Madhya Pradesh. Sirbu Shale preserves broad aseptate tubular filaments, acritarchs, commonly large sized leiosphaerids with small process (viz., *Baltisphaeridium*), and the remains of endosporulating *Sphaerocongregus*. From the youngest bed of Dholpura Shale Formation exposed near Lakheri Town, comparable form of *Melanocyrillium* is recorded. This bed also preserves discoid impressions comparable to Neoproterozoic sponges. Analyses of the overall assemblages indicate

the total absence of any of the typical Cambrian forms in the Vindhyan, but shows the presence of Vendian forms only. Thus, it has been concluded that the uppermost limit of Vindhyan is older than PC/C Boundary.

R. Babu

Visited Jalendri, Narayanpura, Sathur, Dalelpura, Bundi Fort, Utranda, Khataggarh, Foḷai, Kankra, Indergarh Fort and Bhavpura of Vindhyan Supergroup, Bundi District, Rajasthan for the collection of palynological samples and macroscopic remains.

Programme 1.2 : Palaeobiology of the Proterozoic sediments in Cuddapah, Kaladgi and Bhima Basins

M. Shukla & M. Sharma

The presence of carbonaceous macrofossil *Chuaria* has been recorded from 3 levels in the Owk Shale Formation of Kurnool Group near Ankireddipalli Village in Ragareddi District of Andhra Pradesh. The carbonised compressions and impressions of these discoid remains range in size from 0.5 to 5 mm, while majority of the forms range in size from 2.5 - 3.5 mm. The forms clearly show presence of atleast two type of vesicles : (i) hollow vesicles with thin walls as is shown by cracking on the margin, and (ii) thick-walled forms with concentric foldings. Further study is in progress. Macerated residue of Owk Shale Formation shows rare occurrence of ill-preserved broken smooth sphaeroidal acritarchs. Well preserved biota mainly consisting of smooth sphaeroidal acritarchs and broken organic films has also been recorded from the Tadpatri shales exposed at Bugga Circle near Ankireddipalli Village in Andhra Pradesh.

Programme 1.3 : Calcareous skeletal algae from Indian Phanerozoic sediments

A.K. Ghosh

Thin sections of coralline limestones from the Cretaceous-Tertiary sediments of Tiruchirapalli District, Tamil Nadu (Ariyalur, Reddipalayam, Peryarkurchi, Dalmiapuram, Varagur, Sendurai and Niniyur localities) were studied. The study reveals that the coralline limestones of Ariyalur, Reddipalayam and Dalmiapuram contain skeletal algae chiefly belonging to Chlorophyceae and Rhodophyceae. For the first time, species of *Sporolithon, Halimeda, Indopolia,* etc. are reported from the Ariyalur and Reddipalayam localities belonging to Kallankurchi Formation of Maastrichtian age. Occurrence of skeletal algae from the oil-bearing limestones (as observed in the field) of Reddipalayam is significant.

B.N. Jana & A.K. Ghosh

Visited the Cenozoic localities of Kutch District, Mesozoic localities of Surendranagar District and sea shores of Okha and Dwarka of Gujarat. For the study

of calcareous skeletal algae in all about 110 samples of coralline limestones were collected from Harudi, Waior, Akri Mota, Bare Moti, Bare Nani, Maniara Fort and Babia Hill sections of Kutch District and Bet Dwarka section of Jamnagar District. A variety of modern algae were collected from the sea shores of Okha and Dwarka.

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

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

A.K. Srivastava

The Talchir Needle shales exposed in Jaitri River and Kumandih Nala, Auranga Coalfield were studied. The flora shows the presence of *Gangamopteris-Glossopteris* association alongwith specimens of *Noeggerathiopsis* (*Gangamopteris cyclopteroides, G. major, G. angustifolia, Glossopteris communis, G. angustifolia, G. indica, G. decipiens* (?) and *N. hislopii*).

Samples studied from the section exposed near Bendi Railway Station contain 6 species of *Glossopteris* and number of specimens of *Trizygia speciosa*. The flora shows its comparison with the flora of Raniganj Formation.

Morphotaxonomy of plant fossils recovered from the Barakar Formation in South Jharia (Area 1) and Bird Moodidih (Area 5) collieries and Barren Measures Formation in Katri Nala Section of Jharia Coalfield were studied. The flora is represented by the dominance of *Glossopteris* spp., e.g., *G. damudica, G. arberi, G. senii, G. angusta, G. angustifolia, G. tenuifolia, G. stenoneura, G. communis, G. indica, G. subtilis, G. spathulata, G. intermedia, G. syaldiensis* and *Glossopteris* sp. The flora from Barakar Formation also shows the presence of *Noeggerathiopsis hislopii* and fragmentary specimen of *Sphenophyllum*. The genus, *Cyclodendron*, reported earlier in Barren Measures, is not recorded in the present investigation. However, comparison of the flora from known assemblages indicates that number of *Glossopteris* species recorded in the assemblage range in their vertical distribution right from Barakar to Raniganj Formations.

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

Shaila Chandra & K.J. Singh

SEM studies of conifer cuticles from South Belanda Colliery, Talcher Coalfield were completed.

Studies on the fossil megaflora from Madhupur area in Angul District, Orissa show the dominance of the genus *Glossopteris* with *G. indica* and *G. spathulata* representing about 18-20 per cent each. The typical Kamthi species, i.e., *G. leptoneura* and *G. stricta* are also recorded. The other forms include *Schizoneura, Neomariopteris, Lidgettonia, Eretmonia* and *Partha*. The flora of Madhupur beds compares well with the known Kamthi flora of Handapa beds in the Hinjrida Ghati and could possibly represent lateral extension of the same beds of Late Permian age. Plant megafossils were also collected from various Early Permian to Triassic exposures of the area.

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

Shyam C. Srivastava

The study of isolated fruiting bodies from Nidpur (100 in number) was completed. A few specimens have been found to be attached to their axis. Four distinct types have been identified on the basis of epidermal structures. Type-A reveals its affiliation with the *Voltzia*-complex conifers. Type-B appears to belong to Gondwana conifer *Voltziopsis*. The remaining are new types which are being studied.

Drawings of polymorphic *Dicroidium* leaves and stomatal apparatus in different magnifications have been completed. Two new species have been identified out of about 1000 specimens. The already known species: *Dicroidium nidpurensis* and *Dicroidium papillosum* have shown their forked fronds ruling out the contention of Nidpur dicroidia being unforked. With this finding, inference could be drawn that Dicroidium flora of Nidpur possesses both bipinnate and forked dicroidia like other Triassic assemblages of Gondwanaland.

Neeru Prakash

The photodocumentation of varied specimens of the genus *Dicroidium* was carried out. Their photoplates and line drawings of leaves and stomatal apparatus in different magnifications have been prepared. Forked and bipinnate specimens of *Dicroidium* have been recorded. *D. odontopteroides* has also been recorded.

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

Archana Tripathi

Archana Tripathi investigated the palynoflora in subsurface sediments in Talcher Coalfield (BH TP-8). The palynoflora reveals the presence of three distinct assemblages. The topmost coal-bearing sediments shows presence of taxa *Gondisporites, Densipollenites* and *Arcuatipollenites* in striate bisaccate dominating composition, indicating Late Permian (Raniganj) age. In the overlying sediments the second assemblage has abundance of *Lundbladispora* spp. associated with other Late Early Triassic elements, while the third and the youngest assemblage contains

Samaropollenites, Brachysaccus, Callialasporites and equates with the Late Triassic palynoflora.

Archana Tripathi & K.L. Meena

The bore cores of Bore hole TCP-39, TCP-41 and TNA-7 from Talcher Coalfield were palynologically studied. The qualitative assessment of spore-pollen in TCP-39 (depth 381.70 m) and TCP-41 (470.25 m) shows palynocomposition typical of Late Permian palynoflora having dominance of striate bisaccates and *Weylandites, Guttulapollenites, Kamthisaccites, Densipollenites* spp. and stray occurrence of *Arcuatipollenites*. In the bore-hole TNA-7 the samples investigated at 27.20 to 87.25 m shows the composition similar to that from TCP-39 and TCP-41 in addition to *Striatosporites, Quadrisporites* and *Leiosphaeridia*.

K.L. Meena

The palynodata of bore-hole IBSH-6 from Ib-River Coalfield, Orissa was studied. The age of bore core sediments compares to Raniganj. Processing of samples from bore-holes IBT-2, IBT-3 and IBT-6 for palynodating have been completed.

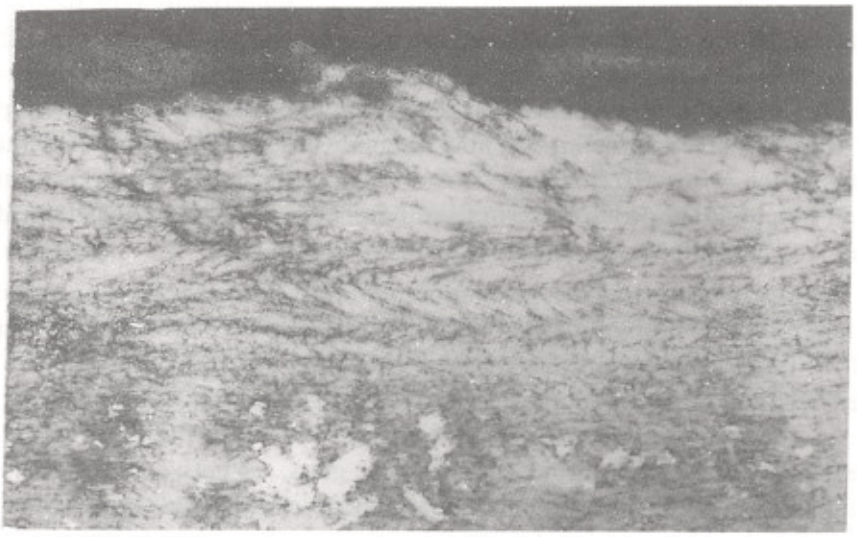
Visited Geological Survey of India, Calcutta for scientific discussion and consultation of library. Visited Sohagpur Coalfield (M.P.) and collected the bore core as well as outcrop samples for palynological analysis.

Programme 2.5 : Morphological study of plant megafossils from Raniganj, Karanpura and Rajmahal Coalfields and ultrastructure of megaspores, cuticles, seeds and *in situ* pollen/spores

H.K. Maheshwari & Usha Bajpai

Further investigated the ultrastructure of the cuticular membrane recovered from healthy and fungi-infected leaves of *Thinnfeldia indica* Feistmantel, in order to understand the nature of changes brought about in the cuticular membrane by the fungi and how cuticle is lost from the compression fossils. In general, the structural configuration of both cuticular membranes is similar. In the infected leaf, precursors of cutin accretions are irregularly present at the sub-cuticular surface. These accretions are interpreted as possible result of breakdown of cutin due to the secretion of an enzyme by the fungi infecting the leaf. The study on the cuticular membrane of infected leaf of *Thinnfeldia indica* under Transmission Electron Microscope shows various stages of degradation of amorphous matrix by the release of enzyme (cutinase). The upper portion of cuticular membrane is completely intact. It thus seems that fungi, besides edaphic factors, do play a role in the break-down of the cutin and thus constrain the preservation of the cuticular membranes.

Transmission electron micrographs of the cuticular membrane of *Dicroidium* sp., a Late Triassic leaf collected from the Tiki Formation of Madhya Pradesh, exhibit a '*herring bone*' structure which possibly is an indicator of environmental stress. On



Fine structure of cuticular membrane of *Dicroidium* sp. from Late Triassic of Tiki Formation, Madhya Pradesh showing "herring bone" structure indicating environmental stress,x 62,000.

sedimentological grounds, Late Triassic in India is believed to have been a period of widespread aridity.

H.K. Maheshwari & S.M. Singh

Investigated about 200 specimens of cordaites and glossopterids. Cuticular preparations were made from a large number of specimens, but in most specimens the cellular structure is not decipherable. The preservational aspect, i.e., taphonomy of this assemblage is very interesting. Some of the leaf megafossils show a peculiar distortion of the lamina, that may represent effects of depositional environment.

Usha Bajpai & S.M. Singh

Further collected more specimens similar to those earlier reported to superficially resemble a sphenopsid. The specimens have leaves arranged in a close spiral on a relatively thick axis. Further maceration of the carbonified crust did not yield a stomatiferous surface thus handicapping precise comparison of the fossil with known taxa. The leaves are dimorphic, some are linear-lanceolate with parallel running straight veins, while others are cuneate with spreading venation. None of the leaves show signs of anastomoses.

H.K. Maheshwari

Analysed the available data on the glossopterid group of plants for taxonomic position and affinities of the group. This group is mostly known through leaves that invariably were simple, with smooth margins and reticulate venation. Due to regular association, pycnoxylic *Araucarioxylon*-type stems and *Vertebraria* roots have been

related to some of the glossopterids. Ovule-bearing *Dictyopteridium*-type fructifications, found attached to the midrib of the leaf, are dorsiventral, foliar structures that bore ovule only on the adaxial surface. Cross-sections of the petrified material have shown that due to revolute nature of the leaf lamina, the ovule-bearing surface was partially covered. None of these characters support the inclusion of this group of plants under the Pteridosperms *sensu-stricto*. Sum total of vegetative and fertile organs ranks this group as an independent order, Dictyopteridiumales in the Class Glossopteridopsida. This group was a phyllosperm, and not a caulosperm.

A major overview of the problems related to Permian-Triassic Boundary in the global context was prepared. The major stratigraphic divisions of the Phanerozoic are based on mass extinction events. These divisions are called as systems and the boundaries between them are more often based on the concept of biotic crisis, than on lithology. In continuous sequences it is usually possible to clearly draw the system boundaries, but in cases of global stratigraphic gaps, as between the Permian and Triassic, the placement of the system boundary becomes a difficult task. This overview discusses and analyses available information of the Permian-Triassic Boundary interval both in the marine and continental sediments and brings out gaps in informations as far as continental strata are concerned.

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

Vijaya

In the Domra sub-basin in Bore hole PGD-6 (501.65-229.60 m thick strata), the upper part of Panchet Formation has yielded *Murospora florida* palynozone, which directly overlies the *Lundbladispora-Verrucosisporites* palynozone in Panchet Formation. Subsequently, in Rajmahal Formation, the Intertrappean sediments have yielded *Cicatricosisporites australiensis* palynozone. Here the *Murospora florida-Cicatricosisporites australiensis* palynozones suggest the Jurassic-Cretaceous transition at the Panchet-Rajmahal formational boundary level (501.65 m depth) in Bore hole PGD-6

Visited eastern most part of Panagarh-Deocha, West Bengal and Rajmahal Basin for the collection of rock samples for palynological studies. Also visited Geological Survey of India, Calcutta for scientific discussions and consultation of literature.

Programme 2.7 : Composition, relationship and age of the megafossil flora of Rajmahal Formation

Jayasri Banerji

Megafossil assemblage of fossiliferous Intertrappean bed near Balidih in Rajmahal Basin was studied. It includes — *Equisetites rajmahalensis, Phyllopteroides laevis, Pachypteris* sp. cf. *P. indica, Thinnfeldia indica, Ptilophyllum acutifolium, P. cutchense, Anomozamites* sp. cf. *A. fissus, Taeniopteris* sp. cf. *T. spatulata, Elatocladus*

Thinnfeldia indica Feistmantel from Balidih locality in Rajmahal Hills, Bihar, x 2.

confertus, Araucarites cutchensis and *Coniferocaulon* sp. The floristic composition, its relationship with others and presence of index Neocomian species *"Phyllopteroides laevis"* suggest Neocomian age.

Bartala megafloral assemblage is being investigated. Ten genera belonging to various species have been identified and the assemblage is predominated by the genus *Anomozamites*. Examination of Sonajori chert slides is continued and a few slides have also been prepared for detail study.

Megafossils from Dhokuti locality of Rajmahal Basin show the presence of *Marattiopsis macrocarpa, M. reversa, Cladophlebis* sp. cf. *C. denticulata, Gleichenia gleichenoides, Sphenopteris imbricata, Sphenopteris* sp., *Pterophyllum princeps, Pterophyllum medlicottianum, Pterophyllum kingianum, Pterophyllum morrisianum*

etc.

B.N. Jana

Studied the fragmentary plant remains from Gumapahar, Rajmahal Basin. The assemblage contains *Rienitsia* sp., *Taeniopteris* sp., *Anomozamites* sp., *Ptilophyllum acutifolium* and *P. cutchense*. The study is continued.

Neeru Prakash

Recorded plant megafossils from Sitalpur locality, Rajmahal Basin (*Cladophlebis* sp., *Ptilophyllum cutchense, P. acutifolium, Elatocladus* sp., *Brachyphyllum* sp. and *Araucarites* sp). The detailed morphotaxonomic study shows its affinity with the Gollapalle floral assemblage of West Godavari District in having dominance of cycadophytes and conifers.

Morphotaxonomic study of fossil flora of Dudhkol has been carried out. The recorded elements are *Equisetites* sp., *Haydenia* sp., *Todites indicus* and *Ptilophyllum cutchense*. The flora on the whole is dominated by pteridophytes.

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

Archana Tripathi

The palynological investigations of intertrappean sediments (10.50-22.42 m) in the bore hole RCH-151 (410.95 m deep) about 2 km east of Chattam drilled by MECL were carried out. The detailed analysis shows dominance of gymnospermous pollen *Callialasporites/Araucariacites*. The other taxa found are *Leptolepidites, Matonisporites, Cicatricosisporites, Cycadopites* and *Schizosporis reticulatus*. Among the hilate forms only *Coptospora kutchensis* is recorded. The qualitative composition of assemblage indicates Early Cretaceous age.

The palynodating of samples from Dubrajpur Formation in Lakraphela Pahar, Mahuagarhi Coalfield has been done. Poor yield of palynofossils delimits precise age assignment. However, the Permian taxa recorded are : *Callumispora, Parasaccites, Plicatipollenites, Sahnites* and *Scheuringipollenites*. The Triassic spore-pollen — *Ringosporites, Brachysaccus* and *Ovalipollis* are sporadically recorded. A Triassic age is tentatively assigned to these sediments having reworked Permian palynomorphs. In Mahuagarhi Coalfield, the samples up to 47.25 m depth in bore hole RJMG-10 (466.10 m deep), drilled east of Talpahari Village) were analysed for palynodating. A Late Permian age is assigned to sediments from 8.20 to 24.30 m depth on the basis of abundance of genus *Densipollenites*.

In Pachwara Coalfield, the palynoflora recovered from samples (5.15-47.0 m depth) of Bore hole RJP-49 (199.70 m deep, south of Chirudih Village) has shown dominance of striate bisaccate *Striatopodocarpites* and increased frequency of genus *Alisporites*. The qualitative search for age marker taxa reveals presence of

Lundbladispora, Arcuatipollenites pellucidus, Alisporites spp., *Brachysaccus* indicates the transitional phase from Permian to Triassic.

Visited easternmost part of Panagarh-Deocha, West Bengal and Rajmahal Basin for the collection of rock samples for palynological studies. Also visited Geological Survey of India, Calcutta for scientific discussions and consultation of literature.

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

B.K. Misra & B.D. Singh

Prepared 58 coal pellets from bore-hole RJP-11 which encountered nine coal seams in Pachwara Coalfield. Quantitative study under normal incident light revealed that the coals contain variable proportions of macerals of vitrinite and inertinite groups. Whereas, liptinite macerals are poor. In fact, inherent argillaceous mineral matter intimately associated with liptinites tend to mask them, at times completely, rendering their identification difficult. However, study under fluorescence mode (blue light excitation) shows manifold increase in relatively hydrogen-rich liptinite contents, and is chiefly constituted by sporinite (spores-pollen), alginite (algae) and liptodetrinite (detritus). Reflectance measurements taken on vitrinite particles suggest that Pachwara coals are of sub-bituminous A to high-volatile bituminous C rank (Ro max. 0.42-0.56%).

Visited Central Mine Planning and Design Institute Limited (CMPDIL), Ranchi, Central Fuel Research Institute (CFRI) and Indian School of Mines (ISM) Dhanbad for consultation and scientific discussions. Dakra and Piparwar collieries were also visited along with the scientists of CMPDIL. The samples were collected for organic petrological studies from these collieries.

Programme 2.10 : Palynology of the Gondwana Sequence in Satpura Basin

Pramod Kumar

Palynology of Almod Beds in Satpura Basin has been studied. The palynoassemblage is dominated by *Striatopodocarpites* (24-27%) followed by *Faunipollenites* (4-13%), which continue from the Late Permian, Bijori Formation in Satpura Basin. The presence of the significant palynotaxa, viz., *Arcuatipollenites, Playfordiaspora, Lundbladispora, Chordasporites, Klausipollenites, Alisporites, Satsangisaccites, Falcisporites, Goubinispora, Densoisporites, Cycadopites,* etc. in the palynoassemblage indicates onset of Early Triassic age.

Palynostratigraphic study of the sediments exposed at Tamia Scarp (Pachmarhi Formation) near Chota Mahadeva and Tamia Ghat Road at Tamia in Chhindwara District, Madhya Pradesh has been continued. The palynoassemblage contains the dominance of *Falcisporites* (25-28%) followed by *Satsangisaccites* (14-15%). The other significant forms are *Nidipollenites, Podocarpidites, Alisporites, Klausipollenites, Goubinispora, Trochosporites, Lundbladispora, Brachysaccus, Staurosaccites, Weylandites*, etc. It has

been dated between Early Triassic to Early Middle Triassic or extend up to Anisian/ Ladinian age. Palaeoclimate during late Late Permian and Triassic time was warm and semiarid.

Visited GSI, Central Region, and MECL and CMPDI Offices, Nagpur for discussion and consultation. Besides, visited Tamia, Mutkuli, Jhirpa, Renikhera, Khari, Dukrikhera, Pipariya (outcrop samples) and Amarwada (bore-cores MPJ-12 & 15) for collection of palynological samples.

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

Suresh C. Srivastava, Neerja Jha & Ratan Kar

Palynological studies of sediments from bore-hole GC-17 have revealed presence of palynoflora equivalent to Early Triassic in Chintalpudi sub-basin. Significant palynomorphs in the assemblage are *Falcisporites, Klausipollenites, Chordasporites, Playfordiaspora, Goubinispora, Nevesisporites, Lundbladispora, Densoisporites, Classopollis, Rajmahalispora*, etc.

Palynostratigraphic studies of bore core GJ-6 from Bhopalpalli area were compiled. Barakar and Raniganj palynoflora have been identified in the above sequence.

Visited Geological Survey of India, Calcutta for scientific discussion and consultation of literature. Also visited Kothagudem and Sattupalli areas in Godavari Graben for collection of samples for palynological studies.

Programme 2.12 : Organic petrographic evaluation of coals from Godavari Graben

O.S. Sarate

Maceral and microlithotype analyses of 36 coal pellets representing Manuguru area have been carried out. The study has revealed that majority of the coals are vitric in nature containing broad microbands of vitrinite. Sporangia, seeds, resin bodies and megaspores are also recorded. The study in fluorescence mode has revealed the existence of fluorescing material in the cell cavities. It indicates that the fluorescing hydrogen-rich matter has occupied the available space present in various macerals.

Visited Yellendu and Manuguru open cast mines of Godavari Valley for collection of coal samples for biopetrological study. Also visited Geological Survey of India, Calcutta to explore the possibilities for procurement of coal samples from various localities in Wardha-Godavari Valley for organic petrological investigations.

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

Anand Prakash, Rakesh Saxena & Jyotsana Rai

The maceral distribution pattern under fluorescence mode and normal reflected

light suggests that Talcher coals are rich in Liptinite group of macerals. The characteristic algal bodies, viz., telalginite and lamalginite were identified in these coals. High incidence of well-preserved varied cross sections of leaves, sporangia, seeds together with tracheids, etc., suggest that these coals have originated under hypo-autochthonous conditions. The presence of typical structured inertinites further support this contention. Fluorinite associated with cutinite, spores and other liptinitic group of macerals, is the characteristic feature of the coals. These macerals at different time levels indicate the presence of shallow niches over the deposited peat surface.

Reflectance pattern of 40 coal samples from number of blocks has been recorded and the maturation trend (0.5 - 0.7%) suggests these coals to be lying in the range of high volatile bituminous coals.

Rakesh Saxena & Jyotsana Rai

Visited Geological Survey of India, Calcutta, C.G.C.R.I, Jadavpur and Indian School of Mines and C.F.R.I., Dhanbad for consultation and research discussions.

Programme 2.14: Palynostratigraphy of recently explored subsurface Gondwana Sequence in Tamil Nadu and Pondicherry (U.T.)

Archana Tripathi & Vijaya

Palynostratigraphic study in bore hole PBSD-1 (549.50 m deep), Oragadam sub-basin of Palar Basin was taken up to determine the age of Sriperumbudur Formation. Palynoassemblages recovered between the depths 26.00 to 526.50 m contain dominance of *Callialasporites-Araucariacites* with onset of *Callialasporites* at 539.00 m depth in the lithounit containing pebbles/cobbles in greenish-grey sediments, earlier grouped as Talchir Formation. FAD of *Cicatricosisporites australiensis* and *C. ludbrookiae* at 248.00 m depth deciphers a precise placement in the Mesozoic palynosequence, i.e., at the older level in *Microcachryidites antarcticus* zone of Indian peninsula, and *Cicatricosisporites australiensis* zone in Australia extending from Tithonian-Valanginian in age. Prominence of radial monosaccate pollen (*Plicatipollenites, Parasaccites*) between 314.50 to 256.30 m suggests reworking of Talchir sediments. A mixed assemblage of Permian and Jurassic-Cretaceous palynotaxa is also present between 475.30-539.00 m.

Programme 2.15: Palynostratigraphy of Gondwana Sequence in Tatapani-Ramkola Coalfield, Madhya Pradesh

Suresh C. Srivastava & Ratan Kar

Palynological study of Raniganj-Panchet sediments exposed along Iria Nala was finalized. On the basis of quantitative dominance, 3 Assemblage Zones have been distinguished in ascending order — (i) *Densipollenites magnicorpus* zone, (ii) *Crescentipollenites fuscus* zone, and (iii) *Falcisporites stabilis* zone. The Permo-Triassic Boundary has been drawn between the second and third palynozones.

Palynological investigations of outcrop samples from Mangra Dhora Nala (near Chaki Village) and Moran River (near Wadrafnagar) revealed a dominance of striate disaccates mainly represented by *Faunipollenites, Striatopodocarpites, Striatites* and *Crescentipollenites*. Good representation of triletes is also seen. The palynoassemblage is comparable to the *Striatopodocarpites-Crescentipollenites* Assemblage Zone representing Upper Raniganj (Late Permian) palynozone. Palynofloristically, the two sections are comparable.

Palynological studies of coal-carbonaceous shale samples outcropping just north of bore hole TRM-1 in the Banki River were carried out to correlate the surface exposures with that of the upper part of the sequence in bore hole TRM-1. Dominance of striate disaccates (*Faunipollenites - Striatites - Striatopodocarpites*) along with *Densipollenites magnicorpus* has been recorded which represent Raniganj Palynozone.

Samples from conglomerate beds occurring in different formations, and from Panchet mudstone sequence (below Juba Pahar on Manikpur road) were collected during the Field workshop organised by Coal Wing, G.S.I., and macerated for palynodating. However, all the above samples were found to be devoid of palynofossils.

Visited Tatapani-Ramkola Coalfield and studied in detail various Gondwana formations exposed in the area in relation to structural and lithological characteristics. Collected coal and carbonaceous shale samples from bore-holes TRDM-2 and TRSS-1 and from various outcrop sections for palynological studies.

Programme 2.17: Evolutionary diversification of Cretaceous flora of Pranhita-Godavari Graben

A. Rajanikanth

Morphotaxonomy of conifer strobilii, *Conites* and *Podostrobus* has been analysed, the latter being the first report from the Gangapur Formation. *Stachyotaxus* has been described for the first time from the Gangapur Formation. Taxa assigned to *Taeniopteris, Anomozamites, Ptilophyllum, Pagiophyllum* and *Elatocladus* have been systematically described. The entire assemblage of Gangapur Formation has been compared with floral assemblages known from the pericratonic east-coast basins. Taphonomic bias in the interpretation of fossil plant evidences has been evaluated.

Visited Wardha-Pranhita-Godavari Valley and collected a number of fossil specimens and sediment samples.

Programme 2.18 : Petrographic evaluation of coals from Ramkola-Tatapani Coalfield, Madhya Pradesh

Anand Prakash & Shinjini Sarana

Maceral and microlithotype analyses of coals from bore-holes TRS-15 and TRS-16 were completed. A brief report on the petrological assessment of coals from bore-hole TRS-15 was sent to GSI, Coal Wing, Calcutta. Revaluation of reflectance is

in progress. Photomicrography of characteristic macerals from the coal samples of bore-holes TRS-15, 16, TRM-3 and some outcrop samples has been carried out. Presence of fluorinite, exsudatinite, suberinite, sporangia, resin infilled spores and portions of the transverse section of leaves were observed. A well-preserved megaspore exine of laevigate nature measuring 1.856 µm has also been recorded. In some samples good preservation of cell walls in fusinite was seen. Apart from the primary and secondary cell walls, possible preservation of middle lamella in some of the plant tissues was also observed.

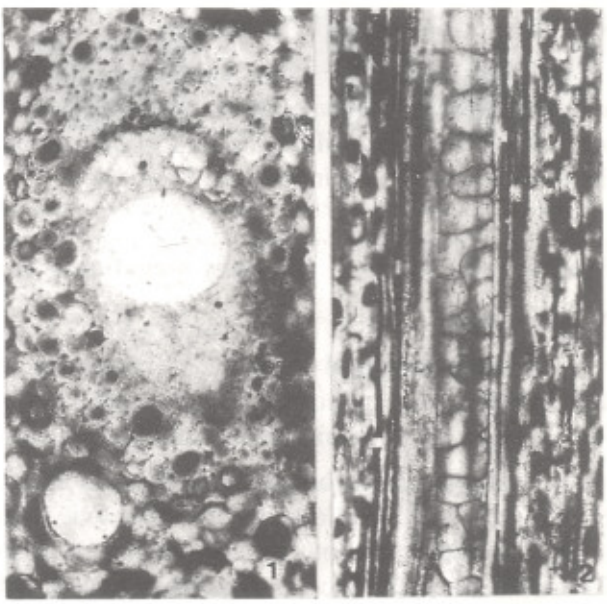
Number of samples from bore-hole TRDM-1 were processed for petrological study. The thermally metamorphosed vitrinite (R_o max. 3.0%) along with the formation of numerous vacuoles due to a dolerite intrusion was observed. On the basis of the unaffected nature of the pyrite, it is suggested that the temperature might have gone up to about 500°C during the injection of the dyke.

Collected coal and carbonaceous shale samples from bore-holes TRDM-2 and TRSS-1 and various outcrop sections for organic petrological studies.

PROJECT 3 : CENOZOIC PLANT BIOGEOGRAPHY OF PENINSULAR INDIA

Programme 3.2 : Studies on the Tertiary floras of western India

J.S. Guleria



1. Cross section of a palm wood from Deccan Intertraps of Kutch showing mucilage canals and fibrovascular bundle, x 100; **2**. longitudinal section showing tyloses in vessels and mucilage canal in a lepidocaryoid fossil palm wood, x 63.

A number of petrified woods were studied from the Neogene sediments of Gujarat and Rajasthan. The following taxa belonging to five different families, viz., *Afzelia-Intsia* (Fabaceae), *Barringtonia* (Lecythidaceae), *Diospyros* (Ebenaceae), *Ficus* (Moraceae) and *Syzygium* (Myrtaceae) were identified. Besides, two types of palm woods from the Deccan Intertrappean of Kachchh were identified.

Visited areas in Rajasthan (Bojri mine, Nal clay mine, Kalayat of Bikaner District and Kapurdi Giral lignite mines, etc. of Barmer District) and Gujarat (Anjar, Matanomadh, etc., of Kutch District) and collected a large number of megafossils including woods and leaves. The Herbarium and Wood Anatomy Branch of the Forest Research Institute, Dehradun were also visited for comparing the fossil leaves and woods with their living counterparts.

Programme 3.4 : Neogene plant megafossils of West Coast

Rashmi Srivastava

A number of carbonised woods from Kerala Coast were studied and the following taxa were identified which are new to the area : *Dipterocarpus indicus* (Dipterocarpaceae), *Mischocarpus fuscencens* and *Sapindus trifoliatus* (Sapindaceae), *Rhus mysorensis* (Anacardiaceae), *Albizia amara* and *A. lucida* (Fabaceae), *Sandoricum indicum* (Meliaceae), *Artocarpus lakoocha* (Moraceae) and *Polyalthia andamanica* (Anonaceae). Their modern equivalents are distributed in Indo-Malayan region and Myanmar indicating similar climate in Kerala Coast during deposition of Warkalli Beds.

Visited Xylarium and Herbarium of the Forest Research Institute, Dehradun for comparing fossil woods and leaves with the extant taxa.

Rashmi Srivastava & R.K. Saxena

Studied carbonised woods from Sindhudurg Formation (Miocene) in Ratnagiri and Sindhudurg Districts, Maharashtra. The extant equivalents of these woods are presently growing in Malaysia and Myanmar indicating more humid climate during the sedimentation of Sindhudurg Formation.

Programme 3.6 : Tertiary megafossils from Neyveli lignite, Tamil Nadu

Anil Agarwal

Sectioning and study of 15 carbonised fossil woods of old collection were done but the preservation of all the woods is too poor to reveal any structural detail. Photographs of 10 fossil leaves from old collection were also investigated.

About 126 carbonised fossil wood specimens and 125 fossil leaves from the Neyveli lignite Mine 1 and 2 were collected. Tentative identification of about 35 fossil leaves belonging to about 18 families, viz., Anacardiaceae, Apocynaceae, Burseraceae, Combretaceae, Clusiaceae, Dipterocarpaceae, Ebenaceae, Euphorbiaceae, Fabaceae,

Guttiferae, Lauraceae, Lythraceae, Myrtaceae, Myrsinaceae, Moraceae, Rubiaceae, Sapindaceae and Rutaceae has been done.

Visited the Neyveli lignite Mine 1 and 2, South Arcot District, Tamil Nadu and collected carbonised woods and leaf samples. Also visited Central National Herbarium, Howrah for the comparative study of fossil leaves.

Programme 3.9 : Organic petrology of Kutch lignites, Gujarat

Alpana Singh & B.K. Misra

Reflectance measurements have been taken on samples of old mine section from Panandhro Lignitefield. The R_o max. values (0.42-0.46%) indicate that the lignites have attained sub-bituminous C/B stage. Quantitative assessment of lignite under normal incident mode indicates that huminite (74.4-82.0%), the dominant maceral group, is chiefly constituted by humocollinite (25.6-61.0%) and humodetrinite (11.4-40.8%). Humotelinite (3.6-20.8 %) is in relatively lower proportion. Liptinite, the sub-ordinate group of macerals (4.6-26.0 %) is mainly contributed by resinite, cutinite and sporinite. Secondary macerals bituminite and fluorinite were also observed in few samples (under fluorescence mode).

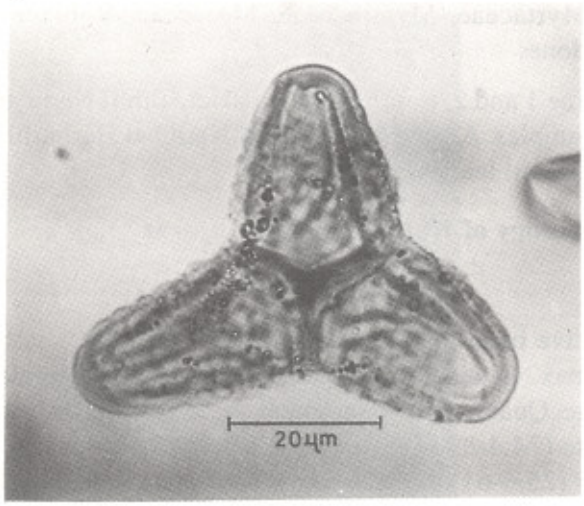
Further collection of lignite samples from two seams exposed in Mine Block II of Panandhro Lignitefield has been done. The lignite when fresh is compact and dark brown in colour and becomes friable on exposure to air. Many shale bands (up to 5 cm) of pinching and swelling nature were observed at places. Resin in the form of specks, globules and bands (5-8 cm) was present throughout the seam thickness. Visited Directorate of Geology and Mining (DGM) offices at Ahmedabad, Gandhi Nagar, Bhuj and Gujarat Mineral Exploration Circle (Bhuj) for discussions and consultation regarding geological, petrological and geochemical reports on Kutch lignites.

Coal samples from Guneri Coalfield were also collected from exposed 2.5 feet thick seam interbedded between creamish white sandstones. The seam is commercially unexploitable.

Programme 3.10: Palynostratigraphy of the Tertiary sediments of Gujarat

J.P. Mandal

The palynoassemblage of 4 sections from Panandhro, Akri and Matanomadh lignite mines belonging to Naredi Formation was studied. In all the sections two distinct palynoassemblages have been recognised. In the lower lignite-bearing horizon *Minutitricolporites, Triangulorites, Tripilaorites, Retitrilatiporites* together with well-preserved dinocyst occur in good number. The upper part is devoid of dinocyst and dominant palynotaxa are *Cheilanthoidspora, Lakiapollis, Pellicieroipollis, Dermatobrevicolporites, Pilatrisyncolpites* and tetrad pollen which are characteristic of this assemblage.



A new tetrad pollen from Naredi Formation, Early Eocene, Kutch.

B.D. Mandaokar

About 40 samples from bore-hole K-15, drilled by Central Ground Water Board in Tupni area of Jamnagar District were studied. A poor palynoassemblage comprising bisaccate pollen grains (? *Podocarpidites*) could be recovered, which does not permit definite age assignment.

Outcrop samples (40) were collected from Bet Shankhodar, Gujarat. Palynologically all the samples proved barren, except some samples which have yielded foraminifera and dinoflagellate cysts.

Visited Dwarka, Sasangir, Jamnagar, Somnath and Harshad in Gujarat to collect rock samples for palynological studies.

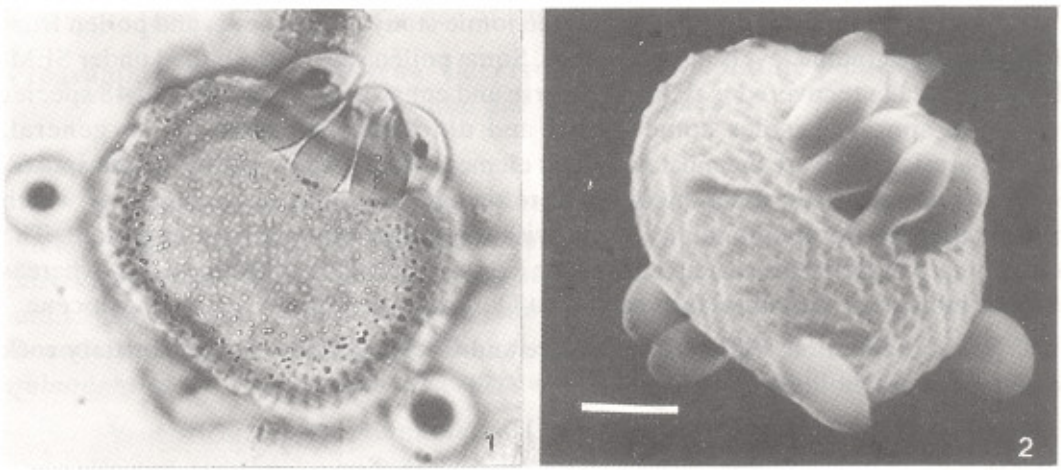
Programme 3.11: Palynological investigation of the Tertiary formations of Rajasthan (other than Kapurdi area)

K. Ambwani

Samples from bore-hole RGBH-33/14, drilled near Raneri Village, Bikaner District yielded rich and varied spores and pollen assemblage. Association of *Lycopodiumsporites, Proxapertites, Spinizonocolpites, Lakiapollis, Matanomadhiasulcites* as well as *Retitribrevicolporites* along with *Dandotiaspora* (*D. dilata*) in the assemblage indicates a Late Palaeocene age for the sediments.

A new genus *Clavadiporopollenites raneriensis* was instituted while studying the palynoassemblage. The affinities of this pollen grain could not be traced out with the modern counterpart. However, its typical exine morphology with peculiar finger-like processes around the pores signifies an important evolutionary trend in the plant communities during Early Tertiary Period.

Visited Raneri, Gadala and Bethnok localities of Bikaner District for collection of Tertiary rock samples.



Clavadiporopollenites raneriensis Ambwani & Singh 1996 from Raneri Village, Bikaner District, Rajasthan; **1.** under light microscope, x 1,000; **2.** SEM photograph, x 1,200.

Programme 3.12 : Palynostratigraphic investigations of the Tertiary sediments of Eastern Coast of south India

K. Ambwani

Lignite samples from Mine-1 of Neyveli Lignitefield, Tamil Nadu were studied. Apart from the angiospermic pollen and pteridophytic spores, fungal spores and fruiting bodies were also present in the assemblage, majority of them belonged to microthyriaceous group. The well-preserved ones were also studied under SEM to understand their morphology.

A monocot fossil axis belonging to Agavaceae was further studied in detail under SEM to understand its anomalous secondary growth. The leafy tuft of the axis (probably flowering part) on maceration yielded pollen grains (=*Dracaenopollis*) that further confirm the affinities of the plant to Agavaceae (Liliales). This also supports the existence of liliaceous plant which acquired the advancement in its anatomy but retained primitive characters in the flowers. The role and status of this plant were employed in the palynostratigraphy of the area to understand evolution and migration aspects.

Visited Neyveli Lignitefield to collect Tertiary rock samples for palynological studies.

Programme 3.13: Palynostratigraphical investigation of the Tertiary sediments of Western Coast of India

R.S. Singh

Chemical processing of the Tertiary sediments from Kundra, Quilon and Warkalli in the state of Kerala was done. Morphotaxonomic study of the spores and pollen from different stratigraphic levels has been done. Some pollen were also studied under SEM. The assemblage recovered is rich and diverse and consists of 36 genera and 48 species of pollen-spores, besides some fungal and dinoflagellate remains. In general, angiospermic pollen are the most dominant elements followed by pteridophytic spores. Several ecological floral communities were recognised in the assemblage, of which back-mangrove floral community along with dinoflagellate cysts are important. The assemblages of the surface samples indicate Oligocene to Lower Miocene age, whereas the assemblage of the subsurface section at Quilon ranges from Eocene to Miocene.

Visited Quilon, Varkala, Cannanore and Cochin areas to collect Tertiary rock samples for palynological studies.

PROJECT 4 : PHYTOPLANKTON BIOSTRATIGRAPHY OF MARINE SEDIMENTARIES OF INDIA

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

Rahul Garg

Photodocumentation of some stratigraphically significant holococcoliths discovered across K/T Boundary was done. Besides, a manuscript on integrated phytoplankton stratigraphy across K/T Boundary at Um Sohryngkew, Meghalaya was prepared.

Rahul Garg & Khowaja-Ateequzzaman

Two draft manuscripts entitled "Stratigraphic significance of Late Palaeocene dinoflagellate cyst assemblage from Lakadong Sandstone" and "Morphological and taxonomical studies on Late Maastrichtian-Early Danian dinoflagellate cyst genus *Disphaerogena* from Khasi Hills" were prepared.

Besides, scanning of slides to check dinoflagellate cyst productivity of Late Cretaceous sequence of Mawsynram area was carried out. Type slides of Jain, Sah and Singh (1979) from coeval Dawki sequence representing abundance of *Dinogymnium* species are being restudied.

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

Khowaja-Ateequzzaman & Rahul Garg

Compiled data on Cretaceous dinoflagellate cyst bioevents in Cauvery Basin,

south India. Documentation of frequency distribution of Neocomian dinoflagellate cyst types from subsurface sequence of Palar Basin is being carried out.

Programme 4.3 : Neogene calcareous nannoplankton palaeoceanography of Andaman and Nicobar Islands

S.A. Jafar

Calcareous nannofossil data of Neogene sections exposed in various islands of Archipelago group and Car Nicobar group was compiled using computer graphics. Sawai Bay, Passa Bridge and Mus Jetty sections of Car Nicobar Island were studied and calcareous nannofossil documentation was done under LM. Miocene/Pliocene Boundary could be established in Sawai Bay section based on LAD of *Discoaster quinqueramus, Triquetrorhabdulus rugosus* and FAD of *Ceratolithus acutus*.

Visited Car Nicobar, Kamorta and Great Nicobar Islands in Andaman sea region and collected samples for palynological and nannofossil studies.

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

Anil Chandra

Rock samples from three sections namely Passa Bridge, Sawai Bay and Kakana of Car Nicobar were chemically analysed for siliceous microfossils. Sawai Bay Formation is exposed in all the three sections, whereas Kakana Formation is seen only in Sawai Bay and Kakana sections. Samples from Sawai Bay Formation of Sawai Bay section have yielded diatoms and silicoflagellates. The diatom assemblage from Sawai Bay Formation indicates a Miocene-Pliocene age for this formation.

EDAX of selected rock chips from Car Nicobar was carried out. Consideration was made to select the specimens from different stratigraphical horizons. Microfossils having circular and bilateral symmetry were grouped separately. Composition of siliceous microfossils in 1 sq mm of the slide was also determined. SEM photographs and EDAX print-outs were prepared. XRD analysis of a few samples from Car Nicobar was carried out through XDAL-3000 programme. A draft manuscript on the diatoms from Car Nicobar is under preparation. A manuscript dealing with the lithostratigraphy of Car Nicobar was finalized.

Visited Neill and Havelock islands to collect rock samples from Neogene sequences (covering five sections) for diatom study. John Lawrence, Wilson, Strait and Nicolson islands were also surveyed.

Programme 4.5 : Palaeogene-Neogene phytoplankton biostratigraphy and palaeoceanographic set-up of Kutch and Saurashtra Basins, India

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

Discovered for the first time a diagnostic suit of *Nannoceratopsis* species, viz., *N. dictyoambonis, N. ambonis* and *N. plegas* in the subsurface sequence of Lakhpat bore hole, Kutch Basin suggesting Late Aalenian-Early Bajocian age. The detailed morphological study of dinoflagellate cyst assemblages from supratrappean outcrop sequence belonging to the lower part of Naredi Formation was done. Dinoflagellate cyst productive levels from Harudi Formation are being identified.

PROJECT 5 : PALAEOFLORISTIC DIVERSIFICATION IN HIMALAYA

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

Vijaya

Benchmark palyno-events at the transition of Permo-Triassic in the marine sequence of Tethys Himalaya were studied and tagged them with those in continental sediments in Raniganj Coalfield of Damodar Basin.

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

Suresh C. Srivastava & A.P. Bhattacharyya

The samples from Kalijohra, Gish and Lish River sections in Darjeeling District were remacerated. The samples were tried with various techniques. The bore-hole samples from Bhutan were studied palynologically. Striate disaccate along with *Densipollenites* are dominant in the assemblage. The presence of sulcate palynofossils are common in the assemblages.

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

Samir Sarkar & Vandana Prasad

Palynostratigraphical study of Subathu sediments, collected from 7 measured sections in the Kalakot and its adjoining areas, has been completed. The palynoflora comprises 35 genera and 48 species and are distributed in several palynoassociations. Dinoflagellate cysts and fungal spores/ascostromata constitute an important part of the assemblage, though pteridophytic spores and angiospermous pollen have also been recorded. Palaeocene dinocyst taxa were recorded for the first time from the Beragua Formation. On the basis of palynological assemblage, it is postulated that the basin was very shallow and the sediments were deposited in marine condition.

Palynological study of the Siwalik sediments of three measured sections, viz., Papar-Mansar, Parmandal-Uttarbaini and Jajarkotly-Bantala has also been completed. All the samples of the Jajarkotly-Bantala Road section proved to be barren, whereas the samples from Mansar and Uttarbaini areas have yielded very poor palynoassemblage.

Fifteen genera belonging to fungi, pteridophytes, gymnosperms and angiosperms have been identified. The generated data base is not sufficient for any tangible interpretation.

Visited Kalakot, Uttarbaini and Jammu areas of Jammu and Kashmir. Stratigraphically located samples from Subathu Formation as well as Siwalik Group of rocks were collected. Reconnaissance survey was also made at several places of Jammu as well as Himachal Pradesh and Haryana.

Programme 5.5 : Palynostratigraphy of the Tertiary sediments of Kargil Basin, Ladakh Himalaya

R.K. Saxena & Samir Sarkar

Work under this project could not be carried out due to non-availability of material.

Programme 5.6 : Neogene Himalaya : floristics, evolutionary patterns and climate

N. Awasthi, J.S. Guleria, Rashmi Srivastava & M. Prasad

Leaf-impressions collected from Kasauli, Dagshai and Dharmshala were studied. Leaves/leaflets belong to *Amoora, Bambusa, Bauhinia, Dipterocarpus, Ficus*, palmate palm and legumes.

N. Awasthi & M. Prasad

The work on plant megafossils from Siwalik sediments of Surai Khola, Nepal was completed and submitted for publication. Its palaeoecological and phytogeographical implications have been discussed.

M. Prasad

The leaf-impressions, collected from Arjunkhola, Koilabas, Seria Naka, Tanakpur and Hardwar were investigated. The assemblage reveals the presence of about 35 new taxa. Out of which, 9 taxa are from Arjunkhola (*Securidaca inappendiculata, Dipterocarpus bourdillonii, D. incans, Anisoptera scaphula, Isoptera borniensis, Drimycarpus racemosus, Flemingia wightiana, Sapindus attenuatus, Terminalia tomentosa*), 11 from Seria Naka (*Fissistigma wallichii, Mitrephora macrophylla, Phaeanthus* sp., *Goniothalamus* sp., *Flacourtia catafracta, Mangifera indica, Dracontomelon sylvestre, Dalbergia volubilis, Nephelium glabrum, Diospyros pruriens, Diospyros* sp.), 10 from Koilabas (*Brucea mollis, Shorea trapizifolia, Miliusa thoretii, Fissistigma elegans, Popowia nitida, Berchemia rhamosa, Dalbergia cultrata, Cynometra eripa, Phyllanthus reticulatus, P. columnaris*), 3 from Hardwar (*Vatica mangachapoi, Eugenia occidentalis, Bassia longifolia*) and 2 from Tanakpur (*Mitrephora maingayi, Oxymitra biglandulosa*).

Fossil woods collected from Siwalik sediments of Kalagarh and Tanakpur have been cut and studied. Most of them are found duplicate resembling *Hopea, Shorea, Dipterocarpus, Bauhinia, Millettia* and *Diospyros*, besides 3 new taxa which are under

Fossil leaf resembling *Phyllanthus reticulatus* Prail. from the Siwalik sediments near Koilabas, western Nepal (Nat. size).

investigation.

Visited Kathgodam and Tanakpur in Uttar Pradesh and collected plant megafossils comprising leaf, fruit and seed-impressions and fossil woods. Visited Koilabas and Seria Naka areas on Indo-Nepal border and collected leaf- and seed-impressions. Also, visited Central National Herbarium, Howrah for identification of plant fossils collected from different localities of Siwaliks.

Programme 5.7 : Palynology, palaeoecology and palaeogeography of the Tertiary sediments of Nepal Himalaya

Samir Sarkar

Palynological investigations of the Siwalik succession from the Surai Khola and Arjun Khola areas have been completed. A rich palynofloral assemblage has been recovered which consists of 67 genera and 92 species belonging to gymnospermous and angiospermous pollen, pteridophytic spores, algal zygospores and fungal spores and ascostromata. Several palynoassociations have been recognised between 12 to 2 Ma. The data has been plotted against a chronostratigraphic control based on the

An *in situ* fossil wood in thick Siwalik sandstones exposed on Punyagiri Road near Tanakpur, Uttar Pradesh.

magnetostratigraphic study. A standard palynofloral model has been prepared showing vegetational changes during the Neogene Period of western Nepal and it has also been used for comparative study in other regions of Himalaya. The qualitative and quantitative analyses have added new dimensions to the interpretation of Siwalik palynoflora in the Indian subcontinent.

Critical morphotaxonomic analysis of Hyphomycetes fungi recovered from Siwalik succession of India and Nepal was carried out.

Programme 5.8 : Palynofloral study of Siwalik sediments from Punjab and Himachal Pradesh

M.R. Rao

Literature related to Siwalik sediments of the area was consulted to find out the existing gaps. Rock samples were collected from Tertiary localities exposed in

Nurpur and adjoining areas of Kangra District and Haritalyangar and adjoining areas of Bilaspur District, Himachal Pradesh. Chemical processing of the samples is continued.

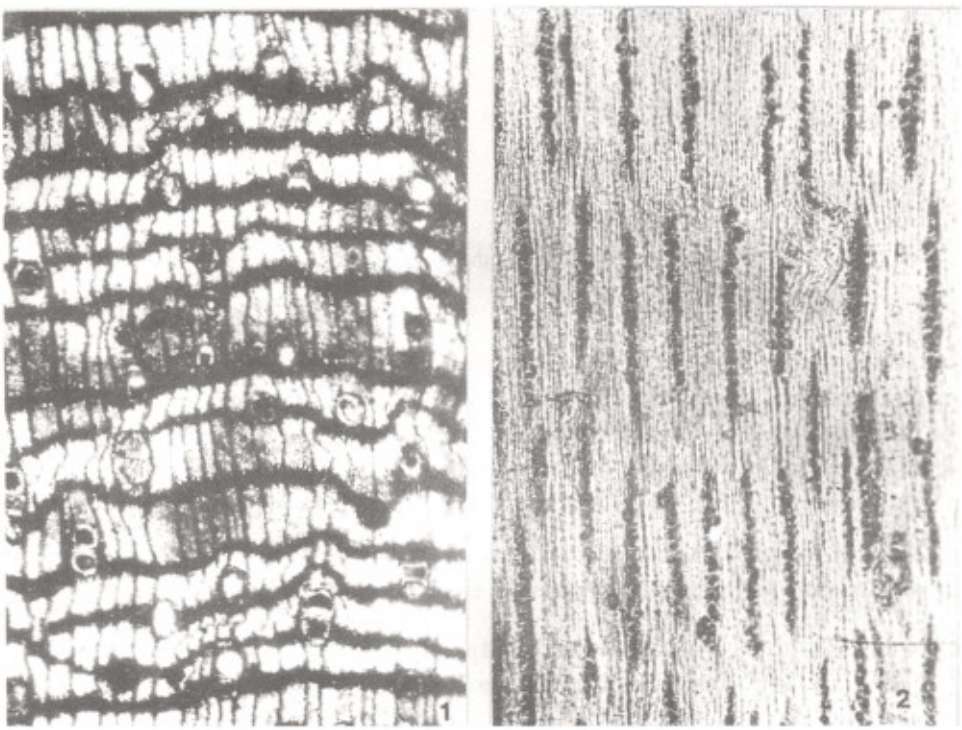
Visited Tertiary localities (Siwalik) around Haritalyangar area; Jwalamukhi-Kangra Road Section and Nurpur and adjoining areas, in Bilaspur and Kangra Districts, Himachal Pradesh, respectively and collected 104 samples for palynological studies.

Programme 5.9 : Palynological investigations of Siwalik sediments exposed in Ambala District, Haryana

S.K.M. Tripathi

Consulted pertinent literature to find out the existing gaps in knowledge on Siwalik sediments in the area of investigation.

Tertiary localities around Jammu were visited and collected 140 samples from well measured Lower and Middle Siwalik sediments for palynological studies. Sedimentological studies were also carried jointly with a geologist from Nainital University.



Fossil wood resembling *Cynometra alexandri* C.H. Wright, an African element, from the Neogene of Arunachal Pradesh; **1**. transverse section x 40; and **2**. transverse longitudinal section, x 95.

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

Programme 6.1 : Tertiary floral history of north-east India

R.C. Mehrotra

About 30 fossil woods were investigated from the Neogene of Arunachal Pradesh and Meghalaya. Out of them, 10 seem to be new and their study is under progress. About 100 fossil leaves from Tura Formation of Garo Hills, Meghalaya were cleared and photographed. Their study is also under progress.

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

Madhav Kumar

The palynological analyses of rocks from Bhuban and Bokabil formations exposed in Lumding-Haflong Road, Maibong and Bara Langpher River sections were done. The palynoflora constituted dinoflagellates, fungal fruiting bodies, pteridophytic spores, gymnosperm and angiosperm pollen grains. Poorly-preserved Permian saccate grains were also recorded. Dinoflagellates are absent in Bokabil Formation. The Miocene palynotaxa belong to Microthyriaceae, Parkeriaceae, Polypodiaceae, Pteridaceae, Arecaceae and Pinaceae. The palynofloral assemblage suggests subtropical vegetation.

Programme 6.7 : Palynostratigraphy of Barail sediments in Upper Assam

B.D. Mandaokar

Coaliferous samples (30) from Tikak Parbat Formation, Tipong Colliery, Makum Coalfield were macerated for spore and pollen grains. The recovered palynoassemblage is rather poor in quality as well as quantity. The genera *Striatriletes* and *Polypodiaceaesporites* are predominant. The recovered tropical to subtropical palynoassemblage is comparable to other well known Oligocene marker palynofossils, viz., *Crassoretitriletes, Trisyncolpites, Polyadopollenites* and *Bombacacidites*.

A report on Tertiary plants and animal megafossils from Arunachal Pradesh and a fossil wood of *Duabanga* from Tipam sandstone in Tinsukia District, Assam have been worked out.

Visited north-eastern India and collected Tertiary rock samples from deep mine sections, Tipong Colliery (Assam) as well as outcrop sections from Namchik-Namphuk Coalfield (Arunachal Pradesh) and Nazira Coalfield (Nagaland).

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

G.K. Trivedi

Fifty six samples from Umrangso section of Kopili Formation were studied. Only three samples yielded pollen and spores which were assigned to : *Striatriletes, Densiverupollenites, Polypodiaceaesporites, Monolites, Todisporites major, T. minor, Diporodicellaesporites* and few fungal bodies.

A draft manuscript entitled "Palynology of the Kopili Formation (Upper Eocene) in the type area, Khorungma, Assam, India" was finalized.

Visited North-Central Hill District, Assam for the collection of samples for palynological studies.

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

B.K. Misra

Fluorescence microscopic investigation on 25 coal samples from four coal seams of Changki Valley Coalfield, Nagaland was carried out. The coals contain high to very high proportions of fluorescing macerals. Of the total fluorescing macerals, perhydrous vitrinite constitutes up to 50 per cent. The liptinite macerals (up to >30%), in order of decreasing abundance, are liptodetrinite, resinite, cutinite, suberinite, sporinite and exsudatinite, besides minor amount of alginite (*Botryococcus*) and fluorinite. In petrographic composition, under fluorescence mode, these coals are similar to the other Late Palaeocene and Oligocene coals from Meghalaya, Assam and Arunachal Pradesh.

Programme 6.11: Palynostratigraphy and correlation of Tertiary sediments of Meghalaya

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

Recovered a rich palynofloral assemblage consisting of dinoflagellate cysts, fungal remains, pteridophytic spores and angiospermic pollen from the Tura Formation (Palaeocene-Eocene) exposed along Tura-Dalu Road Section in West Garo Hills District. Dinoflagellate cysts are represented by *Operculodinium* spp. and *Homotryblium* spp. Fungal remains are constituted by spores and fruiting bodies. Angiospermous pollen are the dominant constituents of the assemblage. The palynoflora indicates a tropical-subtropical climate sustaining wet evergreen forest in the vicinity of the area. Deposition of the studied sequence is inferred to have taken place under shallow marine conditions as the assemblage shows presence of dinocysts. The palynofloral assemblage exhibits a similarity with known Palaeocene-Eocene assemblages recorded from the Cherra and Therria Formations of Meghalaya, Mikir Formation of Assam and Matanomadh Formation of Kutch, Gujarat.

Rich palynofloral assemblage has also been recorded from the Rewak Formation exposed along Siju-Baghmara Road in South Garo Hills District. The assemblage consists of dinoflagellate cysts, fungal remains, pteridophytic spores and angiospermic

pollen. The fungal remains are represented by *Inapertisporites, Lirasporis, Parmathyrites* and *Phragmothyrites*. Rich representation of pollen belonging to Alangiaceae, Bombacaceae and Arecaceae suggests existence of thick evergreen forests in the vicinity of the area of deposition. Occurrence of mangrove element, viz., *Paleosantalaceaepites* and dinocysts suggests near shore environment of deposition. Abundance of pteridophytic spores and fungal remains indicates a warm-humid (tropical-subtropical) climate with heavy rainfall.

Palynological study of the Tura Formation exposed in Nongwal Bibra area in East Garo Hills District was finalized and submitted for publication.

R.K. Saxena & M.R. Rao

Samples from the Oligocene-Lower Miocene sediments exposed along Tura-Dalu Road Section in West Garo Hills District were investigated. Study of palynoflora recovered from the Kherapara Formation (Oligocene) of this section has been completed. The assemblage is dominated by pteridophytic spores followed by angiospermous and gymnospermous pollen. Dinoflagellate cysts and fungal remains are also present. The assemblage also contains reworked Permian and Cretaceous palynofossils, e.g., *Parasaccites, Rouseisporites, Callialasporites, Plicatipollenites* and *Striatopodocarpites*. Present day distribution of the families represented in the assemblage, dominance of pteridophytic spores and presence of fungal remains (*Phragmothyrites, Trichothyrites, Parmathyrites, Multicellaesporites*, etc.) indicate tropical-subtropical (warm and humid) climate. Representation of dinoflagellate cysts (*Achomosphaera* and *Spiniferites*) mangrove and back-mangrove elements (*Paleosantalaceaepites* and *Malvacearumpollis*) and coastal plants (*Spinizonocolpites*) suggests a near-shore environment of deposition.

Palynofloral study of the Boldamgiri Formation exposed along Adugiri-Purakhasia Road near Boldamgiri in West Garo Hills District was finalized for publication.

PROJECT 7 : RECONSTRUCTION OF QUATERNARY VEGETATIONAL PATTERNS

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

H.P. Gupta, S.K. Bera & Anjum Farooqui

Pollen analysed 5 modern surface samples collected from Konalur and Kuntan Shola, Palni Hills. The vegetational composition has enabled to understand the interplay of pollen/spores and also to interpret the face value of the pollen diagram to be constructed from the area. Pollen analysed two sediment profiles, one each from Konalur swamp (2.0 m) and Kuntan Shola (1.5 m) dating back to 4000 yrs BP and 1000 yrs BP,

Konalur swamp with Pine forest around Berijam Lake in Palni Hills, south India.

respectively.

The evaluation and interpretation of pollen diagram is continued. The study has revealed the overall dominance of non-tree taxa over trees. Higher percentage of graminoid pollen (70-80%), low to moderate proportions of Cyperaceae, *Senecio, Artemisia, Impatiens, Ranunculus* and Apiaceae, etc. alongwith monolete and trilete spores are suggestive of the abundance of grasses and herbaceous elements. The occurrence of *Rhododendron, Ilex, Osbeckia* and Sapotaceae indicate the existence of forests in the vicinity of Konalar in the past. The relative abundance of *Acacia* and *Pinus* pollen in surface samples is from the surrounding plantation. Fungal spores are also encountered in good values. Since shola arboreals are not adequately represented in the sediments, their meagre representation could be positive indicator of the existence of the forest.

H.A. Khan

Studied pollen morphology of Apocynaceae, Menispermaceae and few tree taxa of other families. Also visited Botany Department, Calicut University, Kerala to collect polleniferous material of Silent Valley.

Programme 7.2 : Depositional environment and climate during the Quaternary Period in the Himalaya : a palynological approach

Chhaya Sharma & M.S. Chauhan

Pollen analysis of 1.2 m deep profile from the alpine Kupup Lake, Sikkim has revealed that between 1700-1300 yrs BP alpine scrub vegetation flourished in the region comprising *Betula, Alnus, Rhododendron* together with herbaceous elements, viz., grasses, sedges, *Artemisia*, Ranunculaceae, etc. under cold and moist climate. Between 1300-700 yrs BP, the decline in the arboreal elements and simultaneous improvement in grasses, sedges and other herbaceous taxa indicate the deterioration of climate. Thereafter, an amelioration in climate took place as evidenced by the improved frequencies of the arboreals.

Pollen analysis of four surface samples from Sat Tal, Garhwal Himalaya has revealed the dominance of arboreals and poor representation of non-arboreals. Among the arboreals, the excessively high frequencies of *Pinus, Cedrus, Quercus, Betula* and *Carpinus* demonstrate well established mixed conifer broad-leaved forests in the region. Poaceae, Cyperaceae, Cheno/Ams, Caryophyllaceae and Asteraceae among the non-arboreals chiefly constituted the ground cover. Recent pollen spectra from Chharka Tal (Sat Tal) was also prepared.

Chhaya Sharma & Asha Gupta

Aeropalynological study of the samples collected from Chaurangikhal (2300 m) and Nachiketa Tal (2550 m) situated 4 km apart in the temperate belt in Uttarkashi, Garhwal Himalaya was completed. Studies have shown the dominance of arboreals over non-arboreals, reflecting more or less faithfully the thick forests in the region.

The pollen diagram from Deoria Tal, Garhwal Himalaya was prepared and a manuscript entitled " Early Holocene palaeofloristics and climate of Garhwal Himalaya" was finalized.

Continued the pollen analysis of a profile from Kupup Lake, Sikkim. The study reveals the dominance of non-arboreals over arboreals. Arboreals are represented by low values of *Quercus, Alnus, Betula, Carpinus, Rhododendron, Ulmus, Celtis, Corylus*, etc. Non-arboreals show the dominance of Cyperaceae, followed by Poaceae, Cheno/Ams, Asteraceae, Ranunculaceae, Brassicaceae, Polygonaceae, Caryophyllaceae, etc.

Programme 7.3 : History of mangrove vegetation in India

H.P. Gupta & Asha Khandelwal

Pollen analysis of 16 samples of Bhuvania profile collected from northern flank of Chilka Lake, Orissa exhibits poor occurrence of mangrove taxa. However, a few pollen grains of Rhizophoraceae, *Avicennia, Heritiera* and *Excoecaria* were encountered. The non-arboreals, indicative of the existence of salt marshes, such as Poaceae, Chenopodiaceae/Amaranthaceae, Cyperaceae, Urticaceae, Acanthaceae, Brassicaceae and some hinterland taxa are well represented.

Pollen diagram of Dangmal profile from Baitarni-Brahmani Delta, Orissa, India was prepared and history of mangroves since 1,500 yrs B.P. was worked out.

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

R.R. Yadav

Climatic reconstructions using tree ring width data during Science Engineering Foundation Fellowship in Korea were done. To develop tree growth/climate models for climatic reconstructions SAS system and SYSTAT were used. Single and multiple predictor variables (untransformed as well as orthogonalized) were used to develop climatic reconstructions. Spring temperature and precipitation for about 600 and 818 years have been reconstructed using ring width chronology.

R.R. Yadav & A. Bhattacharyya

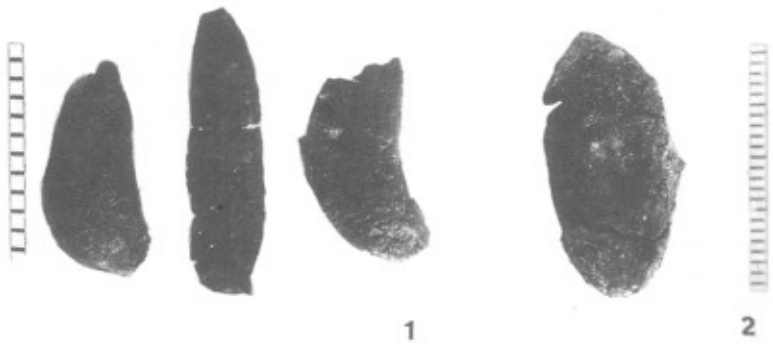
Worked on the meteorological data from the Himalayan region to prepare regional climatic data series for climate reconstruction. Growth ring features of *Araucarioxylon* sp. and *Podocarpoxylon* sp. (Coniferae) described from various Tertiary localities were studied to understand climatic implications.

Programme 7.5 : Plant remains from pre- and proto-historic sites in northern and northwestern India

K.S. Saraswat

The investigations on botanical remains from Banawali on the dried channel of ancient Saraswati River in Hissar District of Haryana were continued. More than 1,000 pieces of wood charcoals from early Pre-Harappan (Ca 2750-2500 BC) and Mature-Harappan (Ca 2500-2000 BC) levels were processed for section cutting and anatomical study. A large number of charcoal remains from Pre-Harappan deposits at the site have been found belonging to babool (*Acacia* cf. *nilotica*), Khejri (*Prosopis spicigera*), siras (*Albizia lebbeck*), mulberry (*Morus alba*), gular (*Ficus glomerata*), khajoor (*Phoenix* sp.), kendu (*Diospyros montana*) and jujube (*Ziziphus* sp.). Most of the charcoals from the succeeding phase of Mature-Harappan Culture belong to similar kinds of taxa. Further work is in progress.

Visited an excavation site at Musanagar, district Akbarpur (formerly known as Kanpur Dehat), Uttar Pradesh and collected botanical remains of ancient Iron-Age Culture.



Carbonised remains of : **1.** Garlic (*Allium sativum*) cloves from Mature-Harappan period (2,000-1,700 B.C.); and **2.** Chebulic-myrabolan (*Terminalia chebula*) from Pre-Harappan period (2,300-2,000 B.C.) at Balu, Haryana (scale in mm).

Visited an excavation site at Imlidih-Khurd, district Gorakhpur, Uttar Pradesh and collected botanical remains from the deposits of early Chalcolithic Culture. Also an excavation site at Waina, district Ballia, Uttar Pradesh was visited and collected ancient plant remains from Iron-Age Culture.

K.S. Saraswat & A.K.S. Pokharia

An extensive collection of carbonized remains of seeds and fruits made through excavations of Pre-Harappan and Mature-Harappan deposits on a mound in Balu Village, Kaithal District, Haryana, in order to reconstruct the model of the utilization of botanical resources for subsistence and other purposes. Barley (*Hordeum vulgare*), dwarf-wheat (*Triticum sphaerococcum*), bread-wheat (*Triticum aestivum*), rice (*Oryza sativa*), horse-gram (*Dolichos biflorus*) and green-gram (*Vigna radiata*) have been found to be the common field-crops grown by Pre-Harappans during 2300-2000 BC. Seeds of *Vicia sativa*, a weed in the winter leguminous-crop fields, are also encountered. Fruit remains include melon (*Cucumis* cf. *melo*), water-melon (*Citrullus lanatus*), wild-jujube (*Ziziphus nummularia*) and chebulic-myrobalan (*Terminalia chebula*).

During the subsequent phase of Mature-Harappan Culture (2000-1700 BC), in addition to the Pre-Harappan field-crop remains, naked-barley (*Hordeum vulgare* var. *nudum*), field-pea (*Pisum arvense*), grass-pea (*Lathyrus sativus*), lentil (*Lens culinaris*), chick-pea/gram (*Cicer arietinum*), til (*Sesamum indicum*) and Egyptian clover (*Trifolium alexandrinum*) have also been recovered which suggest a rich and varied crop economy. Seeds of kundru (*Coccinia cordifolia*) suggest the use of fruits of this common climbing cucurbit in wild state, for green vegetable. There is definite evidence of the consumption of fruits, furnished by the seeds of wild-jujube (*Ziziphus nummularia*), date (*Phoenix* sp.) and grape (*Vitis vinifera*). The most outweighing discovery from Harappan Balu includes a few pieces of cloves of garlic (*Allium sativum*). Garlic's precise origin, most likely in Central Asia, predates the written history. It is discovered for the first time in

South-East Asia, in the Harappan cultural context of Punjab.

Commenced four visits to an archaeological site at Raja Nal-Ka-Tila, situated in plateau region of Kaimur extensions in Sonebhadra District, Uttar Pradesh and recovered an impressive array of archaeobotanical material, through excavations of ancient chalcolithic (?) and Iron-Age deposits.

Chanchala Srivastava

Anatomical investigations of the wood charcoals from Kudan, district Taulihawa, Nepal — a site of Buddhist Period (N.B.P.W.) in the north-eastern part of Ancient India dating between ca. 600 to 200 BC were continued. For this, processing, block-preparation and section-cutting of the remaining wood charcoals were done. Taxa recovered are the same as reported earlier, belonging to tropical deciduous Sal forest available locally in the Tarai and Bhabar region; chief components being *Shorea robusta, Terminalia tomentosa* and *Adina cordifolia*.

Pollen analysis of seven soil samples from four trenches at Shikarpur, Rann of Kutch — a Harappan site (ca 2500-2200 BC) in Gujarat, was carried out. The study revealed mainly the pollen of non-arboreals such as Poaceae, Cyperaceae, Chenopodiaceae/Amaranthaceae, *Polygonum* sp., etc. Arboreals are few represented by the stray pollen of *Ficus* and *Acacia* species. The overall pollen assemblage shows the open nature of vegetation with arid climatic condition in the region. However, the frequent record of pollen of Chenopodiaceae/Amaranthaceae indicates the prevalence of saline condition around the site during the course of deposition of the sediments. The study of pollen analysis supports the botanical investigations done earlier on macro-remains, viz., seeds, fruits and wood charcoals from Shikarpur in Harappan times.

Programme 7.6 : Aerospora of Lucknow : its biochemical and clinical implications

Asha Khandelwal

Daily monitoring of aerospora by employing Burkard air sampler, in the premises of BSIP, Lucknow, revealed 18 types of pollen grains and 23 types of fungal spores. The pollen encountered are of Poaceae, Chenopodiaceae/Amaranthaceae, *Eucalyptus* sp., *Morus alba, Holoptelea integrifolia, Ailanthus excelsa, Putranjiva roxburghii, Xanthium strumarium, Coriandrum sativum,* etc. The fungal spores of *Alternaria, Helminthosporium, Curvularia, Cladosporium, Cercospora, Epicoccum, Nigrospora, Torula, Tetraploa, Beltrania*, etc. were recorded in varying frequencies.

PROJECT 8 : GEOCHRONOMETRY OF INDIAN ROCKS

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

G. Rajagopalan

A total of 90 samples were processed, of which 64 samples were dated. Some of the results are as follows :

Sediment samples from Sat-Tal, Dharali and one sediment sample from Chharka Tal, Uttar Kashi (U.P.) have been dated to understand the depositional environment and climate during the Quaternary Period in Himalaya. The base of Dharali sediments was dated as 1240 ± 90 yrs BP. The C-14 date of Chharka Tal sediment at 3.65-3.75 m depth comes out to be 2090 ± 140 yrs BP.

Two peat samples from Konalur River Basin, Kodaikanal have been dated to work out the history of vegetation and climate in tropical montane forest in south India. The C-14 date at base (140-150 cm) is 3360 ± 110 yrs BP. Peat samples from Wadda Lake, Pithoragarh have also been dated and the rate of sedimentation works out to 34 cm/1000 yrs. Two peat samples from Paradise Lake, Selapass, Kameng, Arunachal Pradesh have been dated to understand climatic change in the eastern Himalayan region. The C-14 date at 1.0 m is 1650 ± 140 yrs BP.

Three charcoal samples from Raja-Nal-Ka-Tila near Ram Garh (U.P.) have been dated to reconstruct regional models of agriculture and economic exploitation of plants in the prehistoric past for the Vindhyan plateau region. At the depth of 3.15-3.2 m, C-14 date is 2830 ± 100 yrs BP.

Installation of Ultra Low Background Liquid Scintillation Counter is being carried out. Fabrication of high vacuum system for synthesizing low volume Benzene samples has been done and some trial syntheses of low volume Benzene samples have been started. Microwave samples preparation system using microwave digestion method for chemical analysis has been installed. Atomic absorption spectrometer has also been installed and test measurements have commenced.

Thirty-nine samples have been dated as a part of consultancy services offered by the Institute.

G. Rajagopalan & B. Sekar

Interpreted the past climatic changes around Tsokar Lake, Ladakh; Didwana Lake, Rajasthan and Paradip River delta core on the basis of elemental analysis, authigenic phosphorus concentrations. The results were presented in the IGBP Symposium held at Bhubaneshwar.

Visited Kalpi and adjoining areas and collected shell and kankar samples for ^{14}C dating of Quaternary history of Gangetic alluvium.

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

C.M. Nautiyal

A set of new Saes getters was fixed. The gettering action of the Ti-Zr as well as Saes getters was monitored with temperature variation. Six thin sections of trap specimens and four of the fossil wood were made. Modification in the MS control unit

(FET-replacement, etc.) was carried out. Residual spectra were recorded with Quadropole and the 180° mass spectrometer.

Visited Mandla area in Madhya Pradesh and collected a number of trap and fossil wood specimens including a fossil stem with roots as well as one with attached branch .

PROJECT 9 : ANNOTATED ATLASES, CATALOGUES, MONOGRAPHS AND BOOKS AND RESEARCH PROGRAMMES *AD FINUM*

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

Archana Tripathi, Vijaya & Ram-Awatar

The FADs of certain significant palynotaxa have been evaluated in the delimitation of stratigraphic units through Permian sequence on peninsular India. FADs of *Jayantisporites conatus* and *Parasaccites densicorpus* delimit the base level of Talchir Formation. The coal deposits of Permian Period are classified as Karharbari and Barakar Formations. The initiation of these deposits can be easily identified by the LAD of *Parasaccites densicorpus* at the beginning of Karharbari and FAD of *Densipollenites magnicorpus* at the top of Kulti Formation. The FADs of the Index species *Arcuatipollenites pellucidus, Kamthisaccites kamthiensis, Lundbladispora brevicula* and *Playfordiaspora cancellosa* gradually herald the transition from Late Permian carbonaceous sediments into khaki-green facies of Early Triassic (Panchet Formation) demarcating the Raniganj-Panchet formational boundary *vis-a-vis* P/Tr.

Programme 9.2 : A catalogue of fossil dinoflagellates from India

Khowaja-Ateequzzaman & Rahul Garg

Stratigraphic distribution of dinoflagellate cyst taxa from Cretaceous-Tertiary sedimentary sequences of India is being compiled for preparation of computer data base.

Programme 9.6 : Patterns of leaf architecture and cuticle in some tropical dicotyledonous families

D.C. Saini

Leaves of *Ficus religiosa, F. benghalensis, F. retusa, F. glomerata, F. infectoria, F. hispida, F. benjamina, F. comosa, F. mysorensis, F. tsiela, F. trigona* and *F. elastica* were collected and identified. Herbarium sheets of these species were prepared. Duplicate specimens were treated with chemicals and prepared the slides of cuticle and laminated mount of leaf venation patterns. An atlas of leaf print was also prepared.

The morphology of leaf and venation pattern were described alongwith their cuticular features. These features, however, furnish useful taxonomic characters in the family Moraceae.

Programme 9.9 : Cenozoic plant remains of Palamu, Bihar

G.P. Srivastava

Morphotaxonomy and photodocumentation of new fossil taxa were carried out and three papers were finalized and submitted for publication.

Programme 9.10: Siwalik flora of West Bengal

J.S. Antal

Fossil leaf resembling *Zizyphus apetala* H.f. from Sevoke Road Section, Darjeeling District, West Bengal (Nat. size).

Plant megafossils comprising leaf-impressions, fruits and fossil woods from Ghish River, Lish River, Sukha Nala and Sevoke Road cutting sections in the Himalayan foot-hills of Darjeeling District, West Bengal were studied. The leaf-impressions were identified belonging to modern angiospermous taxa—*Xanthophyllum flavescens, Pterospermum semisaggitatum, Swintonia floribunda, Millettia albiflora, Glochidion hirsutum, Dipterocarpus tuberculatus, Shorea buchananii, Zizyphus apetala* and *Polyalthium longifolium*. The fossil woods which form the first record from West Bengal Siwaliks, belong to modern taxa *Bauhinia malabarica* and *Diospyros kurzii*. The presence of these taxa indicates the existence of tropical climate with plenty of rainfall during Siwalik sedimentation as well as a fair exchange of floral elements between Malaya Peninsula and India.

Visited the Himalayan foot-hills of Darjeeling District, West Bengal and a good number of well-preserved leaf-impressions, fruits and some carbonised woods were collected. Besides, Central National Herbarium, Howrah was visited for identification of fossil leaves collected from different localities of Bengal Siwaliks.

Programme 9.12 : SEM studies on the pollen morphology of arborescent monocots of India with special reference to palms

K. Ambwani

In order to assess the affinities of fossil monocotyledonous taxa, SEM observations of the pollen of monocot taxa were carried out on: *Areca catechu, A. triandra, Roystonea oleraceae, Iriatella setigera, Oncosperma tegillarium, Arenga engleri, Caryota mitis, C. urens* and *Cocos nucifera*. SEM photomicrographs were also taken for their detailed interpretations. Studies on fossil *Sclerosperma*-like pollen and the extant *Sclerosperma manii* were completed.

Programme 9.13: Palynological studies on the Late Cretaceous sediments of central India

R.S. Singh

The spore-pollen recovered from areas around Jabalpur and Nagpur are scanty and mostly represented by pteridophytic spores. The assemblage from Lameta Formation from Nagpur includes *Cicatricosisporites, Cyathidites, Todisporites, Appendicisporites, Ariadnaesporites* and few pollen belonging to Palmae, whereas the Intertrappean sediments apart from above have *Tricolpites, Nypa* and some porate-pollen. Maestrichtian marker genus *Ariadnaesporites* is found in both Lameta Formation of Nagpur and Intertrappean beds of Jabalpur area.

PROJECT 10 : APPLICATION OF GEOBOTANICAL ANALYSIS IN :

I. MINERAL PROSPECTING

II. RECONSTRUCTING THE HISTORY OF MODERN VEGETATION THROUGH CENOZOIC ERA

J.S. Guleria, D.C. Saini, B. Sekar, S.K. Bera & Madhav Kumar

A preliminary investigation of indicator plants of copper and manganese occurring in the ore-rich areas of Balaghat District, Madhya Pradesh has been completed.

Work other than Programmes

Shaila Chandra & K.J. Singh

Study on the floristic evolution of Talchir Formation and its equivalents in other parts of Gondwana was finalized and submitted for publication.

Suresh C. Srivastava & A.P. Bhattacharyya

Samples from two bore-holes UMK-3 and UMK-2 from Wardha Valley Coalfield were processed. Report of UMK-3 was sent to GSI, Calcutta. The assemblage was dominated by striatites — *Faunipollenites, Densipollenites*. The age of these sediments has been suggested to be Raniganj. Maceration and study of another bore-hole samples (BR 21, 22 and 23) are in progress.

Vijaya (& S. Kumar)

About 50 samples of Spiti shale (Jurassic) from Malla Johar area were studied. Only in 2-3 samples, scanty occurrence of *Callialasporites* and few taeniate spores is noted. The specimens are highly metamorphosed, blackish with peeled exine, due to which their identification is difficult.

Rahul Garg, Jai Krishna(B.H.U.), Khowaja-Ateequzzaman & K.P. Jain

A manuscript entitled "Biostratigraphic potential of dinoflagellate cysts recovered from the Late Jurassic ammonoids of Tethys Himalaya" has been finalized.

J.S. Guleria & R.C. Mehrotra

A manuscript entitled "On some plant remains from the Deccan Intertrappean localities of Seoni and Mandla districts of Madhya Pradesh, India" has been prepared.

R.K. Saxena (& Sanjay Khare)

A manuscript entitled "*Gemmatriporopollis*, a new pollen genus from Neyveli Lignite Mines and Jayamkondacholapuram Well-12 in Tamil Nadu, India" was prepared and finalized.

J.P. Mandal

Standardised the maceration of different kinds of samples by Microwave Digestive System.

B.K. Misra & B.D. Singh

Collected data on fluorescence microscopy of the Indian coals and lignites. Compiled and updated the information on characteristics of various fluorescing macerals with an emphasis on caution taken into consideration during observation under

fluorescence mode and some useful suggestions.

Alpana Singh & B.K. Misra

A paper describing the typical fluorescing bodies, probably a new maceral of liptinite group of unknown affinity, from the lignites of Neyveli field (Tamil Nadu), has been finalized. The multicellular bodies are always found in association with leaf cuticles (cutinite).

M.R. Rao (& K.K. Nair)

A manuscript entitled "Palynological investigation of Miocene sediments exposed in Kundara-Kannanelur area, Quilon District, Kerala" was prepared and finalized.

Samir Sarkar & A.P. Bhattacharyya

On the basis of palynological study, a Late Miocene vegetational scenario of Lower Siwalik sediments exposed in the Kathgodam area of Uttar Pradesh has been envisioned. The inferences are copiously supplemented with megafossil data already published. The floral elements mainly pertain to broad leaf forest communities typical of subtropical climate. The presence of zygospores of Zygnemataceae proves beyond doubt that the environment of deposition was stagnant, shallow and mesotrophic fresh water.

S.K.M. Tripathi

Studies on biopolymer structure and its symmetry operations on partially degraded walls of *Botryococcus braunii* colonies from Hungarian Tertiary Oil Shales were carried out at the Cell Biological and Evolutionary Micropaleontological Laboratory, J.A. University, Szeged, Hungary. A manuscript incorporating the results was finalized.

Jyotsana Rai

A paper entitled "Scanning electron microscopic studies of the late Middle Eocene (Bartonian) calcareous nannofossils from Kutch Basin, western India" was finalized and submitted for publication.

A manuscript entitled "Calcareous nannofossils from Eocene of Kutch Basin, western India" has been prepared.

Neeru Prakash

Two papers on "The genus *Phlebopteris* in the Indian Gondwana" and "Some new records of plant fossils from Chui Hill, Jabalpur Formation: A comment on its age" were prepared and finalized.

Usha Bajpai [& T. Singh]

A silicified fossil wood collected from the Garu Formation (Early Permian)

Transverse section of a fossil wood, *Megaporoxylon maheshwarii* sp. nov., from Garu Formation, Arunachal Pradesh showing spiral to scalariform thickenings in primary xylem.

exposed in Arunachal Pradesh has been described. The wood is characterised by the presence of distinct growth zones, endarch primary xylem and a single, large, circular or oval, irregularly oriented pits in the cross-field. These features are diagnostic of the genus *Megaporoxylon*. As the wood does not match with any of the known species of the genus, it is named as *Megaporoxylon maheshwarii* sp. nov.

Sponsored Projects

S.P. I : Holocene palynostratigraphy and palynoenviron-ment of Chilka Lake : An inter-disciplinary approach (DST NO. ES/44/019/90)

H.P. Gupta & Deepak Kohli

The project accomplished and the project report has been submitted to DST, New Delhi.

S.P. II : Palaeogene floral diversity-biostratigraphy and palaeoenvironmental implications (DST NO. ES/44/037/93)

K. Ambwani (Co-investigator)

A detailed report was compiled and submitted to the Department of Science and Technology, New Delhi.

S.P. III : Reconstruction of past climatic changes in eastern Himalayan region using tree-ring data (DST No. ES/44/018/90)

A. Bhattacharyya, R.R. Yadav & Vandana Chaudhary

Tree-ring samples of *Abies densa, Tsuga dumosa, Larix griffithii, Pinus wallichiana, Pinus roxburghii* and *Juniperus* sp. collected from Arunachal Pradesh have been processed. Tree-ring sequences of these samples have been dated to the accuracy of calendar year and measured. From the ring-width measurements, chronology of *Larix griffithii* has been found to be of excellent potential for climatic studies. Climatic reconstruction using this chronology is in progress.

A. Bhattacharyya & Vandana Chaudhary

Visited Tawang, Lungroba, Bomdila, Dirang and other sites in Arunachal Pradesh and collected tree-ring samples of *Abies densa, Tsuga dumosa, Larix griffithii, Pinus wallichiana, Pinus roxburghii* and *Juniperus* sp.

S.P. IV : Palaeobiological investigations across Archaeozoic-Early Proterozoic transition (DST NO. ESS/CA/A4-09/93)

P.K. Maithy, R. Babu, S. Kumar (L.U.) & S. Sharma

Further field observations were done on the Iron Ore Group exposed in Barbil - Noamundi area about ± 10 km east of Barbil, Orissa. About 107 m thick dolomite

sequence is well exposed at Kashia Mine. The dolomite sequence is seen as a lenticular body within Iron Ore Group. This lithostratigraphic unit is named as the Kashia Dolomite with a rank of Formation after the name of the mine where it is best exposed. It is dominantly represented by dolomite with subordinate shale. Its lower contact is sharp with overlying areno-argillaceous unit. The areno-argillaceous unit is conformably overlain by banded hematite-jasper horizon containing iron and manganese ores.

The Kashia Dolomite is subdivided into six lithostratigraphic members referred as A, B, C, D, E and F. The lowermost Member A is 30 m thick lithounit made up of grey to greyish-black silicified dolomites. Member B is the most characteristic horizon made up of greyish-black chert and red shales and is 2-4 m thick. Both upper and lower contacts of this unit are sharp. Member C is represented by ca 5 m thick dolomite with papery thin whitish-grey shales. A few horizons show development of cyanobacterial mat. Member D is 6 m thick grey to greyish white shale horizon with subordinate violet coloured dolomite. It shows gradational contact with the overlying members. Member E is 12 m thick, light grey to greyish-black dolomite, which shows development of *Conophyton*. The youngest horizon of Kashia Dolomite is the Member F which is made up of a grey to greyish-black dolomite with minor shale partings. Cyanobacterial mat horizons are quite common. Member F also shows presence of sandstone dyke.

Sedimentary structures are well preserved. On the basis of sedimentary structures the environment of deposition of Kashia Dolomite can be suggested as inter-tidal to subtidal region of a lagoon.

To study biological remains thin sections of chert were prepared. Rich organic-walled microfossils composed of spheroidal cells are preserved as algal mat. Many of the specimens in mat show distinct vegetative reproduction by means of binary fission. Two distinct types of filamentous forms are identified. Stromatolites were studied in thin sections by obtaining three dimensional diagram. The stromatolites are small in size.

S.P. V : Aeroallergens and human health : An aero-biological study (Ministry of Environment & Forest No. 42/14/94-RE dt. 30.03.94)

Asha Khandelwal, Rashmi Tewary, Deepak Kohli, Shantanu Chatterjee, Alka Srivastava & Lily Misra

Three samplers — Burkard, Andersen and Rotorod were employed for aeropalynological surveys at different places in Lucknow as follows :

1. Rotorod samples:

(A) *Continuous sampling* (October 1996 - March 1997)

Rotorod samples from Kursi Road exhibited 18 types of pollen grains and 24 types of fungal spores.

(B) *Spot sampling* (October 1996 - March 1997)

2. **Burkard samples** : Vegetable market, Kaiserbagh (11 types of pollen grains and 22 types of fungal spores)
   - Chikan work place, Chowk (7 types of pollen grains and 17 types of fungal spores)
   - Military Dairy farm, Dilkusha (8 types of pollen grains and 23 types of fungal spores)
   - Garbage disposal unit, Gaughat (11 types of pollen grains and 23 types of fungal spores)
   - Vivekanand Polyclinic (Outdoor, Indoor) (12 types of pollen grains and 21 types of fungal spores)
3. **Andersen samples** : Chikan work place, Chowk (20 types of fungal colonies)

   The bulk of 42 types of pollen grains and 18 types of fungal spores were sent to CBT, New Delhi.

S.P. VI : Palaeobiology and biostratigraphy of the Proterozoic sediments of the Indravati Group of Bastar District, Madhya Pradesh, India (SP [SR/SY/A- 16/93])

Mukund Sharma

The project accomplished and the report has been finalized.

Collaborative Projects/Work

PROJECT I : PRECAMBRIAN-CAMBRIAN BOUNDARY EVENTS (IGCP PROJECT - 303)

P. K. Maithy & R. Babu

Noteworthy organic-walled microfossil assemblage from the Shale Member of Upper Tal Formation, Mussoorie Syncline, Lesser Himalaya, Uttar Pradesh has been reported. The Shale Member of the Upper Tal Formation is well known for its palaeontological remains and trilobite, viz., *Redlichia noetilingi* and brachiopods—*Magnicanalis, Walcottina, Lingulella, Obolus* and *Obolella*. On the basis of the reported assemblage of animal remains the age of the beds has been derived to be Botomian stage of the Early Cambrian. The beds containing those animal fossils are exposed at:

(a) about 1.5 km from Dhaulagiri, towards Maldeota along Maldeota - Surkhet - Gopi Chand Ka Mahal Section, Mussoorie Syncline;

(b) at 8 km stone before Mussoorie near Jabarkhet Toll Barrier along Mussoorie - Dhanaulti section.

The rock samples comprise greyish - black shale interbedded with quartzite. The black shales in petrographic thin section show preservation of rich and diversified organic - walled microfossils previously unreported from this bed. The recorded organic walled microfossils belong to acritarch, viz., Sphaeromorphitae (Monosphaerite - *Favososphaeridium, Stictosphaeridium* and *Nucellosphaeridium*); Polyspherite (*Symplassosphaeridium*), Prismatomorphite (*Octaedryxium*), Polygonomorphite (*Anguloplanina*) and Versimorphite (*Pulvinomorpha*). The macerated residue comprises *Obruchevella, Sphaerocongregus* and *Micrhystridium*. The assemblage shows continuation of PC/C marker forms.

PROJECT III : PALYNOLOGICAL STUDIES OF FLYSCHOID SEDIMENTS FROM ANDAMAN-NICOBAR BASIN, INDIA

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

Ten flyschoid shale samples of Baratang Island were analysed by normal maceration and by microwave digestive system.

PROJECT IV : PALYNOSTRATIGRAPHY AND PALYNOFACIES OF TERTIARY SEDIMENTS OF NORTH-EAST INDIA

Madhav Kumar [& S.K. Dutta (Dibrugarh)]

Samples (45) were macerated from Disang and Disang-Barail contact rocks exposed around Kohima, Nagaland for DOM studies. Only 15 samples yielded structured terrestrial, biodegraded terrestrial/aqueous and amorphous organic matters.

Shaila Chandra [& G.M. Bhat (Jammu)]

Study of plant megafossil specimens from Margan Top locality in Anantnag District, Kashmir was continued. The plant fossil study indicates Early Carboniferous age instead of ? Ordovician as the flora contains typical plant fossils.

Shaila Chandra [& Sun Keqin (Beijing, China)]

Evolution and comparison of the Gondwana and Cathaysia floras were carried out and finalized.

Distribution, evolution and extinction of global Carboniferous flora was studied and a paper finalized.

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

Thirty samples from Wadda Lake (Sections I-C, I-E and PN) covering a time span of 28,000 yrs B.P. have been macerated for pollen analysis. Study of 8 samples has revealed the dominance of non-arboreals over arboreals. Arboreals are represented by low values of *Quercus, Alnus, Juglans, Larix, Ulmus, Pinus*, etc. Non-arboreals are dominated by Poaceae, Cyperaceae, Cheno/Ams, Ranunculaceae, Urticaceae and low values of Asteraceae, Rosaceae, etc. The study of remaining samples is in progress.

A. Bhattacharyya (& J.T. Gergan, Dehradun)

Eighty tree cores from 40 trees of *Abies pindrow* growing near timber line around Dokriani-Bamak glacier have been dated. The age of most of these trees extends back to 1618 AD. However, the age of two trees dates back to 1493 AD. The chronology preparation and climatic reconstruction are in progress to correlate with glacier fluctuations.

Six samples from 9.0 m deep paleolacustrine deposit near the snout of Dokriani-Bamak glacier have been macerated for pollen analyses. Detailed pollen analyses are in progress.

A. Bhattacharyya (& B.S. Kotlia, Nainital)

Eight samples from exposed lacustrine deposit from Lamaruryu palaeolake, Ladakh have been macerated for pollen analyses. Samples have been found very poor in pollen contents. Detailed pollen analyses are in progress.

Organisational Structure
Governing Body

Up to 28.09.1996

Chairman
Professor C.V. Subramanian
"Anjaneya", Plot 885
62 Ramaswami Salai, K.K. Nagar
Madras 600 078

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

Professor V.S. Ramamurthy
Secretary or His Nominee
Department of Science & Technology
Technology Bhavan, New Mehrauli Road
New Delhi 110 016

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

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

Sri D.B. Dimri
Director-General
Geological Survey of India
27, Jawaharlal Nehru Road
Calcutta 700 016

From 29.09.1996

Chairman
Professor C.V. Subramanian
17, South Mada Street
Nungambakkam
Chennai 600 034

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

Professor V.S. Ramamurthy
Secretary or His Nominee
Department of Science & Technology
Technology Bhavan, New Mehrauli Road
New Delhi 110 016

Sri Rahul Sarin
Joint Secretary & Financial Adviser
Department of Science & Technology
Technology Bhavan, New Mehrauli Road
New Delhi 110 016

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

Dr S.K. Acharyya
Director-General
Geological Survey of India
27, Jawaharlal Nehru Road
Calcutta 700 016

Dr S.C.D. Sah
9, Vikaspuram Enclave
New Forest
Dehradun 248 001

Dr V.C. Thakur
Director
Wadia Institute of Himalayan Geology
33, General Mahadeo Singh Road
Dehradun 248 001

Professor S.K. Singh
Department of Geology
Lucknow University
Lucknow 226 007

Member-Secretary

Director
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Assistant Secretary (Non-member)

Registrar
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Dr S.C.D. Sah
9, Vikaspuram Enclave
New Forest
Dehradun 248 001

Dr V.C. Thakur
Director
Wadia Institute of Himalayan Geology
33, General Mahadeo Singh Road
Dehradun 248 001

Professor S.P. Singh
Vice Chancellor
Lucknow University
Lucknow 226 007

Member-Secretary

Director
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Assistant Secretary (Non-member)

Registrar
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Research Advisory Council

(Up to 25.02.1997)

Chairman

Professor Ashok Sahni
Centre of Advanced Study in Geology
Panjab University
Chandigarh 160 014

Member Convener

Director
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Members

Dr S.C.D. Sah
9, Vikaspuram Enclave
New Forest
Dehradun 248 006

Dr K.S. Manilal
Department of Botany
University of Calicut
Calicut 673 635

Professor C.K. Varshney
School of Environmental Sciences
Jawaharlal Nehru University
New Delhi 110 067

Professor C.G.K. Ramanujam
Palaeobotany-Palynology Laboratory
Department of Botany
P.G. College of Science
Osmania University, Saifabad
Hyderabad 500 004

Professor B.L.K. Somayajulu
Physical Research Laboratory
Navrangpura
Ahmedabad 380 009

Dr N.D. Mitra
49D, Downshend Road
Bhawanipur
Calcutta 700 025

Professor V.N. Raja Rao
Centre of Advanced Study in Botany
University of Madras
Chennai 600 025

Professor D.D. Nautiyal
Department of Botany
Allahabad University
Allahabad 211 002

Dr Jagdish Pandey
Group General Manager (Exploration)
Oil & Natural Gas Commission

Exploration Business Group, Priyadarshini
6th Floor, Eastern Express Highway, Sion
Mumbai 400 022

Seniormost Scientist
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Special Invitee

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

Secretary (Non-member)

Registrar
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Finance and Building Committee

(Up to 25.02.1997)

Chairman

Professor C.V. Subramanian
17, South Mada Street
Nungambakkam
Chennai 600 034

Members

Sri Rahul Sarin
Joint Secretary & Financial Adviser
Department of Science & Technology
Technology Bhavan, New Mehrauli Road
New Delhi 110 016

Sri S.P. Elhence
Chief Engineer (Retd.) P.W.D., U.P.
B-87, Indira Nagar
Lucknow 226 016

Nominee of Secretary
Department of Science & Technology
Technology Bhavan, New Mehrauli Road

New Delhi 110 016

Professor S.K. Singh
Department of Geology
Lucknow University
Lucknow 226 007

Chief Engineer U.P.P.W.D.
or his nominee
Mahatma Gandhi Marg
Lucknow 226 001

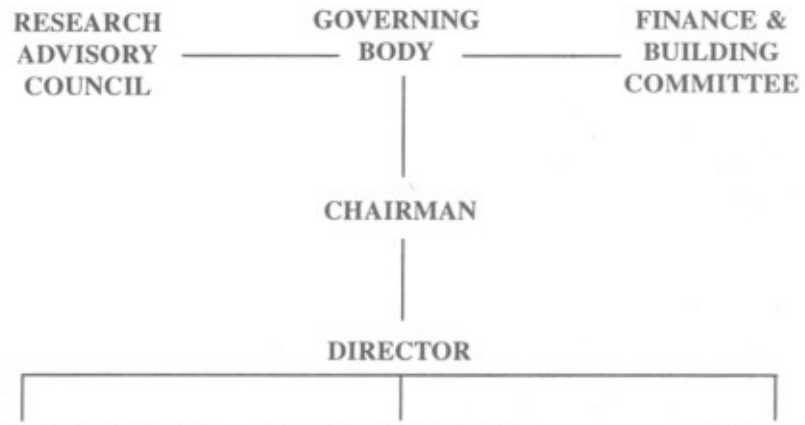
Secretary

Director
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Assistant Secretary (Non-member)

Registrar
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

INSTITUTE'S ORGANISATIONAL SET-UP



RESEARCH PROJECTS IN THE AREAS OF:

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

UNITS ANCILLARY TO RESEARCH

1. Publication
2. Library
3. Museum
4. Herbarium
5. Maceration Laboratory
6. Workshop
7. SEM
8. EDP
9. Photography

REGISTRAR

1. Finance and Accounts
2. Establishment
3. Stores & Purchase
4. Works, Building & Maintenance
5. Scientific Activities (Administrative)
6. Transport & Guest House

National Organizing Committee for Golden Jubilee Celebrations

Convener

Director
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Members

Dr (Mrs) P. Farooqui
Joint Advisor (Human Resources)
Department of Science & Technology
Technology Bhavan, New Mehrauli Road
New Delhi 110 016

Professor R.C. Misra
3, Ramakrishna Marg
Faizabad Road
Lucknow 226 006

Dr Kuldeep Chandra
Regional Director
KDM Institute of Petroleum Exploration
Management Services : Exploration
Oil & Natural Gas Commission
Dehradun 248 195

Professor S.K. Singh
Department of Geology
Lucknow University
Lucknow 226 007

Professor C.P. Sharma
Botany Department
Lucknow University
Lucknow 226 007

Dr Sushil Kumar
Director
Central Institute of Medicinal & Aromatic Plants
Lucknow 226 015

Dr S.K. Acharyya
Director General
Geological Survey of India
Calcutta 700 016

Dr P.K. Hajra
Director, Botanical Survey of India
Calcutta 700 001

Dr P.V. Sane
Director
National Botanical Research Institute
Lucknow 226 001

Dr V.C. Thakur
Director
Wadia Institute of Himalayan Geology
Dehradun 248 001

Dr R.N. Lakhanpal
B-21, Sector A, Mahanagar
Lucknow 226 006

Secretary

Registrar
Birbal Sahni Institute of Palaeobotany
Lucknow 226 007

Review Committee

In accordance with Article 4 of the Memorandum of Association of the Birbal Sahni Institute of Palaeobotany, the Department of Science and Technology constituted a Review Committee in September 1994 under the Chairmanship of Professor W.G. Chaloner, FRS to review the work and progress of the Institute.

The terms of reference of the Review Committee were as follows :

1. To review and report on the quality of research by the scientists of the Institute with emphasis on its appropriateness to Indian needs, its impact, scope and timeliness.
2. To suggest the new directions in which the science of palaeobotany and the scientists of the Institute should address themselves in the future for the proper development ofpalaeobotany in the broadest sense.
3. To suggest and recommend ways and means of evolving suitable conditions necessary for achieving its objective.
4. To examine the organization and the management of the BSIP's scientific work with emphasis on interdepartmental and cross-disciplinary collaboration, and collaboration with other organisations, both nationally and internationally.
5. To advise generally on any matter that in the opinion of the Committee is of importance for the proper development of the science of palaeobotany.

The Review Committee submitted its report to the Central Government in January 1995. The Governing Body in March 1996 considered the recommendations of the Review Committee on Recruitment, Training and Promotion; Communication (Internal and External); Structure; Publications; Equipment; and Future Directions of the Institute. Most of the recommendations of the Review Committee as accepted by the Governing Body have been implemented and the remaining few are in the process of implementation.

International Geological Correlation Programmes

IGCP Project No. 303 : **"Precambrian/Cambrian Boundary events"**

P.K. Maithy & R. Babu

Member, National Working Group

IGCP Project No. 320 : **"Neoproterozoic events and resources"**

M. Shukla

Corresponding Member, International Working Group

IGCP Project No. 329 : **Palaeogeographic and palaeoecologic evolution of Paratethyan basins during Neogene and their correlation to global scales"**

R.K. Saxena

Member, National Working Group

IGCP Project No. 374 : **"Palaeoclimatology and palaeoceanography from laminated sediments"**

A. Bhattacharyya

Member, National Working Group

IGCP Project No. 380 : **"Biosedimentology and correlation of microbial build-ups"**

P.K. Maithy

Member, National Working Group

Recognition

P.K. Maithy	— Co-Chairman, *13th Convention of Indian Association of Sedimentologists,* Varanasi.
	— Convenor, Birbal Sahni Institute of Palaeobotany Golden Jubilee Conference - "*Physical and Biological changes across the major Geological Boundaries*", Lucknow.
	— Expert for the Indian National Science Academy, Proceedings Part B (an interdisciplinary journal in Life Sciences).
Shaila Chandra	— Representative of The Palaeobotanical Society to International Organisation of Palaeobotany (IOP).
Shaila Chandra Bhagwan Singh	— Awarded "Second Prize" by BSIP for doing official work in Hindi.
Chhaya Sharma	— Elected Fellow of The Palaeobotanical Society, Lucknow.
	— Elected Vice President, International Council for Biodeterioration of Cultural Property.
Chhaya Sharma & M.S. Chauhan	— Chairperson and Organiser of Symposium "*Quaternary palynostratigraphy of the Himalayas*" in 9th International Palynological Congress held at Houston, USA.
Jayasri Banerji	— Elected Fellow of The Palaeobotanical Society, Lucknow.
A.K. Srivastava	— Elected Fellow of The Palaeobotanical Society, Lucknow.
Shyam C. Srivastava	— Chaired a scientific session of IOP Conference, Santa Barbara, California, USA, July 1996.
J.S. Antal	— Elected Fellow of The Palaeobotanical Society, Lucknow.

G.P. Srivastava — Elected Fellow of The Palaeobotanical Society, Lucknow.

C.M. Nautiyal — Presented a Memento and Citation by D.M., Barabanki and honoured at a function by Children Science Congress Organising Committee for contribution to science popularisation in U.P.

— Second special Aesthetics prize in photography competition organised by Lucknow Times (The Times of India).

C.M. Nautiyal
Mukund Sharma — First Prize in "Hindi Prashnottari" held at the Institute on the occasion of *Hindi Diwas*.

M. Shukla — Co-Chairman, Session on carbonate buildups in Conference on "*Biosedimentology of Precambrian Basins*", Lucknow.

B.K. Misra
B.D. Singh — Elected Founder, Life Fellow of the South Asian Association of Economic Geologists (FAEG), Indian School of Mines, Dhanbad.

S.K.M. Tripathi — Awarded citation conferred for carrying out excellent work at the Cell Biological and Micropaleontological Laboratory, J.A. University, Szeged, Hungary.

— Recommended for biographical inclusion in the Seventh Edition of *International Directory of Distinguished Leadership* and *Gold Record of Achievement for 1997* by American Biographical Institute, Inc.

R.R. Yadav — Awarded Research Fellowship of Korea Science and Engineering Foundation for the period of 14 months (December 1995-February, 1997)

Neerja Jha — Awarded "First Prize" by BSIP for doing maximum official work in Hindi.

Asha Gupta — Nominated Executive Councillor of "Scientists's Unique and Researcher's Association " Jhansi.

Jyotsana Rai — Member of Jury in 4th District meet of the National Children's Science Congress held at HAL School, Lucknow.

V. Nirmala **S.R. Yadav** **B. Sekar**	—	Awarded "Third Prize" by BSIP for doing official work in Hindi.
S.S. Panwar **Mishrilal**	—	Second Prize in "Hindi Prashnottari" held at the Institute on the occasion of *Hindi Diwas*.
Avinesh K. Srivastava **Avanish Kumar**	—	Third Prize in "Hindi Prashnottari" held at the Institute on the occasion of *Hindi Diwas*.

Representation in Committees/Boards

G. Rajagopalan	• Member, National Organising Committee, Nuclear Track Society of India, Calcutta
	• Member, Academic Committee of School of Archaeological Dating, Jadavpur University, Calcutta
K.P. Jain	• Secretary, Indian Association of Palynostratigraphers
H.K. Maheshwari	• Member, "Committee for Fossil Plants, International Association for Plant Taxonomy"
	• Editor, "Indian Association of Palynostratigraphers"
	• Editor, "*The Palaeobotanist*"
P.K. Maithy	• Convenor, Organising Committee, Scientific Programming and Cultural Committee, "*BSIP Golden Jubilee Conference on Physical and Biological changes across the major Geological Boundaries*", Lucknow
	• Member, *Conference on "Biosedimentology of Precambrian Basins"*, Palaeontological Society of India, Lucknow
N. Awasthi	• Vice President, The Palaeobotanical Society, Lucknow
Anand-Prakash	• Member, Executive Council, The Palaeobotanical Society
	• Treasurer, Indian Association of Palynostratigraphers
	• Member, Bureau of Indian Standards, Solid Mineral Fuels Sectional Committee-PCD-7.
Anil Chandra	• Member, Executive Council, Palaeontological Society of India, Lucknow
Shaila Chandra	• Vice-President, Indian Society of Geoscientists
	• Co-ordinator, International Project "Gondwana Alive"
H.P. Gupta	• Secretary, The Palaeobotanical Society, Lucknow
	• Business Manager, Indian Association of Palyno-stratigraphers, Lucknow

	• Representative of The Palaeobotanical Society in IFPS
S.A. Jafar	• Organising Secretary, Lucknow Chapter, Zaheer Science Foundation, New Delhi
	• Member, International Planning and Building: "Architects across the Borders: Initiative Group, Germany"
Chhaya Sharma	• Vice President, International Council for Biodeterioration of Cultural Property
	• Member, Advisory Committee, "*Journal of Bengal Natural History Society*"
Suresh C. Srivastava	• Chief Editor, Geophytology
Rahul Garg	• Member, Editorial Board, "*Journal of Palaeontological Society of India*"
J.S. Guleria	• Joint Secretary, The Palaeobotanical Society, Lucknow
R.K. Saxena	• Secretary, Indian Society of Geoscientists
	• Member, Editorial Board, "*I.S.G. Bulletin*"
C.M. Nautiyal	• General Secretary, National Children's Science Congress, U.P.
	• Member, Organising Committee, Seminar on "*Environment*" under a scheme of Dept. Environment and Forests
	• Patron, National Children's Science Congress, Lucknow District
A.K. Srivastava	• Editor, "*Geophytology*"
	• Member, Advisory Board, "*Journal Neo Botanica*"
	• Treasurer and Member, Editorial Board, Indian Society of Geoscientists
G.P. Srivastava	• Treasurer, The Palaeobotanical Society, Lucknow
Shyam C. Srivastava	• Convener-Secretary, Birbal-Savitri Sahni Foundation, Lucknow
	• Convener, Birbal Sahni IOP Medal Committee
	• Honorary Member, Botanical Society of America

Archana Tripathi	• Member, Jurassic Microfossil Group, International Subcommission on Jurassic Stratigraphy
	• Editor, *"Geophytology"*
	• Editor, *"Quarterly Journal of Geological Association and Research Centre"*
Vijaya	• Corresponding Member, Committee for Quantitative Stratigraphy
	• Voting Member, International Commission on Triassic Stratigraphy
Usha Bajpai	• Member, Managing Council, Indian Association of Palynostratigraphers
Asha Khandelwal	• Vice Chairman, Academic Programme Committee of ICQMR, China
Neerja Jha	• Member, Rajbhasha Karyanvayan Samiti, BSIP, Lucknow
B.K. Misra	• Member, Bureau of Indian Standards, Solid Mineral Fuels Sectional Committee-PCD-7.
	• Joint Secretary, Indian Society of Geoscientists
Rakesh Saxena	• Associate Member, International Committee for Coal and Organic Petrology
	• Member, Latin American Association of Organic Geochemistry
R. Babu	• Convener, SC/ST Grievance Committee, BSIP
Asha Gupta	• Member, Board of Editors, *"Flora and Fauna"*
Madhav Kumar	• Member, Executive Council, The Palaeobotanical Society, Lucknow
Alpana Singh	• Member, Sale Promotion Committee "Geophytology"

Lectures Delivered

By Institute scientists

G. Rajagopalan

— *"Age determination of geological materials using Radioactive Isotopes: Principles, techniques and limitations of different methods"*. Refresher Course in Geology, Academic Staff College, BHU, Varanasi.

— *"Radiocarbon Dating and Dendro-chronology"*, GSI, Northern Region, Lucknow.

P.K. Maithy

— *"Oldest biological forms on the earth's history"* and *"Glossopteris flora and its stratigraphical importance"*, UGC Sponsored Refresher Course, Department of Geology, Lucknow University, Lucknow.

— *"Our modern environment"*, sponsored programme "Environment pollution and remedies" organised by Central School, Gomti Nagar.

— *"Mahadweepon Ka Vightan"*, T.V. talk, Lucknow Doordarshan.

K.S. Saraswat

— *"Plant remains in Archaeology : methods of their study and interpretational approaches in the pre-historic economics"*, *"Origin of agriculture and the advent of sedentary life and agriculture based economy during the Neolithic revolution in India"*, *"Harappan Civilization in relation to the utilization of botanical resources"* and *"Plant economy of Indian chalcolithic cultures in different time and space, during pre-Christian Era"* at the Institute of Archaeology, Archaeological Survey of India, New Delhi.

— *"Plants used in fire-sacrificial rites in Punjab during Kushana times"* in Professor Radha Raman Das Abhinandan Mahotsav, organized by citizens at Gwalior.

Rahul Garg

— *"Fossil Radiolarians and their significance in Palaeoceanography"* UGC sponsored Refresher Course, Department of Geology, Lucknow University.

B.K. Misra — *"Fluorescence Microscopy"* and *"Fluorescing macerals"* at a Short Training Programme on Coal Petrology at the Staff Training College, Central Mine Planning and Design Institute Limited, Ranchi.

C.M. Nautiyal — *"Our unique planet"* HAL School, Lucknow.

— *"The earth, meteorites and life"*, Lucknow Doordarshan, Lucknow.

— *"Science Communication"* (two lectures in Hindi), Central Institute for Subtropical Horticulture, Lucknow.

— Two lectures at the workshop organised by the Department of Field Publicity and UNICEF at Dehradun on *"Child Rights"*

— *"The importance of Science Education"*. 'Uttarayan', All India Radio, Lucknow.

G.P. Srivastava — "*Introduction to palaeobotany and fossil pteridophytes"* and *"Coal forming vegetation and fossil Gymnosperms*", Refresher course in Botany, Botany Department, Magadh University, Bihar.

Neerja Jha — "*Parag evam Beejanu batate hein Chattano ki Ayu*", Army Public School, Lucknow.

Rakesh Saxena — "*Coal Petrography*", UGC sponsored Refresher Course, Department of Geology, Lucknow University, Lucknow.

R.R. Yadav — *"Tree-rings and climate research scenario in India"* at Department of Forestry Research, Chungbuk National University, Korea.

A. Bhattacharyya — *"Tree-rings in the Himalayan region"* at Institute of Forests, Itanagar, Arunachal Pradesh.

— *"Tree-ring studies in geological applications*" at GSI, Itanagar, Arunachal Pradesh.

A. Rajanikanth — *"Plants and Man - A symbiosis"*, Vigyan Parishad, Allahabad.

— *"Evolution and adaptation of plant life"*, Army Public School, Lucknow.

By outside scientists in the Institute

Prof. Afsar Abbas — Institute of Physics, Bhubaneshwar, "*Dark Matter of Cosmology and Periodic Mass Extinction*", February, 1997.

Deputation/Training/Study/Visit Abroad/in Country

P.K. Maithy

Attended the Working Group Meeting of IGCP Project No. 380: "Biosedimentology and Correlation of Microbial Buildups" held at Geology Department, Lucknow University on February 20, 1997.

Archana Tripathi, Vijaya & K.L. Meena

Attended field workshop on "Recent advances in Stratigraphy and tectonics of Ib-Hingir Valley, Gondwana Basin" organised by GSI, Coal Wing at Jharsuguda, Orissa from February 15-17, 1997. Visited Singrauli, Ib-Hingir and Talcher coalfields and collected samples from 4 bore-holes and 11 outcrop sections for palynological studies.

G.P. Srivastava

Deputed to organise the Science & Technology Exhibition sponsored by DST during Indian Science Congress at Delhi University, New Delhi from January 2-8, 1997.

B.K. Misra, Samir Sarkar & Mahesh Prasad

Participated in the "Interaction Meeting on North-West Himalayan Geotransect Programme" sponsored by the Department of Science and Technology and organised at Wadia Institute of Himalayan Geology, Dehradun during August 30-31, 1996.

S.K.M. Tripathi

Visited the Cell Biological and Evolutionary Micropaleontological Laboratory, J.A. University, Szeged, Hungary and Hungarian Natural History Museum, Budapest from July 1 to August 27, 1996 under the Exchange of Scientists Programme between Indian National Science Academy and the Hungarian Academy of Sciences.

R.R. Yadav

Visited Republic of Korea from December 1995 to February 1997 on deputation to avail Korea Science and Engineering Foundation Research Fellowship. During stay also participated in the "4th Forest Science Symposium" held at Agricultural Science Institute, Chungbuk National University, Cheongju, Korea on April 4, 1996. Visited sub-alpine forests in South Korea from time to time to collect tree-ring samples for dendroclimatic studies.

A. Rajanikanth

Attended IV National Children Science Congress (State) held at Vigyan

Parishad, Allahabad in December, 1996.

Asha Gupta

Visited Botanical Gardens of Glasgow during "British Bryological Society Centenary Symposium" held at Glasgow University, Scotland from August 5-8, 1996. Participated in two field trips organised by authorities of British Bryological Society Centenary Symposium. Visited various localities in Scotland and collected interesting Bryophytes.

Anjum Farooqui

Attended a ten days (January 20-29, 1997) training course in "Late Quaternary climatic and coastal changes" held at Andhra University, Vishakhapatnam organised by DST.

K. Nagapooshanam

Attended the Indian Science Congress on "Computer Networks in National Development" held at Delhi University, New Delhi from January 2-8, 1997.

Deputation to Conferences/Symposia/Seminars/ Workshops

K.S. Saraswat	• *"Annual Conference Association for the Study of History and Archaeology"* held at Aligarh Muslim University, Aligarh from June 15-17, 1996.
R.K. Saxena **M.R. Rao** **Asha Khandelwal**	• *"IX International Palynological Congress" held at Houston,* Texas, USA from June 23-28, 1996.
H.K. Maheshwari **Shyam C. Srivastava** **Shaila Chandra** **G.P. Srivastava**	• *"Fifth Quadrennial Conference of the International Organisation of Palaeobotany " held at Santa Barbara, California,* USA from June 30-July 6, 1996.
G.P. Srivastava	• *"All India Museum Conference"* held at Bharat Kala Bhavan, Banaras Hindu University, Varanasi in August 1996.
Asha Gupta	• *"British Bryological Society Centenary Symposium"* held at Glasgow University, Scotland, UK from August 4-8, 1996.
Usha Bajpai **Mukund Sharma**	• *"30th International Geological Congress"* held at Beijing, China from August 4-14, 1996.
Anil Chandra	• *"14th International Diatom Symposium"* held at Tokyo, Japan from September 2-8, 1996.
Vijaya	• *"The Continental Jurassic Symposium"* held at Flagstaff, Arizona, USA from October 21-26, 1996.
P.K. Maithy **A.K. Srivastava** **Neerja Jha** **Jitendra Pandey**	• *"National Symposium on Recent Researches in Sedimentary Basins : Implication for Exploration of Natural Resources' "XII Convention of Indian Association of Sedimentologists"* held at Banaras Hindu University, Varanasi from October 28-30, 1996.
A. Bhattacharyya	• *"Workshop on the Role of Tibetan Plateau in Global*

	Climatic Changes" held at Dharamsala, H.P. from October 25-31, 1996.
41 Scientists of Institute	• *"BSIP Golden Jubilee Conference on* the *Physical and Biological Changes across the Major Geological Boundaries"* held at the Institute from November 15-17, 1996.
K.S. Saraswat **A.K.S. Pokharia**	• *"Joint Session of XXX Annual Conference of Indian Archaeological Society" "XXIV Annual Conference of Indian Society for Prehistoric and Quaternary Studies"*, held at B-17, Qutab Institutional Area, New Delhi from November 24-26, 1996.
H.A. Khan **S.K. Bera** **B. Sekar**	• *IGBP Symposium on "Changes in Global Climate due to Natural and Human Activities"* held at Regional Research Laboratory, Bhubaneshwar, Orissa from January 15-17, 1997.
P.K. Maithy **M. Shukla** **M. Sharma**	• *"Conference on Biosedimentology of Precambrian Basins"*, held at Lucknow University, Lucknow from February 19-21, 1997.

Papers presented at Conferences/Symposia/Seminars

Babu, R. & Maithy, P.K. — Noteworthy organic-walled microfossil assemblage from the Shale Member of the Upper Tal Formation, Mussoorie Syncline, Lesser Himalaya, Uttar Pradesh. *Conf. Biosedimentol. Precambrian Basins*, Lucknow, February 1997.

Bajpai, U. & Maheshwari, H.K. — Taphonomic constraints on preservation of cuticles in compression fossils : fungi induced ultrastructural changes in the cuticular membrane. *30th Int. Geol.. Congr.*, Beijing, August 1996.

Banerji, J. — Floral change across the Permo-Triassic boundary in Damodar and Auranga valleys. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Bera, S.K., Farooqui, A. & Gupta, H.P. — Late Pleistocene/Holocene vegetation and environment in and around Marian Shola, Palni Hills, south India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Bera, S.K. & Gupta, H.P. — Vegetation and environment since Middle Holocene in Silent Valley as evidenced by palynostratigraphy. *IGBP Symp. "Changes in Global climate due to Natural and Human activities"*, Bhubaneshwar, January 1997.

Bhattacharyya, A. & Ramesh, R. — Climate and vegetation changes during Late Pleistocene in Ladakh, Jammu and Kashmir. *Workshop "The role of Tibetan Plateau in Global climatic changes"*, Dharamsala, October 1996.

Bhattacharyya, A.P. — Palynological dating of subsurface sediments from Wardha Valley coalfields, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Bhattacharya, S.K., Jani, R.A. & Maithy, P.K. — Stable isotopics of Proterozoic Bhima Basin, Karnataka . *Conf. Biosedimentol. Precambrian Basins*, Lucknow, February 1997.

Chandra, A. — Fossil diatoms from the Late Cenozoic sediments of Andaman and Nicobar Islands, India and their biostratigraphical significance. *14th Int. Diatom Symp.*, Tokyo, September 1996.

Chandra, S. — Floral changes of the Carboniferous and Permian in Gondwana, *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Chandra, S. & Sun Keqin — Evolution and comparison of the Gondwana flora and

the Cathaysia flora. *V Quadr. Conf. Int. Organiz. Palaeobot.*, Santa Barbara, June-July, 1996.

Chauhan, M.S., Sharma, C. & Rajagopalan, G. — Vegetation and climate during Late-Holocene Period in Garhwal Himalaya. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Garg, R. & Jain, K.P. — Integrated phytoplankton stratigraphy across K/T Boundary at Um Sohryngkew, Meghalaya, Northeast India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Ghosh, A.K., Jana, B.N. & Maithy, P.K. — Distribution pattern of calcareous algae across the Cretaceous-Tertiary sequence of Cauvery Basin in Tiruchirapalli District, Tamil Nadu. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Guleria, J.S. — Occurrence of fossil woods of *Barringtonia* in the Deccan Intertrappean and Miocene sediments of Kutch, western India and the observed structural changes. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Gupta, A. — Palynology of Bryophytes. *British Bryol. Soc. Cent. Symp., British Bryol. Soc.*, Glasgow, August 1996.

Gupta, H.P. & Khandelwal, A. — Chilka Lake : Testimony of environment. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Jana, B.N., Banerji, J. & Kar, R.K. — First occurrence of *Isoetites serratifolius* Bose & Roy from the Deccan Intertrappean beds of Kutch, Gujarat. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Jana, B.N. & Ghosh, A.K. — Megaspore assemblage from the Athgarh Formation and its biostratigraphic significance. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Khan, H.A. — Significance of Silent Valley bio-reserve microclimate in plant diversity. *IGBP Symp. "Changes in global climate due to natural and human activities"*, Bhubaneshwar, January 1997.

Khandelwal, A. — Long term registration of air borne pollen/spores and its allergenic significance. *IX Int. Palynol. Congr.*, Houston, June 1996.

Khandelwal, A. & Gupta, H.P. — Mangrove history since 1,500 yrs B.P. at Dangmal,

Baitarni-Brahmani Delta, Orissa. *IX Int. Palynol. Congr.*, Houston, June 1996.

Kumar, P. — Palynostratigraphy of Almod Bed in Satpura Basin, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Maheshwari, H.K. — Taxonomic position and affinities of the glossopterid group of plants from Gondwana Supergroup. *V Quadr. Conf. Int. Organiz. Palaeobot.*, Santa Barbara, June-July 1996.

Maheshwari, H.K. — Permian-Triassic boundary : an overview. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Maithy, P.K., Kumar, S., Babu, R. & Sharma, S. — Cellularly preserved microfossils from three billion years old Iron Ore Supergroup, Kashia Area, Orissa, India. *Conf. Biosedimentol. Precambrian Basins*, Lucknow, February 1997.

Mandal, J. & Kumar, M. — Palynofloral distribution pattern across the Palaeocene-Eocene of northeast and western India. *BSIP Golden Jubilee Conf. on "Physical and biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Pal, P.K. & Ghosh, A.K. — Lithological and megafloral successions in the Kamthi Formation with special reference to Permo-Triassic Boundary in the Talcher Coalfield, Orissa. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Pal, P.K., Shome, D., Sannigrahi, A. & Ghosh, A.K. — Raniganj-Panchet Transition *vis-a-vis* Permo-Triassic Transition in the Raniganj Coalfield, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Rajanikanth, A. & Chandra, S. — Mesozoic coniferous wood of India - An appraisal. *V Quadr. Conf. Int. Organiz. Palaeobot.*, Santa Barbara, June-July, 1996.

Ram-Awatar — Palynological evidence for the Permo-Triassic Boundary in Sohagpur Coalfield, M.P., India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Rao, M.R. — Palynostratigraphic zonation of the Tertiary sediments of Kerala Basin, India. *IX Int. Palynol. Congr.,* Houston, June 1996.

Rao, M.R. — Palynological demarcation of Eocene-Miocene sequences, Kerala Basin, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Saraswat, K.S. — Archaeological evidence of some rational herbal-drug yielding plants from eastern Uttar Pradesh. *Annual Conf. Assoc. Study of History and Archaeology*, Aligarh, June 1996.

Saraswat, K.S. — Herbal detergent and shampoo from Pre-Harappan Banawali, Haryana (Ca. 2750-2500 B.C.). *Joint Session XXX Annual Conf. Indian Archaeol. Soc.* and *XXIV Annual Conf. Indian Soc. Prehistoric and Quaternary Studies*, New Delhi, November 1996.

Saraswat, K.S. & Pokharia, A.K.S. — Botanical evidence of fire-sacrifice during Kushana Period (Ca. 100-300 A.D.) at Sanghol, Punjab. *Joint Session XXX Annual Conf. Indian Archaeol. Soc.* and *XXIV Annual Conf. Indian Soc. Prehistoric and Quaternary Studies,* New Delhi, November 1996.

Sarkar, S. & Corvinus, G. — Palynofloral changes in the Siwalik succession (Mio-Pliocene) of western Nepal and its palaeoenvironmental implications. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Saxena, R.K. — Palaeoclimate and depositional environment of the Upper Siwalik sediments in North-western India. *IX Int. Palynol. Congr.*, Houston, June 1996.

Sekar, B. — Chemical analysis and ^{14}C dating of Lake sediments and their significance for interpretation of the past climatic changes. *IGBP Symp. "Changes in global climate due to natural and human activities"*, Bhubaneshwar, 15-17 January 1997.

Shanker, R., Kumar, G., Kumar, V., Maithy, P.K. & Bhattacharya, S.K. — Terminal Proterozoic System in India : Its time limits and global correlation. *30th Int. Geol. Congr.,* Beijing, August 1996.

Sharma, C. & Gupta, A. — Early Holocene sequence of palaeofloristic and climate in Garhwal Himalaya. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Sharma, S., Babu, R., Maithy, P.K. & Kumar, S. — Lithostratigraphy of the Kashia Dolomite Formation, Barbil area, Orissa with reference to environment of deposition. *Natn. Symp. Recent Researches in Sedimentary Basins : Implication for Exploration of National Resources* and *XIII Conv. Indian Assoc. Sedimentol.*, Varanasi, October 1996.

Srivastava, A.K. — Floristic pattern in the Lower Gondwana sediments of India. *Nat. Symp. Recent Researches in Sedimentary Basin: Implication for Exploration of Natural Resources* and *XIII Conv. Indian Assoc. Sedimentol.*, Varanasi, October 1996.

Srivastava, A.K. — Emergence, continuance and extinction of floral elements across Permian-Triassic in India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Srivastava, G.P. — Impact of Himalayan uplift on the Late Cenozoic flora of India. *V Quadr. Conf. Int. Organiz. Palaeobot.*, Santa Barbara, June-July 1996.

Srivastava, Shyam C. — Fertile structures from Triassic of India. *V Quadr. Conf. Int. Organiz. Palaeobot.*, Santa Barbara, June-July, 1996.

Srivastava, Suresh C., Anand-Prakash & Kar, R. — Palynology of Permian-Triassic sequence in Iria Nala, Tatapani-Ramkola Coalfield, M.P., India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Srivastava, Suresh C. & Jha, N. — Stratigraphic correlation of coal resources in Godavari Graben : Palynological parameter. *Nat. Symp. Recent Researches in Sedimentary Basin : Implications for Exploration of Natural Resources* and *XIII Conv. Indian Assoc. Sedimentol.*, Varanasi, October 1996.

Srivastava, Suresh C. & Jha, N. — Kamthi Formation - Palaeobotanical evidences. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Tripathi, A. — Representation of acritarchs across the Permo-Triassic boundary. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Tripathi, S.K.M. — Palynological changes across subsurface Palaeocene-Eocene sediments from Barmer, Rajasthan. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Vijaya & Tiwari, R.S. — Status of continental Jurassic on the Indian peninsula. *Contin. Jurassic Symp.*, Flagstaff, Arizona, October 1996.

Vijaya, Tripathi, A. & Ram-Awatar — Interformational boundaries through Permian and Early Triassic sequence on peninsular India and pattern of spore-pollen species distribution. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, Lucknow, November 1996.

Yadav, R.R. — Tree-rings and climate change studies : Indian scenario. *4th Forest Sci. Sem.*, Cheongju, Korea, April 1996.

Doctoral Degree Awarded

Name	*Supervisor*	*Title of Thesis*	*University*
Deepak Kohli	H.P. Gupta	Palynostratigraphy and palaeoenvironment of Mahanadi delta, Orissa	Lucknow University, Lucknow
Madhabi Chakravorty	R.K. Kar	Palynology of the Palaeocene sediments of North-east India	Kanpur University, Kanpur

Consultancy/Technical Assistance rendered

Consultancy services

Thirty-nine samples from different organisations have been dated by ^{14}C method at the Institute and a sum of Rs. 97,500/- has been earned.

Pollen analysis of seven Jamaican samples and their palaeoenvironmental interpretation, received from Dr Rafi Ahmed, Geology Department, University of West Indies, Kingston, Jamaica, have been carried out in the Department of Quaternary Biogeography and Archaeology for which the Institute received US $ 700.

Technical Assistance

Kumaon University, Nainital in the palynological studies.
National Museum of Natural History in the identification of some fossil remains.

Radiocarbon dating of samples

Geological Survey of India, Lucknow
Physical Research Laboratory, Ahmedabad
Wadia Institute of Himalayan Geology, Dehradun
Kumaon University, Nainital
Indian Institute of Science, Bangalore
Prof. P.K. Banerji, Emeritus Scientist, CSIR, Jadavpur University, Calcutta
Centre for Study of Man and Environment, Calcutta
Centre for Earth Science Studies, Trivandrum
Agharkar Research Institute, Pune
National Institute of Oceanography, Goa
National Geophysical Research Institute, Hyderabad
National Bureau of Soil Survey and Land Use Planning, Nagpur
Deccan College, Pune

Training in SEM techniques

Department of Botany, Lucknow University, Lucknow
Department of Marine Geology, Cochin University of Science and Technology, Ernakulam, Kochin (Kerala)
Central Drug Research Institute, Lucknow

Departments at the Institute (Heads)

Department of Non-Vascular Plants
(Dr P.K. Maithy)

Department of Palaeophytic Evolutionary Botany
(Dr H.K. Maheshwari)

Department of Mesophytic Evolutionary Botany
(Dr Shaila Chandra)

Department of Cenophytic Evolutionary Botany
(Dr N. Awasthi; up to 31.12.1996)

Department of Quaternary Biogeography and Archaeobotany
(Dr H.P. Gupta)

Department of Pre-Gondwana and Gondwana Palynostratigraphy
(Dr Suresh C. Srivastava)

Department of Post-Gondwana Palynostratigraphy of Peninsular India
(Dr S.A. Jafar)

Department of Post-Gondwana Palynostratigraphy of Extra-Peninsular India
(Dr Anil Chandra)

Department of Planktonology
(Dr K.P. Jain; up to 30.09.1996)

Department of Biodiagenesis
(Dr Anand Prakash)

Department of Radiometric Dating
(Dr G. Rajagopalan)

Units
Publication

Journal — *The Palaeobotanist*

During the year Volume 43, Number 3 and a special BSIP Golden Jubilee Volume 45 of *The Palaeobotanist* were published. The special volume comprises 55 contributions, out of which 20 are specially invited papers and remaining 35 were presented at the International Conference on *"Diversification and Evolution of Terrestrial plants in Geological time (ICTPG)"* held at Nanjing, China during September 4-8, 1995. This special volume comprises 456 printed pages.

24th Birbal Sahni Memorial Lecture

The 24th Birbal Sahni Memorial Lecture entitled *"History and progress of plant tissue culture and biotechnology"* delivered by Professor B.M. Johri was processed and sent to press for publication.

Brochure

On the occasion of Institute's Golden Jubilee celebrations, a Brochure was published in which the history and other major achievements of the Institute during last 50 years were highlighted through coloured pictures and charts, etc.

Annual Reports

The Annual Reports for the year 1995-96, both in English and Hindi, were published in which the major achievements and events of the Institute were highlighted through coloured and black and white pictures and graphs, etc. The reports comprise about 190 printed pages each. Printed copies of the reports were sent to the DST, New Delhi and other organisations.

Sale of the Institute publications

This year the publications of the Institute netted an income of Rs.2,75,992.26, out of which US $ 2,577.33 were earned in foreign exchange.

Library

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

The present holdings of the Library are as under:

Particulars	Additions during 1996-97	Total
Books	89	5,057
Journals	174	10,260
Reprints	184	5,238
Reference Books	10	254
Hindi Books	15	134
Ph.D. Thesis	—	83
Reports	—	46
Maps & Atlases	—	61
Microfilms/Fisches	—	294

At present the Library is subscribing 76 journals and has 143 registered Card holders.

Exchange Unit

Journals received on exchange basis	69
Reprints of research papers purchased	32
Reprints sent out in exchange	1,780
Institutions on exchange list	61
Individuals on exchange list	385

The addresses on Institute's exchange list of about 385 individuals and institutions are being revised.

Computer aided Library

Circulation desk of the library is fully computerised. It is on LAN under UNIX O/S. The Software employed is UNIFY RDBMS and the utilities are programmed in

'C' giving different levels of securities. Data entry is in progress and from September, 1996 to March, 1997 about 4,000 records have been entered.

Documentation, data management, exchange list, report generation, subscription of journal records, etc. are also done by the computer to enhance the efficiency and accuracy of Library working.

Reprography Room

The Reprography Room is being renovated and air-conditioned with required new electrical fittings, etc. for efficient services.

Xeroxing facility

Better xeroxing facilities through revised system are now available to Institute's employees as well as to outsiders.

Binding

Binding of 210 periodicals was done within the Institute and about 300 periodicals were sent outside for binding to clear the backlog.

Lamination

To preserve the precious old literature, 58 books were laminated.

Use of Hindi

As per recommendations of the Government of India, routine work in the Library is being carried out in Hindi.

Birbal Sahni's Literature Section

A new section with available literature of Professor Birbal Sahni and his own research contributions has been appended to the Library.

The following institutions availed the Library facilities during the year :

Lucknow University, Lucknow (U.P.).
Tribhuvan University, Kathmandu (Nepal).
Utkal University, Vani Vihar, Bhubaneshwar (Orissa).
Allahabad University, Allahabad (U.P.).
Garhwal University, Garhwal (U.P.).
Gorakhpur University, Gorakhpur (U.P.).
Agharkar Research Institute, Pune (Maharashtra).
Department of Forest Conservation, Lucknow (U.P.).
Institute of Physics, Bhubaneshwar (Orissa).
University of Jammu, Jammu (Jammu & Kashmir).
Pellaus College, Pune (Maharashtra).
Cochin University, Cochin (Kerala).
Kumaun University, Nainital (U.P.).
International Advanced Research Centre for Powder Metallurgy and New Materials, Hyderabad (Andhra Pradesh).

Museum

The Institute's Golden Jubilee year concluding ceremony was held in a befitting manner. A gallery of "Plant Fossils" was erected at Regional Science Centre, Lucknow and was formally opened on September 10, 1996. Concluding function of the Golden Jubilee coincided with the Conference held at the Institute. Poster Session organised during the Conference evoked keen interest among the participants.

The Institute participated in Science and Technology exhibition organised by DST during the 84th Session of the Indian Science Congress at Delhi. Main theme of the exhibition was "Computer Network in National Development". About 3,000 persons visited and took keen interest in our exhibits. A bilingual Brochure was also prepared

A view of Institute's Museum.

and distributed during the Science Congress Session.

A week long activity was organised for the National Science Day celebrations. A debate competition in Hindi and English on the topic "India of my Dreams" was organised in which school children participated. The prizes were also distributed. Screening of educational video films and slide shows were also held for benefit of the visitors. Doordarshan Kendra, Lucknow and the local press also gave a wide coverage to our activities .

Plant fossils were sent to Nature Museum, Augusburg, Germany on exchange. Under educational programme "Palaeobotany for Education", fossil specimens were gifted to 11 educational Institutions. Trans-slides of fossil specimens were sent to Evangelisehe Hoge School Amersfoort, Netherland. Scientists from U.S.A., Belgium and Australia visited the Museum besides citizens of our own country.

Type and Figured Specimens/Slides/Negatives

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

Particulars	Additions during 1996-1997	Total
Type and figured specimens	125	5,493
Type and figured slides	151	11,268
Negatives of the above	170	14,729

New Collections

Specimens/samples collected from 182 localities of the country were submitted to the Museum by Institute's staff.

Departments	*Specimens*	*Samples*
Non-Vascular plants	63 (Stromatolite)	48 58 (Palynol.)
Pre-Gondwana and Gondwana Palynostratigraphy of India	—	877
Post-Gondwana Palynostratigraphy of extra-Peninsular India	—	424

Quaternary Biogeography and Archaeobotany	—	111
Biodiagenesis	—	215
Cenophytic Evolutionary Botany	2375	208 Wood 80 (Palynol.)
Post-Gondwana Palynostratigraphy of Peninsular India	—	572
Radiometric dating	27 (Trap & Mollusk)	52 (Fossil wood)
Museum	112	—

Presentation of Fossil Specimens

- School of Earth Science, Swami Ramanand Teerth Marathwada University, Nanded, Maharashtra.
- P.G. Centre, Bangalore University, Kolar, Karnataka.
- Dr Kurien Jacob, 15/A, Main Karamangala, Bangalore.
- Department of Applied Geology, Barkatullah University, Bhopal.
- Govt. Museum, Eggmore, Chennai, Tamil Nadu.
- Department of Botany, M.M.H. College, Ghaziabad, U.P.
- Department of Geology, North Eastern Hill University, Shillong.
- Pacchunga University College, Aizwal, Mizoram.
- Department of Botany, R.L.S.Y. College, Bakhtiarpur, Patna, Bihar.
- Women's College, Banaras Hindu University, Varanasi.
- A.V.C. College (Autonomous), Mayladuturai Mannapandal, south India.
- Director of General Affairs, Evangelische Hoge School, Amersfoort, Netherland.

Institutional Visitors

- I.T. College, Lucknow.
- Oak Grove Girl's School, Mussoorie.
- City Montessori School, Mahanagar, Lucknow.

R.L.B. Memorial School, Lucknow.

Botany Department, B.H.U., Varanasi.

Life Science Department, Mumbai.

Assembly of God Church School, Lucknow.

A.M. School, Lucknow.

A.V. College, Guwahati.

Teachers attending Refresher/Orientation, Course organized by Academic Staff College, Lucknow University, Lucknow.

Herbarium

To develop Herbarium as repository of reference collection of modern plant materials and their preparations, useful for comparative morphological study of fossil specimens, about 800 plant specimens, wood blocks of 6 species and 60 samples of seeds and fruits were collected from different localities in Uttar Pradesh. About 600 plant specimens were identified, mounted on herbarium sheets, registered and systematically incorporated. About 70 wood slides and 100 pollen slides were also added to the Herbarium. Sixteen laminated mounts of leaf venation patterns and leaf prints of 40 specimens were also prepared. Ten translides and 20 blow-ups of rare, endangered, endemic, medicinal and plants of botanical curiosity were prepared and displayed in the Herbarium Hall. Feeding of data in computer for preparation of an inventory of sporothek and xylarium are being done.

Herbarium holdings :

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

Particulars	Additions during 1996-97	Total
Herbarium		
Herbarium sheets of plant specimens	600	15,275
Herbarium sheets of leaf specimens	20	435
Xylarium		
Wood blocks	6	4,004
Wood disks	—	32
Wood core samples	—	440
Wood slides	70	3,938
Sporothek		
Pollen slides	100	11,599
Carpothek		
Fruits & seeds	60	2,516

Exchange programme

About 25 plant specimens of Uttar Pradesh were sent to the Department of Botany, Calicut University, Calicut and 25 plant specimens of Silent Valley were received from the University under exchange programme.

Herbarium facilities provided to:

Dr Suresh D. Bonde — Agharkar Research Institute, Pune

Miss Sunita Tewari — Department of Geology, D.S.B. College, Nainital

Dr Bhojpal Singh — C.C.P.G. College, Muzaffar Nagar

B.D. Agarwal — School of Life Science, J.N.U., New Delhi

Dr Subir Bandopadhyay — B.S.I., Howrah

Dr Hovithal Sothu — Department of Geology, Nagaland University

Miss Boomika Singh — Department of Botany, B.H.U., Varanasi

Dr Mithilesh Kumar Pathak — B.S.I., Howrah

Institutional Visitors

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

Department of Life Science, North Eastern Hill University, Shillong

Govt. P.G. College, Ambikapur, M.P.

Department of Life Science, University of Mumbai, Maharashtra

Assembly of God Church School, M.G. Marg, Lucknow, U.P.

City Montessory School, Mahanagar, Lucknow, U.P.

Department of Environment, University of Lucknow, Lucknow, U.P.

Department of Botany, Rani Durgawati Vishwavidyalaya, Jabalpur, M.P.

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

Electronic Data Processing

Electronic Data Processing unit was involved in the following activities, viz., planning and up-keep of the unit; updation of Library information management system; software development for scientific, Administration and Accounts Section; providing technical support to staff; rendering basic maintenance to the systems; hardware and software acquisition; and further planning for the coming year.

During Golden Jubilee celebrations the following jobs were also done. A bilingual Folder was designed to be distributed during Golden Jubilee functions. Abstract Volume for the BSIP Golden Jubilee Conference on "Physical and biological changes across major Geological Boundaries" was composed and set for offset printing. Invitation cards English and Hindi were composed for different Institute's functions. Invitees Database was updated and laser printout was taken on the envelops for all the functions. In view of Stamp release by the Department of Post and Telegraph for the BSIP Golden Jubilee celebrations, Stamp design was prepared using Scanner and page layout softwares. Press release for all the functions (both in English & Hindi) were also composed. Besides, other small jobs such as Brochure, Watch (Memento) dial design, preparation of labels, posters and banners were also carried out.

The Library Information Management System has been maintained well and updations have been carried out from time to time. Budget casting for the year 1996-97, monthly account report and Cash-book were also carried out for Accounts Section.

Designing and Laser Printing of various charts, banners, displays, slides and posters were done for staff members who participated in various conferences and delivered lectures. The scientists were helped to carry out reports submission and presentation before RAC and Project proposals for the IX Five Year Plan. The obsolete PC and PC-XT were replaced with Pentium based higher end machines.

Section Cutting

During the year 580 fossil samples of chert material, limestones and petrified woods were cut. A total of approximately 1000 slides of thin sections of fossils were prepared. In addition, 1100 slices of fossil material consisting mostly of bigger and hard specimens were cut and polished. About 40 fossil samples were cut and polished for presenting as gift samples to various organisations and individual scientists on behalf of the Institute.

One "6 position Zero Bonding Jig" was added to the unit to accelerate the process of preparation of larger number of thin section slides. An air compressor pump was also procured for supplying compressed air to Epoma Epovac unit to strengthen/ harden the soft samples so that softer material could also be cut easily.

A number of students and scientists who visited the Institute and its Museum also visited the Section Cutting Unit to satisfy their curiosity as to how thin sections of fossils are cut and polished. Interested visitors were given practical demonstrations and told about various steps involved in the preparation of slides of thin sections of fossil material.

Consultancy, Contract Research and Training

The Governing Body approved the guidelines for offering consultancy, contract research and training which were made effective from September 10, 1995. The Institute offers consultancy services on palynological analysis of Pre-Quaternary and Quaternary sediments, dating through dendrochronology techniques, petrology, megafossils, woods identification, identification of botanical remains from archaeological sites and Radio Carbon dating. Contract training facilities on palynology, coal and/or lignite petrology are also available. In addition, the facilities like Scanning Electron Microscope, section cutting and preparation of slides are also made available to other organisations on nominal charges.

There has been gradual increase in the revenue generated by the Institute on account of Consultancy, Contract Research and Training Services being rendered since their introduction in an organised manner in 1995. The revenue on this account during the year 1996-97 amounted to about Rs.1.27 Lacs.

Distinguished Visitors

This year the following Distinguished Visitors visited the Institute

Prof. M. Atreyi, Chemistry Department, Delhi University, Delhi
Prof. V.K. Gaur, Distinguished Scientist, National Aerospace Laboratory, Bangalore
Prof. T.N. Khooshoo, F.N.A., Emeritus Professor, New Delhi
Dr Levy, Brussels, Belgium
Dr Lalit Kumar, DST, New Delhi
Prof. John A. Milburn, Botany Department, NSW, Australia
Dr S.K. Misra, DST, New Delhi
Prof. H.Y. Mohan Ram, F.N.A., Botany Department, Delhi University, Delhi
Dr Nagalopinath, Director, A.V. College, Guwahati
Prof. S.Z. Qasim, F.N.A., New Delhi
Prof. K.L. Rai, Indian School of Mines, Dhanbad
Prof. S. Ramaseshan, F.N.A., Professor Emeritus, Raman Research Institute, Bangalore
Prof. P.V. Sane, F.N.A., Director, NBRI, Lucknow
Sri K.P. Saxena, Lucknow
Sri K.P. Shajan, Cochin University of Science and Technology, Cochin
Prof. J.S. Singh, F.N.A., Botany Department, Banaras Hindu University, Varanasi
Sri B.N. Swaroop, Advisor to Governor, U.P.
Dr S. Varadrajan, F.N.A., President, INSA, New Delhi
Dr Anupam Verma, Head, Advanced Centre for Plant Virology, IARI, New Delhi
Kathlear Willwood, Wetherford, Texas, U.S.A.

Status of Official Language

In pursuance of the Government of India's Official Language Policy, further steps were taken to promote the usage of Hindi in official work. The Institute continued to be the Convener of the City's Implementation Committee of Official Language, Unit 11. The meetings of the Committee were held regularly during 1996-97.

'Hindi Pakhwara' was organised in the Institute from 14 to 28 September, 1996. The main function was held on September 17, 1996 with noted writer Shri K.P. Saxena as the Chief Guest. A 'Kavya Sandhya' and 'Hindi Prashna Manch' were organised on September 27, 1996 in which quite a large number of scientific, technical and administrative staff members actively participated. Hindi Typewriting contest was also organised during the 'Hindi Pakhwara'.

The use of Hindi in Electronic Data Processing work in the Institute is on gradual increase. A number of books in Hindi were also added in the Library of the Institute.

Reservations and Concessions

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

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

Scientists

Deputy Directors

G. Rajagopalan, Ph.D., F.Pb.S., F.G.S. (Acting Director)

Nilamber Awasthi, Ph.D., F.Pb.S., F.I.A.P. (Retired w.e.f. 31.12.1996)

K.P. Jain, Ph.D., F.Pb.S., F.I.A.P., F.P.S. (Retired w.e.f. 30.09.1996)

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

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

Assistant Directors (Special Grade)

Anand Prakash, Ph.D., F.I.A.P., F.Pb.S.

Jayasri Banerji, Ph.D., F.Pb.S., F.P.S.

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

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

H.P. Gupta, Ph.D., F.I.A.P., F.Pb.S.

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

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

Chhaya Sharma, Ph.D., F.I.A.P., F.Pb.S.

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

Assistant Directors

Krishna Ambwani, Ph.D., F.S.G., F.P.S.

J.S. Antal, Ph.D., F.Pb.S.

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

J.S. Guleria, Ph.D.

C.M. Nautiyal, Ph.D.

R.K. Saxena, Ph.D., F.S.G., F.P.S., F.Pb.S.

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

A.K. Srivastava, Ph.D., F.S.G., F.I.C.S., F.Pb.S., F.P.S.

G.P. Srivastava, Ph.D., F.Pb.S.

Shyam C. Srivastava, Ph.D.

Archana Tripathi, Ph.D., F.P.S., F.G.A.R.C.

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

Senior Scientific Officers

Anil Agarwal, Ph.D.

Usha Bajpai, Ph.D.

B.N. Jana, Ph.D.

Neerja Jha, Ph.D., F.P.S.

H.A. Khan, Ph.D.

Asha Khandelwal, Ph.D.

Pramod Kumar, Ph.D.

J.P. Mandal, Ph.D.

B.K. Misra, Ph.D., F.S.G., F.A.E.G.

Ram Awatar, D.Phil.

M.R. Rao, Ph.D.

Samir Sarkar, Ph.D.

Rakesh Saxena, Ph.D., F.G.M.I.

R.S. Singh, Ph.D.

Chanchala Srivastava, Ph.D.

S.K.M. Tripathi, Ph.D.

R.R. Yadav, Ph.D.

Junior Scientific Officers

Rupendra Babu, Ph.D.

S.K. Bera, Ph.D.

Amalava Bhattacharyya, Ph.D.

A.P. Bhattacharyya, Ph.D.

M.S. Chauhan, Ph.D.

Anjum Farooqui, Ph.D.

A.K. Ghosh, Ph.D.

Asha Gupta, Ph.D., F.L.S., F.P.S., F.S.P.R.

Khowaja Ateequzzaman, Ph.D.

Madhav Kumar, Ph.D.

B.D. Mandaokar, Ph.D.

K.L. Meena, Ph.D.

R.C. Mehrotra, Ph.D.

Jitendra Pandey, Ph.D. (Resigned w.e.f. 10.02.1997)

Neeru Prakash, Ph.D.

Mahesh Prasad, Ph.D.

Vandana Prasad, Ph.D.

Jyotsana Rai, Ph.D., F.P.S.

A. Rajanikanth, Ph.D., F.G.S., F.P.S.

D.C. Saini, Ph.D.

O.S. Sarate, Ph.D., LL.B.

Mukund Sharma, Ph.D., F.G.S.

Alpana Singh, Ph.D.

B.D. Singh, Ph.D., F.S.G., F.G.M.M.S., F.A.E.G.

K.J. Singh, Ph.D.

Rashmi Srivastava, Ph.D., F.P.S.

Rajni Tewari, Ph.D.

G.K. Trivedi, Ph.D., F.P.S.

Birbal Sahni Research Scholars

Ratan Kar, M.Sc.

Manisha Nanda, M.Sc. (Tenure expired on 08.11.1996)

A.K.S. Pokharia, M.Sc.

Shinjini Sarana, M.Sc.

S.M. Singh, M.Sc.

Sponsored Project (DST/Ministry of Environment)

Rashmi Tewari, M.Sc. Ph.D. (RA)

Poonam Sharma, M.Sc. (JRF)(Tenure expired on 27.02.1997)

Reema Singh, M.Sc. (JRF)(Tenure expired on 27.02.1997)

S. Chatterjee, M.Sc.(JRF)(Resigned w.e.f. 29.11.1996)

Deepak Kohli, M.Sc. (JRF)(Resigned w.e.f. 30.07.1996)

Vandana Chowdhary, M.Sc. (PA)

Sheenu Sharma, M.Sc. (PA)

L.M. Joshi (Field Assistant) (Resigned w.e.f. 06.01.1997)

Technical and Administrative Personnel
Technical

Publications

R.L. Mehra, B.A., D.P.T., P.G.D.C.A. (Proof Reader)

Library

Kavita Kumar, B.Sc., B.Lib.Sc. (S.T.A.)

V.K. Nigam, M.Com., B.Lib.Sc. (J.T.A.)

Y.P. Singh, B.Tech. (J.T.A.—Computer)

S.R. Yadav, B.A. (J.T.A.—Temporary officiating)

Avanish Kumar, B.Sc., LL.B., P.G.D.C.A. (Console Operator)

Museum

P.K. Bajpai, B.F.A. (T.O.—Artist)

J.N. Nigam, B.A., B.Lib.Sc. (J.T.O.) (Retired on 31.10.1996)

Kamla M. Chhabra, B.Sc. (J.T.O.)

Prem Prakash, B.Sc. (S.T.A.)

S.N. Meena, B.Sc. (J.T.A.) (Resigned w.e.f. 26.02.1996)

Herbarium

Diwakar Pradhan, B.Sc. (J.T.O.)

Photography

P.C. Roy (J.T.O.)

Pradeep Mohan, B.F.A. (S.T.A.)

Laboratory Services

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

Madhavi Chakraborty, M.Sc., Ph.D. (J.T.O.)

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

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

E.G. Khare, M.Sc. (J.T.O.)

T.K. Mandal, B.Sc. (J.T.O.)

V.K. Singh, M.Sc. (J.T.O.)

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

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

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

V.P. Singh, B.Sc. (S.T.A.)

A.K. Srivastava, B.Sc. (S.T.A.)

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

Keshav Ram, B.A. (J.T.A.)

Vinesh Kumar, M.Sc. (J.T.A.) (Resigned w.e.f. 27.11.1996)

Technical Services

K. Nagapooshanam, B.Tech. (Programmer — Computer)

Madhukar Arvind, B.Sc. (J.T.A.—Computer)

A.K. Srivastava, B.Com., B.Lib.Sc. (Console Operator)

V.S. Panwar (Glass Blower)

A.K. Ghosh, G.I.T.I., N.C.T.V.T., E.S.C. (Electrician)

M.S. Rana, B.A., I.T.I. (Generator Operator)

Chandra Bali I.T.I., N.C.T.V.T. (Mechanic)

Chhotey Lal, I.T.I., N.C.T.V.T., D.E.E.S.I. (Mechanic)

S.C. Singh, B.A. (Mechanic-cum-Section Cutter)

Administration

Registrar

S.C. Bajpai, M.Sc., LL.B., F.I.E.T.E.

Accounts Officer

J.C. Singh, M.A.

P.S. to Director

S.P. Chadha, B.A.

Section Officers

B.K. Jain, B.A. (Retired on 30.11.1996)

I.J. Mehra, B.A.

Bhagwan Singh

H.S. Srivastava, B.Com.

R.K. Takru, B.A.

Maintenance Officer
R.B. Kukreti, B.A.

Accountant
Ramesh Chandra

Assistants
I.J.S. Bedi
N.N. Joshi
R.K. Kapoor, B.A.
V. Nirmala

Stenographer
M. Jagath Janani, B.A.

Upper Division Clerks
Ruchita Bose, M.A.
Usha Chandra
Dhoom Singh, B.A.
P. Thomas
Hari Lal (Officiating)
Swapna Mazumdar, B.A. (Officiating)
Gopal Singh, B.A. (Officiating)
K.P. Singh (Officiating)
Koshy Thomas (Officiating)

Lower Division Clerks
Mishri Lal, M.A.
S.S. Panwar, B.A.
Rameshwar Prasad
Shail S. Rathore, B.A.
A.K. Srivastava, B.A., B.Ed.
Renu Srivastava, M.A.
N. Unnikannan

Drivers
Nafees Ahmed
D.K. Misra

M.M. Misra

V.P. Singh

General Help

Sarju Prasad (Daftari)

Sia Ram (Duplicating Machine Operator)

Mohammad Shakil (Binder)

Attendants

K.C. Chandola

Prem Chandra

Sunder Lal

Haradhan Mahanti

Raja Ram

Satruhan

Ram Singh

Peons

R.K. Awasthi

K.K. Bajpai, B.A.

Maya Devi

V.S. Gaikwad, B.A.

Hari Kishan

Ramesh Kumar

Dhan B. Kunwar

S.C. Misra

Munni

Kailash Nath

Mani Lal Pal

Mahadev Prasad

Ram Dheeraj

Ram Kishan

Ram Ujagar

Shree Ram

Bam Singh

K.N. Yadav

Chowkidars

Kesho Ram

Ram Deen

Ram Dhari (Retired on 31.12.1996)

Malis

Rameshwar Prasad Pal (Skilled)

Mathura Prasad (Unskilled)

Ram Chander (Unskilled)

Ram Kewal (Unskilled)

Appointments and Promotions

Appointments

Sri S.P. Chadha, P.S. to Director re-employed w.e.f. 01.11.96 for one year.

Miss Lily Misra, Junior Research Fellow (Sponsored Project — Ministry of Environment & Forest) w.e.f. 13.01.97

Miss Alka Srivastava, Junior Research Fellow (Sponsored Project — Ministry of Environment & Forest) w.e.f. 13.01.97

Retirements

Dr K.P. Jain, Deputy Director, retired on 30.09.1996

Sri J.N. Nigam, Junior Technical Officer, retired on 31.10.1996

Sri B.K. Jain, Section Officer, retired on 30.11.1996

Dr N. Awasthi, Deputy Director, retired on 31.12.1996

Sri Ram Dhari, Chowkidar, retired on 31.12.1996

Papers/Reviews/Articles submitted

Agarwal, A. — A fossil wood of *Terminalioxylon varkalaensis* Awasthi & Ahuja from Neyveli lignite deposits, India. *J. Indian bot. Soc.*

Ambwani, K. — Pollen morphology and aperture development in African oil palm, *Elaeis guineensis* Jacq. *Prof. C.G.K. Ramanujam Comm. Vol.*

Antal, J.S., Prasad, M. & Khare, E.G. — Fossil woods from the Siwalik sediments of Darjeeling District, West Bengal, India. *Palaeobotanist.*

Awasthi, N. & Mehrotra, R.C. — Some fossil dicotyledonous woods from the Neogene of Arunachal Pradesh, India. *Palaeontographica.*

Awasthi, N. & Mehrotra, R.C. — *Givotioxylon ricinodendroides* gen. et sp. nov., a fossil wood from the Neogene sediments of Tipam District, Arunachal Pradesh. *Prof. C.G.K. Ramanujam Comm. Vol.*

Awasthi, N. & Srivastava, R. — Neogene flora of Kerala Coast and its palaeoecological and phytogeographical implications. *Prof. C.G.K. Ramanujam Comm. Vol.*

Bajpai, U. — Taphonomic constraints on preservation of cuticles in compression fossils: fungi induced ultrastructural changes in cuticular membranes. *Palaeobotanist.*

Bajpai, U. & Singh, T. — On a fossil wood from the Garu Formation (Permian) of Arunachal Pradesh, India. *Palaeobotanist.*

Banerji, J. — Floral change across the Permo-Triassic Boundary in Damodar and Auranga Valleys. *Palaeobotanist.*

Banerji, J. & Jana, B.N. — Early Cretaceous megafossils from Balidih, Rajmahal Basin, India. *Geophytology.*

Bera, S.K., Farooqui, A. & Gupta, H.P. — Late Pleistocene/Holocene vegetation and environment in and around Marian Shola, Palni Hills, south India. *Palaeobotanist.*

Bera, S.K. & Gupta, H.P. — Late Holocene vegetation development in Anamalai Hills, Tamil Nadu, south India. *Palaeobotanist.*

Bera, S.K. & Gupta, H.P. — Pollen interplay in and around Dokriani Glacier, Garhwal Himalaya, Uttarkashi. *Prof. C.G.K. Ramanujam Comm. Vol.*

Bera, S.K., Gupta, H.P. & Farooqui, A. — Berijam Lake: 20,000 years sequence of palaeofloristics and palaeoenvironment in Palni Hills, south India. *Geophytology.*

Bhattacharyya, A. & Chauhan, M.S. — Vegetational and climatic changes during recent past around Tipra Bank Glacier, Garhwal Himalaya. *Curr. Sci.*

Bhattacharyya, A.P. — Palynological dating of subsurface sediments from Wardha Valley Coalfield, India. *Palaeobotanist.*

Chandra, A. & Saxena, R.K. — Lithostratigraphy of the Car Nicobar Island, Andaman and Nicobar Islands, India. *Geophytology.*

Chandra, S. & Keqin, S. — Evolution and comparison of the Gondwana flora and the Cathaysia flora. *Palaeobotanist.*

Chandra, S. & Singh, K.J.— Floristic evolution of Talchir Formation and its equivalents in other parts of Gondwana. *Prof. C.G.K. Ramanujam Comm. Vol.*

Chauhan, M.S., Sharma, C. & Rajagopalan, G.— Vegetation and climate during Late Holocene in Garhwal Himalaya. *Palaeobotanist.*

Choudhry, M.D., Mehrotra, R.C. & Majumder, B.I. — *Gluta* from a new locality of Tipam Sandstone, Assam, India. *Phytomorphology.*

Ghosh, A.K., Jana, B.N. & Maithy, P.K. — Distribution pattern of calcareous algae across the Cretaceous-Tertiary sequence of Cauvery Basin in Tiruchirapalli District, Tamil Nadu. *Palaeobotanist.*

Guleria, J.S. — On the occurrence of two monocots in the Deccan Intertrappean sediments of Kachchh, western India. *Prof. C.G.K. Ramanujam Comm. Vol.*

Guleria, J.S. & Awasthi, N. — Fossil woods and their significance. *Curr. Sci.*

Guleria, J.S., Mehrotra, R.C. & Awasthi, N. — On the nomenclature of Cenozoic megafossils. *Prof. C.G.K. Ramanujam Comm. Vol.*

Guleria, J.S., Saini, D.C., Sekar, B., Bera, S.K. & Kumar, M. — A preliminary study of indicator plants of copper and manganese occurring in the ore-rich areas of Balaghat District, Madhya Pradesh, India. *Geophytology.*

Gupta, H.P. & Bera, S.K. — Vegetation and environment of Palni Hills, south India since 50,000 years B.P. *Prof. C.G.K. Ramanujam Comm. Vol.*

Jafar, S.A. & Singh, O.P. — Fossil coccoliths from Late Miocene of Sawai Bay Formation of Neill Island, Andaman sea, India. *J. Palaeontol. Soc. India.*

Jana, B.N., Banerji, J. & Kar, R.K. — First occurrence of *Isoetites serratifolius* Bose & Roy from the Deccan Intertrappean beds of Kutch, Gujarat. *Curr. Sci.*

Karpavichus, J., Karaitis, J. & Yadav, R.R. — Influence of climatic factors on the radial growth of Scots pine and Norway spruce in Kaunas Lithuania. *Korean J. Ecol.*

Kedves, M., Tripathi, S.K.M., Ver, A., Pardutz, A. & Rojik, I. — Experimental studies on *Botryococcus* colonies from Hungarian Upper Tertiary oil shale. *Plant Cell Biol. Developm.*

Khan, H.A. — Significance of Silent Valley bio-reserve microclimate in plant diversity. *Proc. IGBP Symp.,* Bhubaneshwar.

Khan, H.A. — Pollen morphological diversity of *Cissampelos pareira* L. in Silent

Valley. *Prof. C.G.K. Ramanujam Comm. Vol.*

Khandelwal, A. — Long term registration of air-borne pollen/spores and its allergenic significance. *Aerobiologia.*

Khandelwal, A., Chatterjee, S. & Prasad, R. — Significance of fungi in the house dust of asthmatic patients in Lucknow. *Geophytology.*

Kotlia, B.S., Bhalla, M.S., Sharma, C., Rajagopalan, G., Ramesh, R., Chauhan, M.S., Mathur, P.D., Bhandari, S. & Chacko, S.T. — Palaeoclimatic conditions in the Upper Pleistocene and Holocene Bhimtal-Naukuchiatal Lake Basin in south-central Kumaun, north India. *Palaeogeogr. Palaeoclim. Palaeoecol.*

Kumar, P. — Palynostratigraphy and palaeoecology of Tamia Scarp (Pachmarhi Formation) of Satpura Basin, Madhya Pradesh. *Prof. C.G.K. Ramanujam Comm. Vol.*

Kumar, P. — Palynostratigraphy of Almod Bed in Satpura Basin, India. *Palaeobotanist.*

Maheshwari, H.K. — Review of the Book "Systematic study of plant fossils from Dagshai, Kasauli and Dharamsala Formations of Himachal Pradesh" by A. Mathur *et al. J. geol. Soc. India.*

Maheshwari, H.K. & Bajpai, U. — Significance of ultrastructural studies on fossil plant cuticles. *Abstr. & Proc. Memorial Conf. dedicated to Vsevolod Andreevich Vakhrameev, Moscow.*

Mandal, J. & Kumar, M. — Palynological distribution pattern across the Palaeocene-Eocene of northeast and western India. *Palaeobotanist.*

Mandaokar, B.D. & Ambwani, K. — A report on Tertiary plants and animal megafossils from Arunachal Pradesh. *Prof. C.G.K. Ramanujam Comm. Vol.*

Meena, K.L. — Palynological dating of subsurface Kamthi sediments in Ib-River Coalfield, Orissa. *Geophytology.*

Mehrotra, R.C. & Mandaokar, B.D. — Fossil wood of *Duabanga* from Tipam Sandstone of Tinsukia District, Assam. *Geophytology.*

Misra, B.K., Singh, B.D. & Singh, A. — Maceral alginite in Indian coals and lignites: Its influence and significance. *J. Econ. Geol.*

Nautiyal, C.M. — Birbal Sahni Institute of Palaeobotany (script for documentary). "*Doordarshan, Lucknow*".

Nautiyal, C.M. — Jivanmaya mangal and Mangalmaya Jivan. *Swatantra Bharat.*

Pal, P.K. & Ghosh, A.K. — Late Early Triassic mioflora from the Panchet Formation of East Bokaro Coalfield, India. *Geophytology.*

Pal, P.K., Ghosh, A.K. & Sannigrahi, A. — Megaspores from the Panchet Formation of East Bokaro Coalfield, India. *J. palaeontol. Soc. India.*

Park, W.-K. & Yadav, R.R. — Influence of climatic factors on radial growth of *Pinus*

densiflora in central Korea. *Canadian J. For. Res.*

Park, W.-K. & Yadav, R.R. — Tree-ring analysis of *Pinus densiflora* from Mt Chiri in southern Korea. *Annales de Forest Res.*

Prakash, N. — The genus *Phlebopteris* in the Indian Gondwana. *Geophytology.*

Prasad, M. & Awasthi, N. — Contribution to the Siwalik flora from Surai Khola sequence, western Nepal and its palaeoecological and phytogeographical implications. *Palaeobotanist.*

Rajanikanth, A. — Upper Cretaceous palynoassemblage from the Cauvery Basin. *Phytomorphology.*

Ram-Awatar — Palynological evidence for the Permo-Triassic Boundary in Sohagpur Coalfield, Madhya Pradesh, India. *Palaeobotanist.*

Ram-Awatar — A case of "marginal palynology" from Son Valley, Madhya Pradesh, India. *Geophytology.*

Rao, M.R. — Angiosperm pollen in stratigraphy with special reference to Oligocene-Miocene sediments of south India. *Prof. C.G.K. Ramanujam Comm. Vol.*

Rao, M.R. & Nair, K.K. — Palynological investigation of Miocene sediments exposed in Kundara-Kannanelur area, Quilon District, Kerala. *Geophytology.*

Saraswat, K.S. — Plant economy of Barans at Ancient Sanghol (Ca. 1900-1400 B.C.), Punjab. *Pragdhara.*

Saraswat, K.S., Srivastava, C. & Pokharia, A.K.S. — Palaeobotanical and pollen analytical investigations (1993-94). *Indian Archaeology: A review* (1993-94). *Archaeol. Surv. India, New Delhi.*

Saraswat, K.S., Srivastava, C. & Pokharia, A.K.S. — Palaeobotanical and pollen analytical investigations (1994-95). *Indian Archaeology: A review* (1994-95).

Sarate, O.S. — Biopetrological study of Koyagudem coals, Godavari Basin, Andhra Pradesh, India. *Geophytology.*

Sarkar, S. — A Siwalik palynoflora from Rehar area of western Nepal and its palaeoecological significance. *Sci. Cult.*

Sarkar, S. — Manav Jibon me Paragkano ki Bhumika. *Vigyan Garima Sindhu.*

Sarkar, S. — Tel Anusandhan me Ghurnikasabh putiyon ki Upzogita. *Vigyan Ganga.*

Sarkar, S. & Bhattacharyya, A.P. — Occurrence of palynofossils from Lower Siwalik sediments exposed near Kathgodam, Uttar Pradesh. *J. Rec. Adv. Appl. Sci.*

Saxena, R.K. & Khare, S. — *Gemmatriporopollis*, a new pollen genus from Neyveli Lignite mines and Jayamkondacholapuram Well-12 in Tamil Nadu, India. *Geophytology.*

Saxena, R.K. & Rao, M.R. — Palynological investigation of the Boldamgiri Formation (Early Miocene) in type area, Garo Hills, Meghalaya. *Geophytology.*

Saxena, R.K., Tripathi, S.K.M. & Prasad, V. — Palynofloral investigation of the Tura Formation (Palaeocene) in Nongwal Bibra area, East Garo Hills, Meghalaya. *Geophytology.*

Sharma, C., Chauhan, M.S. & Rajagopalan, G. — Vegetation and climate in Garhwal Himalaya during last 4,000 years B.P. *J. Nepal geol. Soc., Nepal.*

Sharma, C. & Gupta, A. — Early Holocene sequence of palaeofloristics and climate in Garhwal Himalaya. *Palaeobotanist.*

Sharma, M. & Shukla, M. — Microstructures and microfabric studies of palaeoproterozoic small digitate stromatolite (ministromatolites) from Vempalle Formation, Cuddapah Supergroup, India. *J. palaeontol. Soc. India.*

Singh, A. — Koyala: Prakriti ki Anmol Den. *Vigyan Garima Sindhu.*

Singh, A. & Misra, B.K. — Typical liptinitic bodies from Neyveli lignites (Tamil Nadu), India. *Curr. Sci.*

Singh, K.J. & Chandra, S. — Plant fossils from the exposure near Gopal Prasad Village, Talcher Coalfield, Orissa and remark on the age of the bed. *Geophytology.*

Singh, R.S. — Diversity of *Nypa* in the Indian subcontinent : Late Cretaceous to Recent. *Palaeobotanist.*

Srivastava, A.K. — Floristic pattern in the Lower Gondwana sediments of India. *Proc. Natn. Symp. Rec. Res. Sedimentary Basins* and *XIII Conv. Indian Assoc. Sedimentol.*

Srivastava, A.K. — Insect and insect activities in Permian Gondwana of India. *Permophiles.*

Srivastava, A.K. & Srivastava, G.P. — Insect gall impression on fossil angiospermic leaf. *Geophytology.*

Srivastava, A.K. & Tewari, R. — Plant fossils from the Barakar Formation of Auranga Coalfield. *Geophytology.*

Srivastava, G.P. — Impact of Himalayan uplift on the Late Cenozoic flora of India. *Proc. V Quadr. Conf. IOP, Santa Barbara.*

Srivastava, R. & Awasthi, N. — Fossil woods from Neogene of Warkalli beds of Kerala Coast and their palaeoecological significance. *Geophytology.*

Srivastava, R. & Saxena, R.K. — Carbonised woods from the Sindhudurg Formation (Miocene) in Ratnagiri and Sindhudurg districts, Maharashtra, India. *Geophytology.*

Srivastava, Shyam C. — *Ramanujamiastrobus* gen. nov., a new pollen cone from Middle Triassic of (Nidpur), India. *Prof. C.G.K. Ramanujam Comm. Vol.*

Srivastava, Shyam C. — Genus *Krauselitheca* Srivastava : A detached microsporangium from Middle Triassic (Nidpur) of India displaying

pteridophytic affiliation. *Indian Fern J.*

Srivastava, Suresh C., Anand Prakash & Kar, R. — Palynology of Permian-Triassic sequence in Iria Nala, Tatapani-Ramkola Coalfield, M.P., India. *Palaeobotanist.*

Srivastava, Suresh C. & Jha, N. — Stratigraphic correlation of coal resources in Godavari Graben: Palynological parameter. *Proc. Natn. Symp. Rec. Res. Sed. Basins* and *XIII Conv. Indian Assoc. Sedimentol.*

Srivastava, Suresh C. & Jha, N. — Kamthi Formation : Palaeobotanical evidences. *Palaeobotanist.*

Srivastava, Suresh C. & Jha, N. — Palynology of coal-bearing sediments in Bhopalpalli area, Godavari Graben. *J. geol. Soc. India.*

Tripathi, A. — Pollen group showing angiospermoid characters from Late Permian of peninsular India. *Geophytology.*

Tripathi, A. — Representation of acritarchs across the Permo-Triassic Boundary. *Palaeobotanist.*

Tripathi, A. — An acritarch assemblage from Triassic sediments of the Talcher Coalfield, Orissa, India. *Proc. Int. Workshop CIMP Acritarch Subcommission, Prague.*

Tripathi, A. & Vijaya — Biostratigraphic age determination of Sriperumbudur Formation in bore-hole PBSD-1, Palar Basin, Tamil Nadu: A reassessment. *J. palaeontol. Soc. India.*

Vijaya, Tripathi, A. & Ram-Awatar — Pattern of index spore-pollen species at Inter-formational boundaries through Permian sequence on peninsular India. *Palaeobotanist.*

Vijaya — Benchmark Permian-Triassic palynoevents on peninsular India and north-west Tethys Himalaya. *J. palaeontol. Soc. India.*

Vijaya — Palynodating of Inter- and Infratrappean sediments in Mesozoic sequence of bore-hole PGD-6, Domra sub-basin, West Bengal, India. *Cretaceous Res.*

Vijaya — Early Permian Talchir palynoassemblage from Ajay River Section, Damodar Basin, West Bengal, India. *Geophytology.*

Yadav, R.R. — Tree-ring and climate change studies : Indian Scenario. *Proc. 4th Forest Sci. Sem., Cheongju, Korea.*

Yadav, R.R., Bhattacharyya, A. & Park, W.-K. — Climate and growth relationship in blue pine (*Pinus wallichiana*) from the western Himalaya, India. *Korean J. Ecol.*

Yadav, R.R., Park, W.-K. & Bhattacharyya, A. — Dendroclimatic reconstruction of April-May temperature fluctuations in the western Himalayan region, India. *Quaternary Res.*

Yadav, R.R., Park, W.-K. & Bhattacharyya, A. — A 818-year tree-ring based spring precipitation reconstruction for the western Himalayan region, India. *Palaeogeogr. Palaeoclim. Palaeoecol.*

Yadav, R.R., Park, W.-K. & Bhattacharyya, A. — A spring temperature variations over the western Himalayan region as reconstructed from tree-ring: AD 1398-1987. *The Holocene.*

Papers/Reviews/Articles published

Agarwal, A. 1996. Evolutionary status of fossil woods assemblages of Neyveli lignite, Tamil Nadu and Varkala (Warkalli) Bed, Kerala, India. *J. Rec. Adv. Appl. Sci.* **11**(1-2): 1-11.

Agarwal, A. 1996. Two fossil woods from the Neyveli lignite deposits, Tamil Nadu, India. *J. Indian bot. Soc.* **75**: 1-2.

Ambwani, K. & Singh, R.S. 1996. Palynological studies of subsurface sediments of Raneri, district Bikaner, Rajasthan. *Palaeobotanist* **43**(3): 139-142.

Anand-Prakash, Misra, B.K. & Singh, B.D. 1996. Fluorescence microscopy in the evaluation of Indian Gondwana coals. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **2** : 1265-1272.

Anand-Prakash, Srivastava, G.P. & Kar, R. 1996. Imprint of neo-tectonic activity in Mahuadanr Valley, Palamu, Bihar. *Geophytology* **26**(1) : 77-81.

Antal, J.S. & Prasad, M. 1996. Some more leaf-impressions from Himalayan foot-hills of Darjeeling District, West Bengal and their palaeoecological significance. *Palaeobotanist* **43**(2): 1-9.

Antal, J.S. & Prasad, M. 1996. Dipterocarpaceous fossil leaves from Ghish River section in Himalayan foot-hills near Oodlabari, Darjeeling District, West Bengal. *Palaeobotanist* **43**(3): 73-78.

Antal, J.S., Prasad, M. & Khare, E.G. 1996. Fossil woods from the Siwalik sediments of Darjeeling District, West Bengal, India. *Palaeobotanist* **43**(2): 98-105.

Antal, J.S. & Prasad, M. 1996. Leaf-impressions of *Polyalthia* Bl. in the Siwalik sediments of Darjeeling District, West Bengal. *Geophytology* **26**(1) : 125-127.

Awasthi, N., Guleria, J.S., Prasad, M. & Srivastava, R. 1996. Occurrence of *Acrostichum* Linn., a coastal fern in the Tertiary sediments of Kasauli, Himachal Pradesh, North-west Himalaya. *Palaeobotanist* **43**(2): 83-87.

Awasthi, N., Mehrotra, R.C. & Khare, E.G. 1996. A borassoid palm root from the Deccan Intertrappean beds of Wardha District, Maharashtra with critical remarks on fossil roots of *Eichhornia*. *Geophytology* **26**(1) : 57-61.

Awasthi, N., Mehrotra, R.C. & Srivastava, R. 1996. Fossil woods from the Deccan Intertrappean beds of Madhya Pradesh. *Geophytology* **25**: 113-118.

Bagati, T.N., Mazari, R.K. & Rajagopalan, G. 1996. Palaeotectonic implications of Lamayuru Lake (Ladakh). *Curr. Sci.* **71**: 479-482.

Bajpai, U., Maheshwari, H.K. & Kapoor, H.M. 1996. Late Palaeozoic floral succession in the peri-Gondwana. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1** : 251-260.

Banerji, J. 1996. Recent records of Mesozoic ferns from Rajmahal Basin. *Indian Fern J.* **12** : 70-78.

Banerji, J. 1996. Upper Gondwana megafloral succession of Rajmahal Basin, India. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1** : 269-281.

Banerji, J. 1996. Early Cretaceous megaflora from Murlipahar, Rajmahal Basin, India. *Geophytology* **25**: 41-46.

Bera, S.K., Gupta, H.P. & Farooqui, A. 1996. Berijam Lake : 20,000 years sequence of palaeofloristics and palaeoenvironment in Palni Hills, south India. *Geophytology* **26**(1) : 99-104.

Bhattacharyya, A. & Chauhan, M.S. 1997. Vegetation and climatic changes during recent part around Tipra Bank Glacier, Garhwal Himalaya. *Curr. Sci.* **72** : 408-412.

Bhattacharyya, A. & Yadav, R.R. 1996. Dendrochronological reconnaissance of *Pinus wallichiana* to study glacial behaviour in the western Himalaya. *Curr. Sci.* **70**: 739-744.

Chandra, A. 1997. First report of fossil diatoms from Anderson, Andaman and Nicobar Islands, India. *Sci. Cult.* **62**(11-12):273-276.

Chandra, S. 1996. Bryophytic remains from the Early Permian sediments of India. *Palaeobotanist* **43**(2): 16-48.

Chandra, S. & Keqin, S. 1996. Distribution, evolution and extinction of global Early Carboniferous flora. *Palaeobotanist* **43**: 88-94.

Chandra, S. & Singh, K.J. 1996. On *Euryphyllum* Feistmantel and its epidermal features. *Palaeobotanist* **45** : 7-14.

Chandra, S. & Singh, K.J. 1996. Plant fossils from the type locality of Talchir Formation and evidence of earliest plant/animal activity in Gondwana of India. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1** : 397-414.

Chauhan, M.S. & Sharma, C. 1996. Pollen analysis of Mid-Holocene sediments from Kumaon Himalaya. *Geol. Surv. India, Spl. Publ.* **21**(1) : 257-269.

Chauhan, M.S. & Sharma, C. 1996. Late-Holocene vegetation of Darjeeling (Jore-Pokhari), eastern Himalaya. *Palaeobotanist* **45**: 125-129.

Ghosh, A.K. & Maithy, P.K. 1996. On the present status of Coralline red alga *Archaeolithothamnium* Rothpletz recorded from India. *Palaeobotanist* **45** : 64-70.

Guleria, J.S. 1996. Occurrence of *Dipterocarpus* in the Mar Formation of Bikaner, Rajasthan, western India. *Palaeobotanist* **43**(2): 49-53.

Guleria, J.S. & Awasthi, N. 1997. Fossil woods and their significance. *Curr. Sci.* **72**(4): 248-254.

Guleria, J.S., Bande, M.B. & Awasthi, N. 1996. Fossil records and antiquity of

some common plants in India. *Rheedea* **6**(1) : 13-27.

Gupta, H.P. & Bera, S.K. 1996. Silent Valley : A correlation between pollen spectra and vegetation. *Palaeobotanist* **43**(2) : 139-144.

Jafar, S.A. & Kar, R.K. 1996. Glossopterid flora : A case for wetland mangrove vegetation ? *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994),* **1** : 331-338.

Jha, N. 1996. Some new pollen grains from Late Permian sediments of Godavari Graben and their stratigraphic significance. *Geophytology* **25** : 67-75.

Jha, N. 1996. Koyla Utkhanan mein Puraparaganuvigyan Ka Mahatva : Godavari Droni ke Sandarbha mein. *Minetech.* **17**(4): 47-54 (in Hindi).

Jha, N. & Srivastava, Suresh C. 1996. Kamthi Formation : Palynofloral diversity. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994),* **1**: 355-368.

Karpavichus, J., Karaitis, J. & Yadav, R.R. 1996. Influence of temperature and moisture on the radial growth of scots pine and Norway spruce in Kaunas, Lithuania. *Korean J. Ecol.* **19** (4): 285-303.

Karpavichus, J., Yadav, R.R. & Karaitis, J. 1996. Radial growth response of pine (*Pinus sylvestris* L.) and spruce (*Picea abies* (L.) Karst.) to climate and geohydrological factors. *Palaeobotanist* **45** : 148-151.

Khan, H.A. 1996. Palynological study of some Indian Nymphaeaceae with reference to Silent Valley, Kerala. *J. Palynol.* **31**: 151-160.

Khan, H.A. 1996. Tree flora and plant associations of Silent Valley, Kerala. *Geophytology* **26**(1) : 105-108.

Khan, H.A. 1997. Pollen grains of some Indian Thalamiflorae. *Indian J. Appl. Pure Biol.* **12**(1) : 1-4.

Khandelwal, A., Chatterjee, S. & Prasad, R. 1996. Significance of fungi in the house dust of asthmatic patients in Lucknow. *Geophytology* **26**(1) : 39-41.

Kohli, D. & Khandelwal, A. 1996. Pushpa evam Pariavaran. *Cure*: 11-12 (in Hindi).

Kohli, D. & Chauhan, M.S. 1995. Rajasthan Ke Marusthal Ka Pura-vanaspatik Vishleshan. *Vigyan Garima Sindhu* **19** : 11-12 (in Hindi).

Kumar, M. 1996. Palynostratigraphy and palaeoecology of Early Eocene palynofloras of Rajpardi lignite, Bharuch District, Gujarat. *Palaeobotanist* **43** : 110-121.

Kumar, P. 1996. The Jabalpur Formation of Satpura Basin : Palynology and climate. *Proc. 9th Int. Gondw. Symp. Hyderabad (1994),* **1** : 369-386.

Kumar, P. 1996. Permo-Triassic palynofossils and depositional environment in Satpura Basin, Madhya Pradesh. *Geophytology* **25** : 7-54.

Maheshwari, H.K. 1997. Book review of "Systematic study of plant fossils from Dagshai, Kasauli and Dharamsala Formations of Himachal Pradesh" (1996) by

A.K. Mathur *et al. J. Geol. Soc. India* **49** : 350-351.

Maheshwari, H.K. & Bajpai, U. 1996. Significance of ultrastructural studies on fossil plant cuticles. *Abstr. & Proc., Memorial Conf. dedicated to Vsevolod Andreevich Vakhrameev, Moscow.*

Maheshwari, H.K. & Bajpai, U. 1996. Biochemical degradation of the cuticular membrane in an Early Cretaceous frond : A TEM study. *Curr. Sci.* **70**: 933-935.

Maheshwari, H.K. & Bajpai, U. 1996. Ultrastructure of "cuticular membrane" in two Late Triassic corystospermaceous taxa from India. *Palaeobotanist* **45** : 41-49.

Maheshwari, H.K., Kapoor, H.M. & Bajpai, U. 1996. Permian plant mega- and palynofossils from Gondwana equivalent sediments of Kashmir Valley. *Palaeobotanist* **43** : 145-150 (in Hindi).

Maithy, P.K. & Babu, R. 1996. Carbonaceous macrofossils from the Halkal Formation, Bhima Group, Karnataka with remarks on the age. *Palaeobotanist* **45** : 1-6.

Mandal, J. 1996. Palynofossils from the Tertiary (Barail Group) of Nagaland: Palaeoecological interpretation and age. *Palaeobotanist* **45** : 98-108.

Mandal, J., Chandra, A. & Kar, R. K. 1996. Palynological findings from the mud volcanoes of Baratang Island (Andaman & Nicobar Islands). *Geophytology* **25**: 77-81.

Mandaokar, B.D. 1996. A note on occurrence of reworked palynofossils in Tikak Parbat Formation, Ledo Colliery of Barail Group, Assam, India. *J. Rec. Adv. Appl. Sci.* **11**(1&2): 16-24.

Mandaokar, B.D. 1996. *Dillisporites*, a new genus from Dilli Colliery, Tikak Parbat Formation (Oligocene), Dibrugarh District, Assam, India. *J. Rec. Adv. Appl. Sci.* **11**(1&2): 29-33.

Mandaokar, B.D. 1996. Palynology of coal-bearing sediments of Tikak Parbat Formation, Dilli Colliery (Dilli-Jeypore Coalfield), Assam. *J. Rec. Adv. Appl. Sci.* **11**(1&2): 38-45.

Mazari, R.K., Bagati, N., Chauhan, M.S. & Rajagopalan, G. 1996. Palaeoclimatic record of past 2000 years in Trans-Himalayan Lahul-Spiti region. *Proc. Palaeoclim. Environ. Variability Austral-Asian Transect during past 2,000 years, Japan* : 262-269.

Misra, B.K. & Singh, B.D. 1996. Fluorescing inertinite macerals in Indian Gondwana coals with remarks on their genesis, terminology and coking potentiality. *Palaeobotanist* **43**(3) : 78-84.

Misra, B.K., Singh, B.D. & Anand-Prakash 1996. Biopetrographic approach to the spontaneous combustion susceptibility of Indian Gondwana coals: with reference

to some coals of Raniganj and Singrauli Coalfields. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **2**: 1257-1264.

Prasad, M. & Awasthi, N. 1996. Contribution to the Siwalik flora from Surai Khola sequence, western Nepal and its palaeoecological and phytogeographical implications. *Palaeobotanist* **43**(3): 1-40.

Rajanikanth, A. 1996. Acid rain, nuclear winter and radioactivity. *The Pioneer* (8-12-96) : 10.

Rajanikanth, A. 1996. Palaeobotany and stratigraphic implication of Mesozoic Gondwana sediments of Pranhita-Godavari Graben. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1** : 425-438.

Rajanikanth, A. 1996. Diversification and evolution of Early Cretaceous East Coast flora of India. *Palaeobotanist* **45** : 369-377.

Ram-Awatar 1996. Palynozonation of Middle Pali Member in Sohagpur Coalfield, Madhya Pradesh. *Palaeobotanist* **43**(3) : 96-101.

Ram-Awatar 1996. Palynological succession through Gondwana sediments in South Rewa Basin, Madhya Pradesh, India. *Geophytology* **26**(1) : 33-38.

Ram-Awatar 1996. Palynostratigraphy of Supra-Barakar sediments (Pali, Tiki and Parsora Formations) and their stratigraphic positions in South Rewa Basin, Madhya Pradesh, India. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1**: 439-454.

Rao, M.R. 1996. Palaeoecological and stratigraphical significance of pteridophytic spores in the Kerala Basin. *Indian Fern J.* **12**: 97-104.

Rao, M.R. 1996. An Early Miocene palynofloral assemblage from Turavur bore-hole, Alleppey District, Kerala : Its palaeoecological and stratigraphical significance. *Geophytology* **25** : 155-163.

Rao, M.R. & Rajendran, C.P. 1996. Palynological investigations of Tertiary lignite and associated sediments from Cannanore, Kerala Basin, India. *Palaeobotanist* **43** : 63-82.

Sahni, A., Venkatachala, B.S., Kar, R.K., Rajanikanth, A., Prakash, T., Prasad, G.V.R. & Singh, R.Y. 1996. New palynological data from the Deccan Intertrappeans : Implications for the latest record of dinosaurs and synchronous initiation of volcanic activity in India. *Mem. geol. Soc. India* **37** : 267-284.

Saini, D.C. 1996. Flora of Gorakhpur : Check list-1. *J. Econ. Tax. Bot.* **20** (1) : 35-83.

Saini, D.C. 1996. Ethnobotany of Tharus of Basti District, U.P. *In* : Maheshwari, J.K. (Editor) *Ethnobotany in South Asia, J. Econ. Tax. Bot.*, Add. ser. No. 12, : 138-158. Scientific Publishers, Jodhpur.

Saxena, R.K. 1996. Palynology of the Upper Siwalik sediments in north-western India. *Geol. Surv. India, Spl. Pub.* **21**: 249-255.

Saxena, R.K. & Bhattacharyya, A.P. 1996. *Dharamsalasporis*, a new pollen spore genus from the Dharamsala Group of Kangra District, Himachal Pradesh. *Geophytology* **25** : 165-166.

Saxena, R.K. & Khare, S. 1996. *Gemmatriporopollis*, a new pollen genus from Neyveli Lignite mines and Jayamkondacholapuram Well-12 in Tamil Nadu, India. *Geophytology* **26**(1) : 129-131.

Saxena, R.K. & Rao, M.R. 1996. Palynological investigation of the Boldamgiri Formation (Early Miocene) in type area, Garo Hills, Meghalaya. *Geophytology* **26**(1) : 43-56.

Saxena, R.K., Tripathi, S.K.M. & Prasad, V. 1996. Palynofloral investigation of the Tura Formation (Palaeocene) in Nongwal Bibra area, East Garo Hills, Meghalaya. *Geophytology* **26**(1) : 19-31.

Sekar, B. & Rajagopalan, G. 1997. Chemical analysis and C-14 dating of lake sediments and their significance for interpretation of the past climatic changes. *Proc. IGBP Symp. "Changes in global climate due to natural and human activities"* : 173-175. Allied Publishers Ltd.

Sharma, C. & Gupta, A. 1996. Vegetation history of Nachiketa Tal, Garhwal Himalaya, India. *J. Nepal geol. Soc.* **10**: 29-34.

Sharma, C. & Gupta, A. 1996. LM and SEM pollen studies of Indian Alangiaceae. *Palaeobotanist* **45**: 134-142.

Sharma, M. 1996. Microbiolite (stromatolites) from the Mesoproterozoic Salkhan Limestone, Semri Group, Rohtas, Bihar : Their systematics and significance. *Mem. geol. Soc. India* **36** : 167-199.

Singh, K.J. & Chandra, S. 1996. Further observations on the genus *Senotheca* Banerjee. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1** : 455-464.

Singh, K.J. & Chandra, S. 1996. Plant fossils from the exposure near Gopal Prasad Village, Talcher Coalfield, Orissa with remarks on the age of the bed. *Geophytology* **26**(1) : 69-75.

Srivastava, A.K. 1996. Morphology and taxonomy of Lower Gondwana pteridophytes from India. *Indian Fern J.* **12**: 51-58.

Srivastava, A.K. 1996. Plant/animal relationship in the Lower Gondwana of India. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1** : 549-555.

Srivastava, A.K. 1996. Nature and preservation of *Vertebraria* axes in the Lower Gondwana beds of India. *Acta Palaeobotanica* **35** : 189-193.

Srivastava, A.K. 1996. A summary of floral distribution in the Permian Gondwana sequence of India. *Permophiles* **28**: 11-12.

Srivastava, A.K., Chandra, S. & Singh, K.J. 1996. Trace fossils from Talchir Formation of Talcher Coalfield, Orissa. *Geophytology* **25**: 63-66.

Srivastava, A.K. & Tewari, R. 1996. Plant fossils from the Barakar Formation, Auranga Coalfield, Bihar. *Geophytology* **26**(1) : 83-88

Srivastava, R. 1996. Systematic anatomy of fossil woods in the Tertiary flora of India. *In*: Donaldson, L.A., Singh, A.P., Butterfield, B.G. & Whitehouse, L.J. (Editors)—*Recent advances in Wood Anatomy* : 129-138. New Zealand Forest Research Institute Ltd., Rotorua.

Srivastava, R. & Awasthi, N. 1996. Fossil woods from Neogene of Warkalli beds of Kerala Coast and their palaeoecological significance. *Geophytology* **26**(1) : 89-98.

Srivastava, Shyam C. & Manik, S.R. 1996. Reconsideration of *Savitrispermum* from Triassic of Gondwanas. *Geophytology* **26**(1) : 1-11.

Srivastava, Shyam C. & Prakash, N. 1996. Helically arranged aggregated scale leaves from the Triassic (Nidpur Beds) of Gondwana. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1** : 465-470.

Srivastava, Suresh C. & Bhattacharyya, A.P. 1996. Palynofloral assemblages from Permian sediments, West Siang District, Arunachal Pradesh, India. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1**: 261-268.

Srivastava, Suresh C. & Bhattacharyya, A.P. 1996. Permian/Triassic palynofloral succession in subsurface from Bazargaon, Nagpur District, Maharashtra. *Palaeobotanist* **43**(2): 10-15.

Srivastava, Suresh C. & Jha, N. 1996. Palynology of subsurface Permian sediments in Koyagudem area, Godavari Graben, Andhra Pradesh. *Geophytology* **25**: 131-136.

Tewari, R. 1996. Palaeobotanical investigations from Raniganj Formation of Jharia Coalfield. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1** : 135-143.

Tewari, R. 1996. Glossopterid fructifications from Upper Permian of India : A morphographical correlation. *Palaeobotanist* **45** : 315-323.

Tewari, R. & Srivastava, A.K. 1996. Plant fossils from Barakar Formation, Jharia Coalfield, Bihar. *Geophytology* **25**: 35-40.

Tiwari, R.S., Tripathi, A. & Nandhagopal, R. 1996. Computer aided programme - "DCB" for retrieval of references. *Geophytology* **25**: 151-154.

Tiwari, R.S., Vijaya & Tripathi, A. 1996. Gondwana palynostratigraphy from drill-core studies in coastal Tamil Nadu and Pondicherry. *J. geol. Soc. India* **48** : 65-74.

Tripathi, A. 1996. Early and Late Triassic palynoassemblage from subsurface Supra-Barakar sequence in Talcher Coalfield, Orissa. *Geophytology* **26**(1): 109-118.

Tripathi, A. 1996. Palynostratigraphic zonation of Upper Permian coal measures in peninsular India. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1**: 231-250.

Venkatachala, B.S., Saxena, R.K., Singh, H.P., Kar, R.K., Tripathi, S.K.M., Kumar, M., Sarkar, S., Mandal; J., Rao, M.R., Singh, R.S., Mandaokar, B.D. & Ambwani, K. 1996. Indian Tertiary angiospermous pollen : A critical assessment. *Palaeobotanist* **43**(2) : 106-138.

Venkatachala, B.S., Sharma, M. & Shukla, M. 1996. Age and life of the Vindhyans : Facts and conjectures. *Mem. geol. Soc. India* **36** : 137-165.

Vijaya 1996. Advent of Gondwana deposition of Indian Peninsula : A palynological reflection and relationship. *Proc. 9th Int. Gondw. Symp., Hyderabad, India (1994)* **1**: 283-298.

Vijaya 1997. Palynoflora from subsurface Lower Cretaceous Intertrappean beds in Domra sub-basin of the Raniganj Gondwana Basin, West Bengal, India. *Cretaceous Res.* **18**: 37-50.

Vijaya & Meena, K.L. 1996. Corpuscules in the Permian pollen from India. *J. Palaeontol. Soc. India* **41**: 57-61.

Vijaya, Srivastava, A.K. & Keqin, S. 1996. Origin of the Gondwana flora. *Geophytology* **25**: 119-124.

Vijaya & Tiwari, R.S. 1996. Status of the continental Jurassic on the Indian peninsula. *Proc. Symp. Continental. Jurassic, Flagstaff, Arizona :* 379-393.

Yadav, R.R. 1996. Tree-rings and climate change studies : Indian scenario. *Proc. 4th Forest. Sci. Sem., Cheongju, Korea* : 20-26.

Yadav, R.R. & Bhattacharyya, A. 1996. Biological inferences from the growth-climate relationship in teak (*Tectona grandis*) from dry deciduous forest in Andhra Pradesh, India. *Proc. Indian Natn. Sci. Acad.* **B62**: 233-238.

Yadav, R.R. & Bhattacharyya, A. 1996. Growth rings in *Araucarioxylon* and *Podocarpoxylon* (Coniferae) from the Tertiary of India and their climatic implications. *Tertiary Res.* **17**: 59-64.

Yadav, R.R. & Bhattacharyya, A. 1996. Climatic significance of growth rings in the Mesozoic woods from India. *Palaeobotanist* **45** : 57-63.

Abstracts submitted

Babu, R. & Maithy, P. K. — Noteworthy organic-walled microfossil assemblage from the Shale Member of the Upper Tal Formation, Mussoorie Syncline, Lesser Himalaya, Uttar Pradesh. *Conf. Biosed. Precambrian Basins, Lucknow.*

Bajpai, U. & Maheshwari, H.K. — Taphonomic constraints on preservation of cuticles in compression fossils: fungi induced ultrastructural changes in cuticular membranes. *30th Int. Geol. Congr., Beijing.*

Bajpai, U. & Maheshwari, H.K. — Importance of ultrastructural investigations of the fossilised cuticular membranes. *20th Natn. Conf. Electron Microscope Soc. India, Calcutta.*

Banerji, J. — Floral change across the Permo-Triassic Boundary in Damodar and Auranga Valleys. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Bhattacharya, S.K., Jani, R.A. & Maithy, P.K. — Stable isotopics of Proterozoic Bhima Basin, Karnataka. *Conf. Biosed. Precambrian Basins, Lucknow.*

Chandra, S. & Keqin, S. — Floral changes of the Carboniferous and Permian in Gondwana. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Chauhan, M.S., Sharma, C. & Rajagopalan, G. — Vegetation and climate during Late Holocene in Garhwal Himalaya. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Garg, R. & Jain, K.P. — Integrated phytoplankton stratigraphy across K/T Boundary at Um Sohryngkew, Meghalaya, northeast India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Ghosh, A.K., Jana, B.N. & Maithy, P.K. — Distribution pattern of calcareous algae across the Cretaceous-Tertiary sequence of Cauvery Basin in Tiruchirapalli District, Tamil Nadu. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Ghosh, A.K. & Maithy, P.K. — Calcareous skeletal algae across the Cretaceous-Tertiary sequence. *Yaounde 1997 Colloq., Soc. Nat. des Hydrocarb., Cameroon.*

Guleria, J.S. — Occurrence of fossil woods of *Barringtonia* in the Deccan Intertrappean and Miocene sediments of Kachchh, western India and the observed structural changes. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Gupta, A. — Spores through ages. *I.A.B. Symp. 2000's Bryology, Beijing.*

Gupta, A. — Spore types in bryophytes. *I.A.B Symp. 2000's Bryology, Beijing.*

Jana, B.N., Banerji, J. & Kar, R.K. — First occurrence of *Isoetites serratifolius* Bose & Roy from the Deccan Intertrappean beds of Kutch, Gujarat. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Jana, B.N. & Ghosh, A.K. — Megaspore assemblage from the Athgarh Formation and its biostratigraphic significance. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Khan, H.A. — Significance of Silent Valley bio-reserve microclimate in plant diversity. *IGBP Symp. "Changes in Global climate due to Natural and Human activities", Bhubaneshwar.*

Khandelwal, A. — Atmospheric concentration of grass pollen in Lucknow, India. *30th ICAI Conv., Ahmedabad.*

Kumar, B., Divakar Rao, V., Dayal, A.M., Tiwari, V.C. & Shukla, M. — C, O and Sr isotopes in the terminal Proterozoic Cambrian carbonates of India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Kumar, P. — Palynostratigraphy of Almod Bed in Satpura Basin, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Maheshwari, H.K. — Taxonomic position and affinities of the glossopterid group of plants from Gondwana Supergroup. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara.*

Maheshwari, H.K. — Permian-Triassic Boundary : An overview. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Maithy, P.K. & Babu, R. — Upper Vindhyan biota and Precambrian/Cambrian Boundary. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Maithy, P.K., Kumar, S., Babu, R. & Sharma, S. — Cellularly preserved microfossils from three billion years old Iron Ore Supergroup, Kashia area, Orissa, India. *Conf. Biosed. Precambrian Basins, Lucknow.*

Mandal, J. & Kumar, M. — Palynofloral distribution pattern across the Palaeocene-Eocene of northeast and western India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Misra, B.K. & Singh, B.D. — Fluorescing macerals : An update with reference to Indian coals and lignites. *Natn. Sem. Rec. Adv. Geology of Coal and Lignite Basins of India, Calcutta.*

Pal, P.K. & Ghosh, A.K. — Lithological and megafloral successions in the Kamthi Formation with special reference to Permo-Triassic Boundary in the Talcher Coalfield, Orissa. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Pal, P.K., Shome, D., Sannigrahi, A. & Ghosh, A.K. — Raniganj-Panchet transition vis-a-vis Permo-Triassic transition in the Raniganj Coalfield, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Rajanikanth, A. — Aptian plant extinctions in India : A riddle. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara.*

Rajanikanth, A. — Maastrichtian spore-pollen from India : A rummage. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Rajanikanth, A. & Chandra, S. — Mesozoic coniferous woods of India : An appraisal. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara.*

Sarana, S. & Kar, R. — Effect of intrusives on organic microconstituents, Dhamni Block, Tatapani-Ramkola Basin, M.P., India. *Natn. Sem. Rec. Adv. Geology of Coal and Lignite Basins of India, Calcutta.*

Sarkar, S. — Miocene palynofloral assemblages from the Sinda-Mohari Beds of Northeast Congo, Africa. *3rd Symp. African Palynol. Johannesburg.*

Sharma, C. & Gupta, A. — Palaeofloristic and climate of Early Holocene sequence in Garhwal Himalaya. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Sharma, M. & Shukla, M. — Microstructure and microfabric studies of palaeoproterozoic small digitate stromatolites from the Vempalli Formation, Cuddapah, south India. *Conf. Biosed. Precambrian Basins, Lucknow.*

Sharma, S., Babu, R., Maithy, P.K. & Kumar, S. — Lithostratigraphy of the Kashia Dolomite Formation, Barbil area, Orissa with reference to environment of deposition. *Natn. Symp. Rec. Res. Sediment. Basins* and *XIII Conv. Indian Assoc. Sedimentol., Varanasi.*

Shukla, M., Misra, G. & Nigam, S.K. — Steroid(s) : Possible biomarkers from the Proterozoic Shahbad limestone, Bhima Basin. *Conf. Biosed. Precambrian Basins, Lucknow.*

Shukla, M. & Sharma, M. — Palaeobiological evidences from Bhima Basin and their implication on the age of Bhima sediments. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Singh, A. — Probability of a new liptinite maceral from Indian lignites. *Natn. Sem. Rec. Adv. Geology of Coal and Lignite Basins of India, Calcutta.*

Singh, B.D. & Anand-Prakash — Coal petrographic evaluation of Turra Seam from Singrauli Coalfield, Son Basin. *Natn. Sem. Rec. Adv. Geology of Coal and Lignite Basins of India, Calcutta.*

Srivastava, A.K. — Evolution and extinction of Glossopteris flora in India. *1st Int. Symp. Evolution of Life on Earth.*

Srivastava, A.K. — Floristic pattern in the Lower Gondwana sediments of India. *Nat. Symp. Rec. Res. Sed. Basin* and *XIII Conv. Indian Assoc. Sedimentol., Varanasi.*

Srivastava, A.K. — Emergence, continuance and extinction of floral elements across Permian-Triassic in India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Srivastava, C. — Diffusionary trends in the use of Indian timbers in space and time. *Ann. Archaeol. Conf., New Delhi.*

Srivastava, Shyam C. — Fertile structures from Triassic of India. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara.*

Srivastava, Suresh C., Anand-Prakash & Kar, R. — Palynology of Permian-Triassic sequence in Iria Nala, Tatapani-Ramkola Coalfield, M.P., India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow.*

Srivastava, Suresh C., De, B., Jha, N. & Ganguli, B. — Triassic palynoflora from Krishnavaram area, Chintalpudi sub-basin. *Nat. Sem. Rec. Adv. Geology of Coal and Lignite Basins of India, Calcutta.*

Srivastava, Suresh C. & Kar, R. — Palynological dating of some Permian outcrops from Iria Valley, Tatapani-Ramkola Coalfield, M.P., India. *Nat. Sem. Rec. Adv. Geology of Coal and Lignite Basins of India, Calcutta.*

Tripathi, A. & Bhattacharjee, D. — Palynological resolution of Upper Permian sequence in Talcher Coalfield, Orissa, India. *Nat. Sem. Rec. Adv. Geology of Coal and Lignite Basins of India, Calcutta.*

Tripathi, A. & Roy, A. — Palynodating of coal-bearing sediments in Pachwara Coalfield, Rajmahal Basin, Santhal Pargana, Bihar. *Natn. Sem. Rec. Adv. Geology of Coal and Lignite Basins of India, Calcutta.*

Vijaya & Sinha, S. — Late Permian palynoflora in south eastern Korba Coalfield, M.P., India. *Natn. Sem. Rec. Adv. Geology of Coal and Lignite Basins of India, Calcutta.*

Abstracts published

Babu, R. & Maithy, P.K. 1997. Noteworthy organic-walled microfossil assemblage from the Shale Member of the Upper Tal Formation, Mussoorie Syncline, Lesser Himalaya, Uttar Pradesh. *Conf. Biosed. Precambrian Basins, Lucknow* : 33.

Bajpai, U. & Maheshwari, H.K. 1996. Taphonomic constraints on preservation of cuticles in compression fossils: Fungi induced ultrastructural changes in cuticular membranes. *30th Int. Geol. Congr., Beijing* : 128.

Bajpai, U. & Maheshwari, H.K. 1996. Importance of ultrastructural investigations of the fossilised cuticular membranes. *20th Natn. Conf. Electron Microscope Soc. India.*

Banerji, J. 1996. Floral change across the Permo-Triassic Boundary in Damodar and Auranga Valleys. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 59.

Bera, S.K., Farooqui, A. & Gupta, H.P. 1996. Late Pleistocene/Holocene vegetation and environment in and around Marian Shola, Palni Hills, south India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 41.

Bera, S.K. & Gupta, H.P. 1997. Vegetation and environment since middle Holocene in Silent Valley as evidenced by palynostratigraphy. *IGBP Symp. "Changes in Global climate due to Natural and Human activities", Bhubaneshwar* : 95.

Bhat, G.M., Chandra, S. & Dar, A.M. 1996. Record of Early Carboniferous (Tournaisian) flora from Syringothyris limestone "Kashmir Himalaya": An interplay of hoamp-shelf environments. *30th Int. Geol. Congr., Beijing.*

Bhattacharyya, A.P. 1996. Palynological dating of subsurface sediments from Wardha Valley coalfields, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 46.

Bhattacharya, S.K., Jani, R.A. & Maithy, P.K. 1996. Stable isotopics of Proterozoic Bhima Basin, Karnataka . *Conf. Biosed. Precambrian Basins, Lucknow* : 62.

Bhattacharyya, A. & Chaudhary, V. 1996. Is it possible to demarcate floristically transition of Pleistocene / Holocene in India? *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 38.

Chandra, A. 1996. Fossil diatoms from the Late Cenozoic sediments of Andaman and Nicobar Islands, India and their biostratigraphical significance. *14th Int. Diatom Symp., Tokyo* : 10.

Chandra, S. & Keqin, S. 1996. Evolution and comparison of the Gondwana flora and

the Cathaysia flora. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara* : 16.

Chandra, S. & Keqin, S. 1996. Floral changes of the Carboniferous and Permian in Gondwana. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 75.

Chandra, S. & Srivastava, S.C. 1996. Palynological and palaeobotanical studies of the Indian Lower Gondwana sequences. *IX Int. Palynol. Conf., Houston* : 21.

Chauhan, M.S., Sharma, C. & Rajagopalan, G. 1996. Vegetation and climate during Late-Holocene in Garhwal Himalaya. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 67.

Garg, R. & Jain, K.P. 1996. Integrated phytoplankton stratigraphy across K/T Boundary at Um Sohryngkew, Meghalaya, northeast India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 34-35.

Ghosh, A.K. 1996. Megaspore biostratigraphy of the Triassic sequence in peninsular India. *IX Int. Palynol. Congr., Houston* : 51.

Ghosh, A.K., Jana, B.N. & Maithy, P.K. 1996. Critical observations on Coralline algae from the Cretaceous sediments of Cauvery Basin. *XV Indian Colloq. Micropalaeont. Stratigr., Dehradun* : 66.

Ghosh, A.K., Jana, B.N. & Maithy, P.K. 1996. Distribution pattern of calcareous algae across the Cretaceous-Tertiary sequence of Cauvery Basin in Tiruchirapalli District, Tamil Nadu. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 45.

Ghosh, A.K. & Maithy, P.K. 1997. Indian calcareous skeletal algae across the Cretaceous-Tertiary sequence. *Yaounde 1997 Colloq., Soc. Nat. des Hydrocarb., Cameroon.*

Guleria, J.S. 1996. Occurrence of fossil woods of *Barringtonia* in the Deccan Intertrappean and Miocene sediments of Kachchh, western India and the observed structural changes. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 63.

Gupta, A. 1996. Palynology of Bryophytes. *British Bryol. Soc. Cent. Symp., Glasgow* : 20.

Gupta, A. 1996. New fungal fructification from Lower Tertiary sediments of Himachal Pradesh. *Proc. 83rd Indian Sci. Congr., Patiala* : 90.

Gupta, H.P. 1996. Palynostratigraphy and palaeoenvironment of Quaternary deposits of the Mahanadi delta, Orissa, India. *IX Int. Palynol. Congr., Houston* : 55.

Gupta, H.P. 1996. Chilka Lake : Testimony of environment. IGBP PAGES/PEP-II. *Symp. "Palaeoclimate and environmental variability in Austral-Asian*

Transect", Nagoya, Japan.

Gupta, H.P. 1997. Palaeoenvironment of Mahanadi delta, Orissa since Mid-Late Pleistocene. *Int. Sem. Quat. Sea level variation, Shoreline Displacement and Coastal Evolution, Tanjavur, Tamil Nadu.*

Gupta, H.P. & Khandelwal, A. 1996. Chilka Lake: Testimony of environment. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 58.

Jana, B.N., Banerji, J. & Kar, R.K. 1996. First occurrence of *Isoetites serratifolius* Bose & Roy from the Deccan Intertrappean beds of Kutch, Gujarat. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 53.

Jana, B.N. & Ghosh, A.K. 1996. Megaspore assemblage from the Athgarh Formation and its biostratigraphic significance. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 54.

Khan, H.A. 1996. Significance of Silent Valley bio-reserve microclimate in plant diversity. *IGBP Symp., Bhubaneshwar* : 22.

Khandelwal, A. 1996. Long term registration of air-borne pollen/spores and its allergenic significance. *IX Int. Palynol. Congr., Houston* : 79.

Khandelwal, A. & Gupta, H.P. 1996. Mangrove history since 1,500 yrs B.P. at Dangmal, Baitarni-Brahmani delta, Orissa, India. *IX Int. Palynol. Congr., Houston* : 79.

Kumar, B., Divakar Rao, V., Dayal, A.M., Tiwari, V.C. & Shukla, M. 1996. C, O and Sr isotopes in the terminal Proterozoic Cambrian carbonates of India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 4.

Kumar, G., Ravi-Shanker, Maithy, P.K., Mathur, V.K. & Bhattacharyya, S.K. 1996. Terminal Proterozoic Cambrian sequences in India : A review with special reference to Precambrian-Cambrian Boundary. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 5-8.

Kumar, P. 1996. Palynostratigraphy of Almod Bed in Satpura Basin, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 69.

Maheshwari, H.K. 1996. Taxonomic position and affinities of the glossopterid group of plants from Gondwana Supergroup. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara* : 63.

Maheshwari, H.K. 1996. Permian-Triassic Boundary : An overview. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 23.

Maithy, P.K. & Babu, R. 1996. Organic-walled microfossils from the brachiopod beds of Lower Tal Formation. *XV Indian Colloq. Micropalaeont. Stratigr., Dehradun* : 53-54.

Maithy, P.K. & Babu, R. 1996. Some observations on the *Chuaria-Tawuia* complex from the Proterozoic sequence of India. *XV Indian Colloq. Micropalaeont. Stratigr., Dehradun* : 52.

Maithy, P.K. & Babu, R. 1996. Upper Vindhyan biota and Precambrian/Cambrian boundary. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 11.

Maithy, P.K., Kumar, S., Babu, R. & Sharma, S. 1996. Cellularly preserved microfossils from the three billion years old Iron Ore Supergroup, Kashia, Orissa, India. IX *Int. Palynol. Congr., Houston* : 94.

Maithy, P.K., Kumar, S., Babu, R. & Sharma, S. 1997. Cellularly preserved microfossils from three billion years old Iron Ore Supergroup, Kashia area, Orissa, India. *Conf. Biosed. Precambrian Basins, Lucknow* : 37.

Mandal, J. & Kumar, M. 1996. Palynofloral distribution pattern across the Palaeocene-Eocene of northeast and western India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries," Lucknow* : 62.

Mathur, V.K., Maithy, P.K., Ravi-Shanker & Kumar, G. 1996. Physical, geochemical and biological changes across Precambrian-Cambrian transition, northwest Himalaya, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 19-20.

Pal, P.K. & Ghosh, A.K. 1996. Lithological and megafloral successions in the Kamthi Formation with special reference to Permo-Triassic boundary in the Talcher Coalfield, Orissa. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 24-25.

Pal, P.K., Shome, D., Sannigrahi, A. & Ghosh, A.K. 1996. Raniganj-Panchet transition vis-a-vis Permo-Triassic transition in the Raniganj Coalfield, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 26.

Pandey, J. 1996. Climatic implication of plant fossils : Limitations. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 61.

Rajanikanth, A. 1996. Aptian plant extinctions in India : A riddle. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara* : 82.

Rajanikanth, A. 1996. Maastrichtian spore-pollen from India : A rummage. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 49.

Rajanikanth, A. & Chandra, S. 1996. Mesozoic coniferous woods of India : An appraisal. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara, USA* : 82.

Ram-Awatar 1996. Palynological evidence for the Permo-Triassic Boundary in Sohagpur Coalfield, M.P., India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 72.

Rao, M.R. 1996. Palynostratigraphic zonation of the Tertiary sediments of Kerala Basin, India. *IX Int. Palynol. Congr., Houston* : 129.

Rao, M.R. 1996. Palynological demarcation of Eocene-Miocene sequences, Kerala Basin, India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 66.

Ravi-Shanker, Kumar, G., Mathur, V.K., Maithy, P.K. & Bhattacharya, S.K. 1996. Terminal Proterozoic System in India : Its time limits and global correlation. *30th Int. Geol. Congr., Beijing* 1.

Sarkar, S. & Corvinus, G. 1996. Palynofloral changes in the Siwalik succession (Mio-Pliocene) of western Nepal and its palaeoenvironmental implications. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 74.

Saxena, R.K. 1996. Palaeoclimate and depositional environment of the Upper Siwalik sediments in north-western India. *IX Int. Palynol. Congr., Houston* : 141.

Sekar, B. & Rajagopalan, G. 1997. Chemical analysis and ^{14}C dating of lake sediments and their significance for interpretation of the past climatic changes. *IGBP Symp. "Changes in Global climate due to Natural and Human activities", Bhubaneshwar*: 91.

Sharma, C. 1996. Palynostratigraphy of Himalayan lacustrine sediments. *IX Int. Palynol. Congr., Houston* : 146.

Sharma, C. 1996. Modern pollen rain vis-a-vis reflected vegetation in Himalaya. *IX Int. Palynol. Congr., Houston* : 146.

Sharma, C. & Gupta, A. 1996. Palaeofloristic and climate of Early Holocene sequence in Garhwal Himalaya. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 55.

Sharma, M. & Shukla, M. 1997. Microstructure and microfabric studies of palaeoproterozoic small digitate stromatolites from the Vempalli Formation, Cuddapah, south India. *Conf. Biosed. Precambrian Basins, Lucknow* : 16-17.

Sharma, S., Babu, R., Maithy, P.K. & Kumar, S. 1996. Lithostratigraphy of the Kashia Dolomite Formation, Barbil area, Orissa with reference to environment of deposition . *Natn. Symp. Rec. Res. Sed. Basins* and *XIII Conv. Indian Assoc. Sedimentol., Varanasi* : B2:2.

Shukla, M., Misra, G. & Nigam, S.K. 1997. Steroid(s) : possible biomarkers from

the Proterozoic Shahbad limestone, Bhima Basin. *Conf. Biosed. Precambrian Basins, Lucknow* : 67.

Shukla, M. & Sharma, M. 1996. Palaeobiological evidences from Bhima Basin and their implication on the age of Bhima sediments. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 9-10.

Srivastava, A.K. 1996. Floristic pattern in the Lower Gondwana sediments of India. *Natn. Symp. Rec. Res. Sed. Basins* and *XIII Conv. Indian Assoc. Sedimentol., Varanasi* : 5.

Srivastava, A.K. 1996. Emergence, continuance and extinction of floral elements across Permian-Triassic in India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 52.

Srivastava, G.P. 1996. Impact of Himalayan uplift on the Late Cenozoic flora of India. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara* : 95.

Srivastava, Shyam C. 1996. Fertile structures from Triassic of India. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara* : 96.

Srivastava, Suresh C., Anand-Prakash & Kar, R. 1996. Palynology of Permian-Triassic sequence in Iria Nala, Tatapani-Ramkola Coalfield, M.P., India. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 27.

Srivastava, Suresh C. & Jha, N. 1996. Stratigraphic correlation of coal resources in Godavari Graben : Palynological parameter. *Nat. Symp. Rec. Res. Sed. Basins* and *XIII Conv. Indian Assoc. Sedim., Varanasi*, A2 :6.

Srivastava, Suresh C. & Jha, N. 1996. Kamthi Formation : Palaeobotanical evidences. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 28-29.

Tewari, R. 1996. Structural variations in megaspores of Indian Gondwana sequence : An evaluation. *V Quadr. Conf. Int. Organiz. Palaeobot., Santa Barbara* : 101.

Tripathi, A. 1996. Representation of acritarchs across the Permo-Triassic Boundary. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries", Lucknow* : 21.

Tripathi, A. 1996. Stratigraphic evaluation of palynofloras from non-marine Early Cretaceous sediments on peninsular India. *IX Int. Palynol. Congr., Houston* : 162.

Tripathi, A. 1996. Acritarch assemblage from Triassic sediments of Talcher Coalfield, Orissa, India. *3rd Int. Meet. Workshop CIMP Acritarch Subcommission, Prague.*

Tripathi, S.K.M. 1996. Palynological changes across subsurface Palaeocene-Eocene sediments from Barmer, Rajasthan. *BSIP Golden Jubilee Conf. "Physical and*

Biological changes across the major Geological Boundaries", *Lucknow* : 78.

Vijaya 1996. Benchmark Permian-Triassic palynoevents on peninsular India and north-west Tethys Himalaya. *30th Int. Geol. Congr., Beijing.*

Vijaya, Tripathi, A. & Ram-Awatar 1996. Inter-formational boundaries through Permian and Early Triassic sequences on peninsular India, and pattern of spore-pollen species distribution. *BSIP Golden Jubilee Conf. "Physical and Biological changes across the major Geological Boundaries"*, *Lucknow* : 81-82.

Internal Committees

Co-ordination Unit for Scientific Activities
(w.e.f. 29.03.1993)

Dr Suresh C. Srivastava — In-Charge
Dr (Mrs) Archana Tripathi
Dr Bhagwan D. Singh

(w.e.f. 01.05. 1995) **(w.e.f. 13.09.1996)**

Library & Information Committee

Dr H.P. Gupta	Convener	Dr (Mrs) Chhaya Sharma
Dr (Miss) J. Banerji		Dr Manoj Shukla
Dr J.S. Antal		Dr S.K.M. Tripathi
Dr J.S. Guleria		
Dr B.K. Misra		

Museum & Display Committee

Dr R.K. Kar	Convener	Dr G.P. Srivastava
Dr (Mrs) Shaila Chandra		Dr B.N. Jana
Dr G.P. Srivastava		
Dr B.N. Jana		
Sri D. Pradhan		

Herbarium Committee

Dr N. Awasthi	Convener	Dr K.S. Saraswat
Dr K.S. Saraswat		Dr D.C. Saini
Dr H.A. Khan		
Dr D.C. Saini		

Computer Committee

Dr G. Rajagopalan	Convener	Dr (Mrs) Archana Tripathi
Dr H.K. Maheshwari		Dr K. Ateequzzaman
Sri Kamal Narang		Sri K. Nagapooshanam
		Sri Y.P. Singh

Electron Microscopy Committee

Dr H.K. Maheshwari	Convener	Dr H.K. Maheshwari
Dr S.A. Jafar		Dr Suresh C. Srivastava
Dr Krishna Ambwani		Dr Krishna Ambwani

Photography Committee

Dr (Mrs) Shaila Chandra	Convener	Dr (Mrs) Shaila Chandra
Dr (Ms) Vijaya		Dr (Ms) Vijaya
Dr R.S. Singh		Dr R.S. Singh

Maceration Facilities Committee

Dr (Mrs) Chhaya Sharma	Convener	Dr Rahul Garg
Dr M.R. Rao		Dr J.P. Mandal
Mrs Indra Goel		Mrs Indra Goel
Sri V.P. Singh		

Purchase Committee

Dr R.S. Tiwari	Convener	Dr G. Rajagopalan
Dr P.K. Maithy		Dr P.K. Maithy
Sri S.C. Bajpai		Sri S.C. Bajpai
Sri J.C. Singh		Sri J.C. Singh
Sri H.S. Srivastava		Sri H.S. Srivastava

Quality Control Committee

Dr P.K. Maithy	Convener	Dr P.K. Maithy
Dr A.K. Srivastava		Dr A.K. Srivastava
Dr R.K. Saxena		Sri B. Sekar
Dr (Mrs) Archana Tripathi		Sri Bhagwan Singh
Sri B. Sekar		Sri R.K. Takru
Sri Bhagwan Singh		

Excursion Equipment Committee

Dr (Miss) J. Banerji	Convener	Dr R.K. Saxena
Dr (Mrs) Usha Bajpai		Dr (Mrs) Usha Bajpai
Dr (Mrs) Neerja Jha		Dr (Mrs) Neerja Jha
Sri R.K. Kapoor		Sri R.K. Kapoor

Building Maintenance Committee

Dr Anand Prakash	Convener	Dr Anand Prakash
Dr Manoj Shukla		Dr J.S. Guleria

Sri J.C. Singh		Sri J.C. Singh
Sri I.J. Mehra		Sri I.J. Mehra
Sri T.K. Mandal		Sri T.K. Mandal

Electrical Maintenance and Audio Visual Committee

Dr Anil Chandra	Convener	Dr Anil Chandra
Dr C.M. Nautiyal		Dr C.M. Nautiyal
Sri I.J. Mehra		Sri V.K. Singh
Sri V.K. Singh		Sri A.K. Ghosh
Sri A.K. Ghosh		Sri Gopal Singh

Vehicle Maintenance Committee

Dr Suresh C. Srivastava	Convener	Dr Suresh C. Srivastava
Dr K.S. Saraswat		Sri K.P. Singh
Dr S.K.M. Tripathi		
Sri K.P. Singh		

Garden Committee

Dr Pramod Kumar	Convener	Dr Samir Sarkar
Dr Samir Sarkar		Dr D.C. Saini
Sri R.B. Kukreti		

Canteen Committee

Dr S.A. Jafar	Convener	Sri J.C. Singh
Dr J.P. Mandal		Sri P.K. Bajpai
Dr (Mrs) A. Khandelwal		Sri I.J.S. Bedi
Sri P.K. Bajpai		Sri K.C. Chandola
Mrs P. Thomas		
Sri Sia Ram		

Staff Welfare Committee

Dr A.K. Srivastava	Convener	Dr Manoj Shukla
Dr Rahul Garg		Dr O.S. Sarate
Dr (Mrs) Alpana Singh		Dr (Mrs) Alpana Singh
Sri B.K. Jain		Sri Prem Prakash
Sri P.K. Bajpai		Mrs Ruchita Bose
Mrs V. Nirmala		Sri Sarju Prasad
Sri K.C. Chandola		

Vehicle's Planning for Excursion/Field work

Convener	Dr Anand Prakash
	Dr A.K. Srivastava
	Sri R.K. Takru
	Sri K.P. Singh

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

We have audited the attached Balance Sheet of the Birbal Sahni Institute of Palaeobotany, Lucknow, as at 31st March, 1997, and the Income and Expenditure Account and Receipts & Payment Accounts for the year then ended and report that subject to our comments as given in Annexure A to this Report :

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

(i) In the case of Balance Sheet of the state of affairs of the Institute as at 31st March, 1997,

(ii) In the case of Income and Expenditure Account of the excess of income over expenditure for the year then ended, and

(iii) In the case of Receipts and Payment Account, of the receipts and payments of the Institute for the year then ended.

Place : Lucknow
Date : August 29,1997

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

Annexure 'A'

(Annexure to and forming part of the Audit Report for the year ended 31st March, 1997)

Comments on Accounts of Birbal Sahni Institute of Palaeobotany, Lucknow for the year ended 31st March, 1997

Accounts

1. Accounts have been maintained on cash basis.
2. Various advances were found pending recovery for an unduly long period. Efforts are to be made for speedy settlement of the same.

Publication

3. On scrutiny of record of the priced publications of the Institute, it has been observed that during the last several years, the Institute brought out publications on different subjects to sell out in the market. Stock position of these priced publications as on 31.03.97 is about Rs. 22.22 lacs apart from which Rs. 3.69 lacs is reserve stock, totalling stock of Rs. 25.91 lacs.

Library

4. No physical verification was made during the year under audit. As explained to us, library stocks are being physically verified after 5 years, as per Central Government Rules.

Stores

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

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

   No identification marks on the fixed assets have been made for efficient and proper verification thereof.
6. No depreciation on fixed assets has been charged, as per accounting policy of the Institute.
7. The backlog for the maintenance of Fixed Assets Register be updated.
8. During the year appropriation for Reserve fund and Pension fund of Rs. 30,00,000.00 and 9,00,000.00 respectively are made out of Institute fund.

For **R.N. Khanna & Company**
Chartered Accountants
-sd-
(R.N. Khanna)
Partner

Dated: August 29, 1997

Birbal Sahni Institute of Palaeobotany, Lucknow

Seriatim replies to the comments of the Chartered Accountants on the Annual Accounts of the Institute for the year 1996-97

1. No comments.
2. Efforts are being made to settle the outstanding advances, on 31.10.97. Outstanding Advances have been brought down to Rs. 1,14,034.00 from Rs. 23,25,328.00.
3. Institute is trying hard to sell out the old stock of publications. For this, a rebate up to 50% has been offered and an advertisement to attract the purchasers has been published in the Current Science journal. As a result a sale of about Rs. 50,000.00 has been made and the total stock has come down to Rs. 21.72 lakhs as on date.
4. Stock verification of the Library is complete. A copy of the report is annexed herewith.
5. Noted for compliance.
6. No comments.
7. Noted.
8. Appropriation for Reserve Fund and Pension has been made as per provisions under the Bye-Laws of the Institute.

For **R.N. Khanna & Company**
Chartered Accountants
-sd-
(R.N. Khanna)
Partner

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

Sd/-
Suresh C. Bajpai
(Registrar)

Sd/-
G. Rajagopalan
(Acting Director)

Birbal Sahni Institute

Balance Sheet as at

Previous Year	Liabilities (Sources of Funds)	Total As on 31.03.97
72873471	Capital Fund	83626033
	Reserve Fund	3000000
	Pension Fund	`900000
483555	Donated Fund	495091
49718	Deposit Account	50675
50812	Current Liabilities	34632
15013223	General Provident Fund	16775433
88470779	**Total**	**104881864**

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

Sd/-
(R.N. Khanna)
Partner

# of Palaeobotany, Lucknow

31st March, 1997

Previous Year	Assets (Application of Funds)	Total as on 31.03.97
	Fixed Assets	
56416972	i) Owned Assets	59305670
325424	ii) Donated Assets	325424
135600	Investments	3989000
8452883	Current Assets	15590767
8126677	Loans and Advances/Deposits	8895570
15013223	General Provident Fund	16775433
88470779	**Total**	**104881864**

CERTIFICATE

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

Sd/-	Sd/-	Sd/-
J.C. Singh	S.C. Bajpai	G. Rajagopalan
(Accounts Officer)	*(Registrar)*	*(Acting Director)*

Birbal Sahni Institute
Receipts and Payment Account for

Receipts		Plan	Non-Plan	Total
To Opening Balance				
Bank Current Account				
Revenue		203951.00	560334.00	764285.00
Capital		7584275.00	0.00	7584275.00
Savings Bank Account		5000.00	0.00	5000.00
Deposit A/C	Capital	27718.00	0.00	27718.00
	Revenue	17000.00	5000.00	22000.00
Cash in Hand		0.00	202.00	202.00
Group Insurance Scheme		0.00	26873.00	26873.00
C. D. P. Account		0.00	559.00	559.00
Donation Account		0.00	21971.00	21971.00
To Project Accounts				
Opening Balance		163751.00	0.00	163751.00
Grants		782000.00	0.00	782000.00
To Grants:		22000000.00	17000000.00	39000000.00
To Donation and Endowment				
Maturity		0.00	46600.00	46600.00
Interest		0.00	12036.00	12036.00
To R & D Receipts		0.00	365921.00	365921.00
To Admin. Receipts		225345.00	6236400.00	6461745.00
To Depostit Account		11407.00	0.00	11407.00
To Interest		609832.00	606452.00	1216284.00
To Miscellaneous Income & Recovery		683.00	115506.00	116189.00
To Other Receipts		0.00	0.00	0.00
Total		**31630962.00**	**24997854.00**	**56628816.00**

For **R.N. Khanna & Company**
Chartered Accountants
-sd-
(R.N. Khanna)
Partner

# of Palaeobotany, Lucknow
the year ending March, 1997

Payments	Plan	Non-Plan	Total
By Fixed Assets	4005600.00	0.00	4005600.00
By Pay and Allowances	1225896.00	14134406.00	15360302.00
By Retiring Expenses	0.00	2860936.00	2860936.00
By Academic Expenses	2024298.00	2000.00	2026298.00
By Expenses Services/Units Ancillary to Research	644745.00	230344.00	875089.00
By Travelling Expenses	345542.00	50598.00	396140.00
By Publication Expenses	192926.00	196679.00	389605.00
By Maintenance & Repairs	1194305.00	22616.00	1216921.00
By Contingencies	1670974.00	689053.00	2360027.00
By Advances	701630.00	37800.00	739430.00
By General Provident Fund	143793.00	4091708.00	4235501.00
By Payment of Misc. Recoveries/GPF	82123.00	1633826.00	1715949.00
By Investment	3000000.00	900000.00	3900000.00
By Deposit Account	10000.00	0.00	10000.00
By Project Account	473652.00	0.00	473652.00
By Donation Account	0.00	500.00	500.00
By Closing Cash & Bank Balances			
Deposit Account (C.N.R.)	27268.00	0.00	27268.00
Capital	13688386.00	0.00	13688386.00
Deposit Account (Revenue)	18407.00	5000.00	23407.00
Group Insurance Scheme	0.00	250.00	250.00
Savings Bank Account (C.N.R.)	1505000.00	0.00	1505000.00
Revenue Account	203754.00	60905.00	264659.00
Cash in Hand	564.00	567.00	1131.00
Donation Account	0.00	80666.00	80666.00
Project Account	472099.00	0.00	472099.00
Total	**31630962.00**	**24997854.00**	**56628816.00**

Sd/-	Sd/-	-Sd-
J.C. Singh	Suresh C. Bajpai	G. Rajagopalan
(Accounts Officer)	*(Registrar)*	*(Director)*

Birbal Sahni Institute of Palaeobotany, Lucknow

Income and Expenditure Account for the year ending March, 1997

Previous year Plan	Previous year Non-Plan	Previous year Total	Schedule		Current year Plan	Current year Non-Plan	Current year Total
			INCOME :				
7470000.00	16000000.00	23470000.00	1.	Grants	11000000.00	17000000.00	28000000.00
	332390.00	332390.00	2.	R & D Receipts		365921.00	365921.00
3243.00	145793.00	149036.00	3.	Misc. Income & Recoveries	683.00	116169.00	116852.00
	719700.00	719700.00	4.	Interest		655107.00	655107.00
7473243.00	**17197883.00**	**24671126.00**	**Total**		**11000683.00**	**18137197.00**	**29137880.00**
			EXPENDITURE :				
1190225.00	15629855.00	16820080.00	1.	Pay & Allowances	1225896.00	16995342.00	18221238.00
1367815.00	71542.00	1439357.00	2.	Academic Expenses	2024298.00	2000.00	2026298.00
365713.00	386519.00	752232.00	3.	Expenses on Units/ Services ancillaryto Research	644745.00	230344.00	875089.00
381929.00	94502.00	476431.00	4.	Travelling Expenses	345542.00	50598.00	396140.00
211766.00	201711.00	413477.00	5.	Publication Expenses	192926.00	196679.00	389605.00
2135267.00	941939.00	3077206.00	6.	Contingencies	1670974.00	689053.00	2360027.00
1104638.00	447238.00	1551876.00	7.	Maintenance & Repairs	1194305.00	22616.00	1216921.00
715890.00	-575423.00	140467.00	Balance Carried Down		3701997.00	-49435.00	3652562.00
7473243.00	**17197883.00**	**24671126.00**	**Total**		**11000683.00**	**18137197.00**	**29137880.00**
715890.00	-575423.00	140467.00	BALANCE OF INCOME & EXPENDITURE		3701997.00	-49435.00	3652562.00
			Less Appropriation during the year				
			Reserve Fund		-3000000.00		-3000000.00
			Pension Fund			-900000.00	-900000.00
			Balance transfered to Capital Fund				
715890.00	**-575423.00**	**140467.00**	**Net excess of Income over Expenditure**		**701997.00**	**-949435.00**	**-247438.00**

For **R.N. Khanna & Company**
Chartered Accountants
-sd-
(R.N. Khanna)
Partner

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

Sd/-
Suresh C. Bajpai
(Registrar)

-Sd-
G. Rajagopalan
(Director)