Annual Report

1995-96

BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY
LUCKNOW

ANNUAL REPORT
1995-96

Front Cover Photo : A fossiliferous Lower Siwalik bed exposed in Ghish River, Darjeeling District, West Bengal.

Back Cover Photo : A Miocene section exposed at the Anderson Island, Andaman & Nicobar Islands.

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Acknowledgement

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

Contents

Foreword

The systematic study of vegetation of the past is known as Palaeobotany. This science is being intensely pursued in all its botanical and geological aspects because it has a significant place in earth sciences. Palaeobotanical researches have proved to be very effective in tracing the antiquity of early life, evolutionary patterns of floras , vegetation dynamics and for high resolution biostratigraphy, exploration of fossil fuels, palaeoenvironments and palaeoclimatic interpretations, agricultural practices of ancient cultures and other related aspects.

Keeping in view the objectives of the research activities of the Institute and the recent trends for collating data using different techniques, efforts were made for multidisciplinary and collaborative approach in many programmes presented in this report. Consultancy services were also provided to other organisations in areas of expertise available at the Institute.

The research activities of the Institute are organised under 11 Projects with several Programmes under each Project. The target of each Programme Proposed for the year 1995-96 has been achieved. Besides research, many other scientific activities, e.g., In-House Seminars, Professional Training Courses and Lectures were also organised. In the present Annual Report the general information about the Institute's activities during 1995-96 and the details of scientific work carried out under each Programme and research publications during the year and the on-going efforts for the next year are given under various headings.

The members of Scientific Programming Committee of the Institute—Dr R.S. Tiwari (Former Director), Dr Hari K. Maheshwari, Dr P.K. Maithy, Dr R.K. Kar and Dr Suresh C. Srivastava have helped in preparing this document. I am grateful to the members of Research Advisory Council and Governing Body of the Institute for giving fruitful suggestions and advise while discussing the report for approval. Dr Suresh C. Srivastava, Dr Archana Tripathi and Dr B.D. Singh, Sri B.K. Jain and Smt. V. Nirmala of Co-ordination Unit, Dr J.S. Antal of Publication Unit and Mr S.C. Bajpai, Registrar helped in various ways to bring out this Report. The support provided by several colleagues in the scientific, technical and administrative cadres is thankfully acknowledged.

G. RAJAGOPALAN
Acting Director

Major Achievements and Activities of the Institute

Research

The Birbal Sahni Institute has commitment to develop scientific knowledge and expertise in the field of Palaeobotany and related disciplines. An integrated and multidisciplinary approach is adopted to complete the targets of different programmes undertaken for fulfilling the objectives of the Institute.

During the year 1995-96, some of the salient results achieved at the Institute are as follows :

Early Life

The continued efforts to understand the early life during Precambrian and Cambrian time have brought significant results. The biota from argillaceous sediments of Rohtas Formation in Bihar, Uttar Pradesh and Madhya Pradesh has shown presence of Chlorophyta even before 1000 Ma years. Maiden record of shelly fauna from Sahabad Limestone Formation has been made from Bhima Basin. From the present state of knowledge on organic remains from Bhima Basin it is concluded that these sediments belong to latest part of terminal Proterozoic.

Well developed stromatolites were recorded from the Iron Ore Group representing Kashia Formation from Barbil-Noamundi area. The inferred environment of deposition for the Kashia Formation is intertidal to subtidal zone. The sandstone dykes were recorded from Kashia Formation. This is the first record of sandstone dyke from Archaean of India.

Gondwana Sequence and associated coals

Studies of plant fossil assemblages from Auranga, Jharia, Karanpura and Hura coalfields and Hinjrida Ghati (Orissa) have been carried out on Permian (250-280 million years old) sediments. For the first time the male fructification *Nesowalesia* is reported from India which is known only from Australia. The assemblage indicates that very much disturbed conditions prevailed in the preservational and depositional environment of Karanpura and Hura coalfields.

The megafloral assemblage of Mesozoic deposits of Murlipahar, Balidih and Sitalpura localities of Rajmahal Basin and Gangapur Formation (Pranhita-Godavari Basin) has been analysed. *Phyllopteroides laevis*—an index Neocomian species of Eastern Australia has been- recorded from Murlipahar of Rajmahal Basin.

The palynodating and correlation of coal-bearing strata is an important aspect of research at the Institute. Palynological investigations are being carried out on the bore-core materials of the drillings made by G.S.I., M.E.C.L. and Singreni

Colliery Ltd. in unexplored areas. On the basis of palynostratigraphical studies on subsurface materials provided by the above agencies from Rajmahal Basin (Bihar), Domra Panagarh sub-basin (West Bengal), Sohagpur, Tatapani-Ramkola, Talcher, Ib-River and Mand Raigarh coalfields of Son Mahanadi Basin (Madhya Pradesh and Orissa), Satpura Basin (Madhya Pradesh) and Kothagudem area in Godavari Graben, the age determination and correlation of various coal-bearing sediments have been established. The analysis has revealed presence of acritarchs, the organic-walled microfossils of doubtful origin in the Early Triassic sediments of Talcher Coalfield (Orissa) for the first time from Peninsular India.

The genetic materials of spores and pollen have the blue print of morphographic features specific for the particular type. The morphographic characters have been used in the taxonomic studies. The study of exine structures on the body surface of bisaccate pollen has helped in identifying the Indian Gondwana bisaccate pollen from the apparently similar looking Euromerian forms. Search for the angiospermous characters is one of the aspects of research on the origin of angiosperms. The detailed palynological studies have revealed presence of angiospermoid exine characters in the Permian palynomorphs recorded in Talcher Coalfield and Rajmahal Basin.

Quality and grade of Indian coals and lignites

Analyses of the Indian coals and lignites by petrological methods have been continued to understand the quality and grade of coal/lignite. The high concentration of hydrogen-rich microconstituents in sub-bituminous-A to high volatile bituminous-C coals of Hura Coalfield, Rajmahal Basin has shown their amenability for hydrogenation. The coals from Belampalli Coalfield and Manuguru areas of Godavari Graben, Tatapani-Ramkola and Talcher coalfields, Son-Mahanadi Basin and Changki Valley Coalfield, Nagaland have been assessed biopetrologically. Similar studies have also been extended to the lignite from Panandhro Lignitefield, Kutch Basin, Gujarat.

Flowering plants of the Past and palaeoenvironment

Continuing the quest for understanding the origin and diversification of flowering plants, the fossil plant assemblages from Tertiary sediments have been studied. The fossil woods recovered from Wardha District, Maharashtra suggest that central India witnessed uniform floral pattern and climate during Late Cretaceous-Early Tertiary time. Similar studies on fossil woods from western India indicate the existence of moist humid condition during Late Tertiary in Gujarat and Rajasthan.

The palaeobotanical studies were carried out on the Tertiary sediments of Jammu area, Kargil Basin, Ladakh, Himachal Pradesh, West Bengal and Uttar Pradesh to understand the distribution of plant fossils and palaeogeography. Similar studies were also extended to Tertiary sediments of Nepal. The phytogeographical significance and palaeoecology were interpreted on the basis of comparison of fossil taxa with habitat of similar extant plants. Identification of leaf-impressions as *Acrostichum* suggests coastal environment in the vicinity of Kasauli-Kumarhatti during Lower Miocene. In totality, the megafloral evidences

indicate existence of tropical forest all along the Himalayan foot-hills during the deposition of Siwalik sediments. In one of the studies the presence of zygospores referable to Zygnemataceae algae was recorded from Siwalik sediments of western Nepal. This evidences for the clear, stagnant and shallow freshwater environment during the deposition of these sediments.

Detailed Scanning Electron Microscopy was carried out on fossil *Selerosperma* cf. *S. manii* to ascertain the nature of aperture and affinities in fossil and extant pollen. The existence of African Palm-like plants in the Neyveli was confirmed. Scanning Electron Microscopic studies on the fossil woods from Deccan Intertrappeans and modern charcoal revealed absence of middle lamella. This suggests that the volcanic erruptions caused fire which produced fusain at the cost of middle lamella.

On the basis of leaf-impressions from west and central Nepal, a phytogeographical link between Indian subcontinent and southeast Asia was deduced during Miocene-Pliocene.

Studies were also carried out to understand the fossil flora of northeastern India during Tertiary Period. The fossil leaves, fruits, seeds and spores and pollen were investigated to estimate the vegetational components; the palaeoecology of the basin was also assessed. The fossils of monocotyledonous taxon *Nipa,* recorded from Makum Coalfield, indicate that the deposition of coal and associated sediments occurred in coastal environment. In one of the studies the palynological composition from Namdrik River Section, Changlang District, Arunachal Pradesh indicated the existence of a humid tropical to subtropical climate with high rainfall. A shallow marine environment of deposition and subtropical to tropical climate was interpreted for Tertiary sediments in Garo Hills, Meghalaya.

The Quaternary sediments from south Indian tropical montane forest, Garhwal Himalaya, Mahanadi Delta and Andaman and Nicobar Islands were palynologically analysed to understand the history of vegetation and climate. The palynological studies on Spiti Valley material have revealed cold and dry climate during 2000 to 1500 yrs B.P., while between 1500 to 900 yrs B.P. amelioration in climate is indicated. Thereafter, recurrence of the cold and dry climate is recorded. The palynological studies from Sadanandpur profile (Mahanadi Delta) have shown several cyclic changes in the marine transgressive and regressive facies. On the basis of palynostratigraphy and lithostratigraphy from Sadanandpur the ancient shore lines have been deduced. The results of palynological studies from a profile dated back to 20,000 yrs B.P. from Andaman and Nicobar Islands have shown vegetational development in three phases.

The tree ring chronology is being worked out at the Institute. The results of tree ring studies of teak from the Wood Museum of Institute of Wood Science and Technology, Bangalore, date the wood to the period 1159-1959 AD. In a similar study on a Mesozoic wood—*Podocarpoxylon rajmahalense,* warm temperate climate was interpreted for the period.

Phytoplankton stratigraphy

The phytoplankton studies were continued on marine sediments of Kutch and Saurashtra, Meghalaya, East Coast and Andaman and Nicobar Islands. The taxonomical

intricacies of *Disphaerogena*—a latest Maastrichtian-Danian dinoflagellate cyst genus, was resolved. On the basis of dinoflagellate cyst evidences the lower part of Trichinopoly Formation (Cauvery Basin) was dated as Middle-Upper Turonian age. The diatom assemblages recovered from Havelock Island indicated a Miocene age for Long and Inglis formations.

Plant remains from Pre- and Proto-Historic sites

The researches on botanical remains from Pre- and Proto-Historic archaeological sites in north and north-western India have provided significant results. For the first time the studies from Sanghol, district Ludhiana, Punjab have shown the use of varied plant products with healthy constituents and agreeable aroma in the traditional sacrificial rituals.

Geochronometry of Indian rocks

Radiocarbon dating of Quaternary deposits and archaeological remains has been continued for chronological frame work of Quaternary events and cultural developments in the subcontinent. The clay and shell samples from Salt Lake area, Calcutta, Kanya Kumari, Tamil Nadu, Earthquake site (Latur) and Maharashtra were analysed for age determination by C-14 method. The bottom most oyster bed from Koparkhairna District, Thane was dated as 6240 $\pm$ 120 yrs B.P. The samples from Mariana, Kodaikanal and Dangmal, Mahanadi Delta, Orissa were dated to reconstruct the palaeofloristics in south India and Orissa.

Golden Jubilee Celebrations of the Institute

The Institute is in the 50th Year of its fruitful existence since September 10, 1995. This momentous occasion of Institute's entry into the Golden Jubilee Year was inaugurated and graced by Professor V.S. Ramamurthy, Secretary, Department of Science and Technology, Government of India. Professor C.V. Subramanian, Chairman, Governing Body of the Institute presided over the Golden Jubilee inauguration function. Professor Ramamurthy declared Professor Birbal Sahni's room open to visitors as part of Institute's Museum on this occasion. The Founder's room, where Professor Sahni worked using it as his office-cum laboratory, has been renovated and recreated with the articles that were handled by him. The setting and atmosphere of the Professor Birbal Sahni's room is a source of inspiration to all those who visit the Institute. Professor Ramamurthy viewed the picture gallery adjacent to Professor Birbal Sahni's room depicting the important events of Institute's growth to prominence.

Professor V.K. Gaur of National Aerospace Laboratory, Bangalore delivered the First Golden Jubilee Lecture on "Antarctica — the land of Science". In this lecture Professor Gaur gave an excellent account of various scientific experiments being carried out on Antarctica and their implications to mankind. The function was attended by the members of the Governing Body, Research Advisory Council, National Organizing Committee and scientists from various organizations of Lucknow.

On this occasion two Volumes 43(1) and 44 of "*The Palaeobotanist*"—the journal of the Institute, and a book "Coaliferous fuel resources of India—Parameters of studies in

Golden Jubilee Year Celebrations (from left—Dr G. Rajagopalan, Professor V.K. Gaur, Professor C.V. Subramanian, Professor V.S. Ramamurthy and Dr R.S. Tiwari).

palynology and biopetrology" were also released by Professor Ramamurthy.

As one of the scientific programmes of the Golden Jubilee Year Celebrations, a Group Discussion on "Scientific aspects of Pre- and Proto-Historic India" was organised on November 15, 1995. Scientists from five organizations discussed results of recent researches and their views on Stone Age hunter-gatherer, their tool making, glass and ceramic technologies, archaeometallurgical studies, plant domestication and socio-economic aspects of Early cultures of India. A two day "Hindi Karyashala" was also held at the Institute as part of Golden Jubilee Celebrations from December 21-22, 1995. Thought provoking lectures by renowned speakers including Sri Ram Dhaniram, Director, All India Radio, Lucknow; Professor S.P. Dixit, Head, Hindi Department, Lucknow University, were delivered on the occasion. About 20 delegates from State and Central Government and other organizations in

Professor Birbal Sahni's Room declared open for visitors.

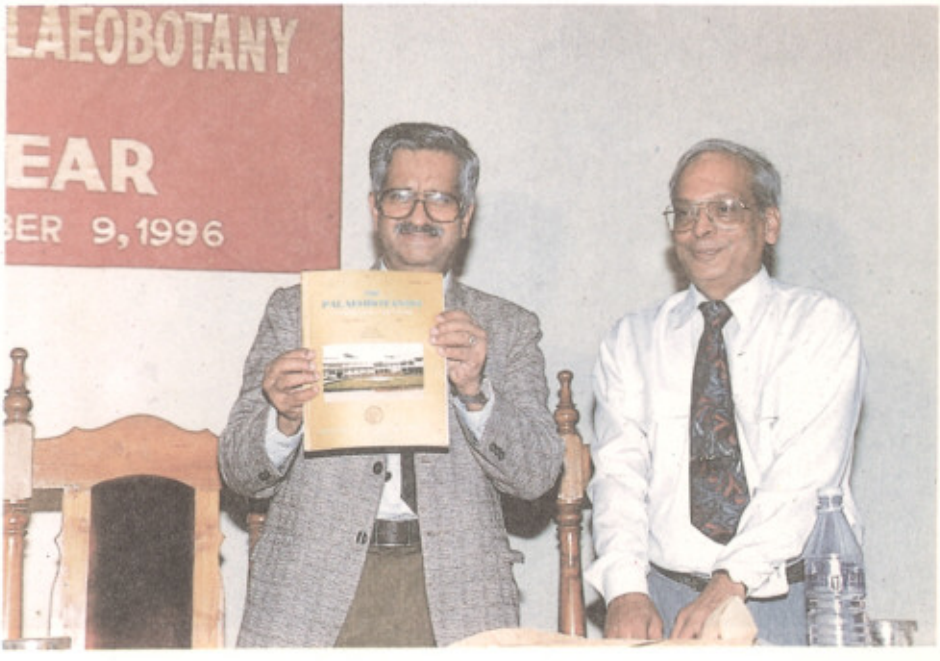
Lucknow attended this Karyashala in which 55 scientific and administrative personnel of the Institute also participated. As part of Golden Jubilee Celebrations, a Kavya Goshthi was also organised during Hindi Pakhwara from September 14-28, 1995. Original Hindi poems were presented by members of the Institute staff.

In the lecture series of the Golden Jubilee Celebrations Professor D.D. Pant, INSA Senior scientist, Allahabad University, Allahabad delivered the Second Golden Jubilee Year Lecture on "The plants of Glossopterids– -A reappraisal and a review" on March 22, 1996.

Other Activities

During the year 72 research papers and 87 abstracts have been published and 82 papers were submitted for publication. Seventy-one research papers were presented in the National and International Conferences. This year 28 scientists were deputed to Conferences in the country and 13 scientists to International Conferences. In the Institute, 6 lectures were

Professor V.K. Gaur delivering the First Golden Jubilee Year Lecture.



Professor V.S. Ramamurthy releasing the First Golden Jubilee Year Volume of *The Palaeobotanist.*

At a Group Discussion (from left—Dr H.P. Gupta, Mr G.V. Joshi, Professor C.V. Subramanian, Dr R.S. Tiwari and Dr K.S. Saraswat).

Sri Ram Dhaniram lighting lamp at two-day "Hindi Karyashala"

Professor D.D. Pant delivering the Second Golden Jubilee Year Lecture.

delivered by the scientists from other institutions, while 16 scientists of the Institute delivered lectures in other organizations.

Under the In-House Seminars, 3 Birbal Sahni Research Scholars delivered the lectures. The Institute sponsored a "Professional Course in Geology" at the Geology Department, Lucknow University, Lucknow. Fourteen young scientists of the Institute were deputed

Hindi Diwas Samaroh.

Scientists from Kyrgyzstan at C^{14} dating laboratory.

in it. Two field excursions were also organised in this course.

Technical assistance has been provided to various universities and organizations in the field of palynology, palynodating, electron microscopy, petrology and radiocarbon dating and archaeology. The entire material of Herbarium was shifted to Mezanin and displayed. About 700 plant specimens were added in the repository of Herbarium. The Herbarium facilities have been provided to various universities, institutes and colleges. The Museum has gifted fossil specimens to 21 educational institutions in the country under special programme "Palaeobotany for Education". Scientists from various countries like France, Poland, Australia, Kyrgyzstan apart from national centres visited the Institute and the Museum.

During the year scientists of the Institute undertook about 40 field excursions. Collection of 2,597 specimens and 2,720 samples was made from 182 localities of the country and deposited in the Museum.

An exhibition was organised during 83rd Session of Indian Science Congress at Patiala. The National Science Day was celebrated on the theme "India can do it" On this

Visitors showing interest in the Institute's exhibits at 83rd Indian Science Congress, Patiala.

occasion a Scientific Poster Competition was organised for school children in which 57 students participated.

The Institute has published Volume 43, Number 1 and 2 of the journal The Palaeobotanist. The special Golden Jubilee Volume 44 of the journal and a special publication—Coaliferous fuel resources of India—Parameters of studies in palynology and biopetrology, have also been published during the year.

The Founder's Day was celebrated at the Institute on 14 November, 1995 with floral tributes at *"Samadhi"* of Professor Sahni. On this occasion, the 41st Sir Albert Charles Seward Memorial Lecture was delivered by Professor C. Virgili, University of Paris on "A critical event in the history of the earth—The Palaeozoic and Mesozoic Boundary" and the 25th Birbal Sahni Memorial Lecture was delivered by Dr Ashok Jain, Director, NISATDS, New Delhi on "Science and technology in social diversity : The changing paradigm"

Besides the scientific activities, the Institute celebrated the National Festivals—Independence Day and Republic Day. On Independence Day outdoor games and cultural programmes were organised by the Staff Welfare Committee. The staff members and their families took part in these functions.

The total strength of the Institute staff is 187, in which 72 are scientists and rest include technical and administrative staff and 5 Birbal Sahni Research Scholars. Five appointments and 19 promotions have been made during the year. Four staff members retired after superannuation including two scientists.

Visitors showing interest in the Institute's publications at 83rd Indian Science Congress, Patiala.

The Institute has lost 3 members—Sri H.N. Boral, Senior Technical Officer, Sri P.S. Salujha, Mechanic and Sri Vishnu Kumar, Chowkidar during the year.

On-going Effort's : 1996-97

The year 1996-97 will be the last year of the VIII Five Year Plan. The programmes already identified under different projects will continue. Being the last year of the VIII Plan results of most of the Programmes will be completed and finalized. The investigations on the following aspects will be persued.

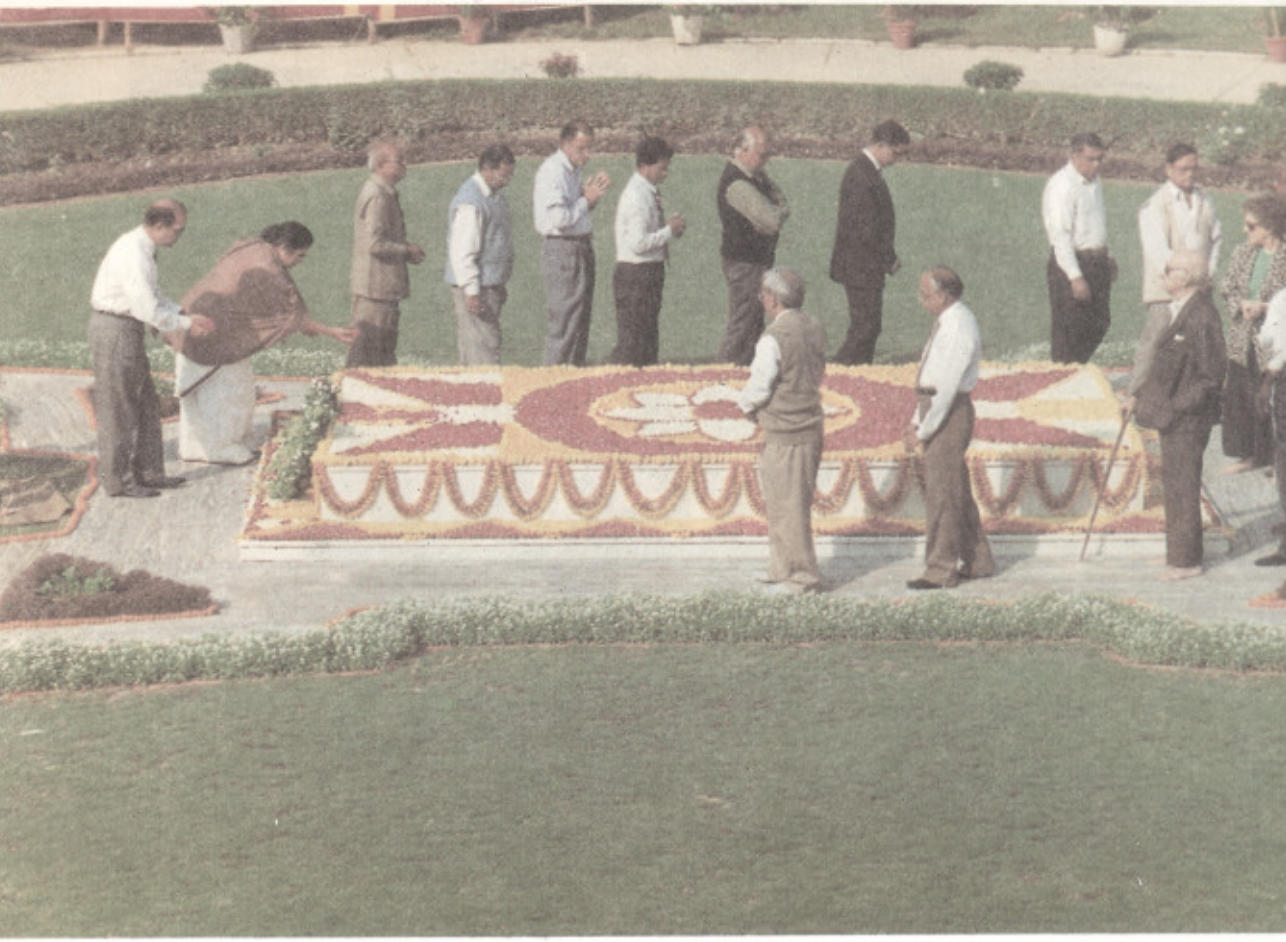
The biota representing early life from Madhya Pradesh and Kurnool basins will be studied and the results on the palaeobiological remains recorded from Kaladgi, Cudapah, Bhima and Kurnool basins will be finalized. The calcareous algae from Maastrichtian-Danian sequence around Ariyalur, Tiruchirapalli District, Tamil Nadu will be studied. The study of plant fossils from Hura, Chuperbhita, Jharia, Karanpura, Bokaro, Auranga, Talcher coalfields,

Children participating in a Poster Competition on National Science Day—February 28, 1996.

Rajmahal and Gangapur beds will be continued to understand the floral change through time. The intricate details of plant fossils, seeds, cuticles, megaspores, etc. will be studied by electron microscopic techniques to trace the taxonomy grouping and affinity with parent plant group. The palynostratigraphical studies and correlation of coal-bearing strata being done on sediments from Rajmahal, Domra-Panagarh, Sohagpur, Pali-Tiki-Parsora basins will be continued. The Himalayan sediments will be analysed for their palynological contents and plant megafossils.

The micro- and megafloral studies on Tertiary sediments from Deccan Intertrappean, Ratnagiri, Neyveli, Eastern Coast of south India, Rajasthan and Gujarat, Assam, Meghalaya, West Bengal, Bihar, Uttar Pradesh and Himachal Pradesh will be continued for palynostratigraphy and biogeographical interpretations. The phytoplankton studies of marine sediments will be continued on Meghalaya, East Coast and Andaman and Nicobar Islands.

The Quaternary sediments from Palni Hills, eastern and Garhwal Himalayas, Gujarat



Pushpanjali at Professor Birbal Sahni's Samadhi.

and Mahanadi Delta will be analysed for the flora and vegetational pattern. The tree-ring analysis will be continued from conifer samples growing in Uttarkashi District, western Himalaya for the palaeoclimate during the recent past. The archaeobotanical remains from Pre-Harappan and Mature Harappan cultures at Hissar District, Haryana and Kudan will be studied. The aerospora of Lucknow will be studied for its biochemical and clinical implications.

The radiocarbon dating of Quaternary sediments of Gangetic plain, coastal and lake deposits and archaeobotanical remains will be continued. Elemental analysis of fossil wood specimens and radiometric dating of trap material by ^{40}Ar-^{39}Ar will be taken up. The existing data bases will be updated for preparation of catalogues and monographs. The geobotanical analysis will be continued for the mineral prospecting and reconstruction of history of modern vegetation through Cenozoic Era. Under the project palaeobiochemistry investigation of

Professor C. Virgili delivering the 41st Sir Albert Charles Seward Memorial Lecture.

Dr Ashok Jain delivering the 25th Birbal Sahni Memorial Lecture.

Independence Day.

dispersed organic matter related material from Garhwal Himalaya and Bihar will be taken up.

Apart from the research programmes of the Institute collaborative projects with other organisations—Geological Survey of India, MECL, Coal India Ltd., Indian Institute of Science, Agharkar Research Institute, Geology Department of various universities, etc. have also been proposed.

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International Geological Correlation Programmes

IGCP Project No. 303 : **"Precambrian-Cambrian events stratigraphy"**
P.K. Maithy
Member, National Working Group
R. Babu
Member, National Working Group

IGCP Project No. 320 : **"Neo-Proterozoic events and resources"**
Manoj 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. 359 : **"Non-marine Triassic"**
R.S. Tiwari
Member, International Working Group
Vijaya
Member, International Working Group

IGCP Project No. 380 : **"Biosedimentology and correlation of microbial buildups"**
P.K. Maithy
Member, National Working Group

Lectures delivered

By Institute's scientists

R.S. Tiwari

— "*An introduction to palynostratigraphy with its bearing on coaliferous fossil fuel*", U.G.C. sponsored Refresher Course on Sedimentology, Micropalaeontology and Tectonics for University College teachers, Geology Department, Lucknow University, Lucknow.

G. Rajagopalan

— "*Dating methods for Archaeology : principle, technique and limitations*", at training course in conservation. National Research Laboratory for Conservation, Lucknow.

— "*Fission track dating*", National Workshop on SSNTD, Organised by the Nuclear Track Society of India, D.V. Postgraduate College, Orai.

— "*Dating methods for geological samples*", U.G.C. sponsored Refresher Course on Sedimentology, Micropalaeontology and Tectonics for University College teachers, Geology Department, Lucknow University, Lucknow (a series of two lectures).

P.K. Maithy

— "*Earliest earth's atmosphere and evolution*", sponsored programme "Clean up India" organised by Central School, Lucknow.

— "*Earliest fossil remains and what they mean*" and "*Emergence of animals*", U.G.C. sponsored Refresher Course on Sedimentology, Micropalaeontology and Tectonics for University College teachers, Geology Department, Lucknow University, Lucknow.

— "*Oldest biological remains and their significance*", U.G.C. sponsored Refresher Course, Academic Staff College, Burdwan University, Burdwan.

— "*Jivashm : ek rochak kahani*" and "*Mahadweepon ka Vighatan* ", TV talks under "Vigyan Jagat", Doordarshan Kendra, Lucknow.

N. Awasthi

— "*Neogene flora of India*", Department of Geosciences, Osaka City University, Osaka, Japan.

— "*Neogene flora of India : diversification and influence of the Himalayan uplift*", Department of Botany, Kyoto University, Kyoto, and at the Department of Geology, Shimane University, Shimane, Japan.

S.A. Jafar

— "*Some major breakthrough in nannofossil research: academic and economic scene*" and "*Contribution of calcareous nannofossils in understanding K/T boundary events*", U.G.C. sponsored Refresher Course on Sedimentology, Micropalaeontology and Tectonics for University College teachers, Geology Department, Lucknow University, Lucknow.

— "*Electron microscopy of botanical materials*", VIII National Workshop on Electron Microscopy at Regional Sophisticated Instrumentation Centre (RSIC), Punjab University, Chandigarh (a series of two lectures).

— "*Architecture of Baarudosphaera bigelowi* (Coccolithophorid) : marine alga with quasicrystalline skeleton", First Professor S.N. Singh Memorial Lecture, sponsored by Palaeontological Society of India, Geology Department, Lucknow University, Lucknow.

K.S. Saraswat

— "*Plants in archaeological perspectives*", "*Origin of agriculture and the emergence of early farming cultures in the Indian subcontinent*" and "*Plant economy in Indus / Saraswati civilization*", Institute of Archaeology, Archaeological Survey of India, New Delhi.

— "*Neolithic plant economy in the Mid-Ganga plains*", U.P. State Archaeological Organization, Lucknow.

Shyam C. Srivastava — "*Gondwana palaeobotany of India*" (in series), Institute of Botany, Beijing, China.

C.M. Nautiyal — "*Of life, its diversity, ozone and Isotopes*" and "*Our Sun*" (on C.V. Raman Day), Regional Science Centre, Lucknow.

— "*Astronomy, Physics and Palaeobotany*", Vigyan Parishad, Allahabad.

— "*Solar Eclipse*", under the scheme of Council of Science and Technology, U.P. and live commentary on Solar Eclipse, Allahabad on National TV Network.

— "*Effective science and technology communication*", Lucknow University, Lucknow (to M.Sc. Tech. students).

— Science Journalism courses to trainees in the NCSTC (DST) sponsored workshop at Fatehpur.

— "*Hindi mein vigyan sanchar*", BSIP under Nagar Rajbhasha Karyanvayan Samiti.

J.S. Antal — "*Palaeobotany and palaeoenvironment*", Rajbhasha Conference, Department of Hindi, Lucknow University, Lucknow.

A.K. Srivastava — "*Glossopteris flora and insect/plant relationship*" Palaeobotany Laboratory, Museum of Earth, Warsaw, Poland.

A. Bhattacharyya — "*Quaternary climatic studies in the Himalayan region*", Brainstorming Seminar on Himalayan Experiment (HIMEX) organised by D.S.T., Indian Institute of Technology, New Delhi.

— "*Tree-ring studies in tropical trees*", Brainstorming Session on Past global changes , IITM, Pune.

A. Rajanikanth — "*Extinctions and endangered plant species*", Regional Science Centre, Lucknow.

— "*Early Cretaceous flora of India*", Institute of Botany, Beijing, China.

— "*Mimic plants*", Army Public School, Lucknow.

— "*Fossil algae*", Madras Christian College, Madras.

Mukund Sharma — "*Palaeobiological remains of the carbonate sequences of Cuddapah Basin and their bearing on the age of Cuddapah Supergroup*", Annual Meeting of the Geological Society of India, Sri Venkateshwara University, Tirupati.

Jyotsana Rai — "*Itihas jinka rini hai—Chikitsa ke itihas mein Adward Jainer*", All India Radio, Lucknow.

Vandana Prasad — "*Vigyan ki rochak baten*", All India Radio, Lucknow.

Anjum Farooqui — "*Vigyan ki rochak baten*", All India Radio, Lucknow.

— "*Science Quiz*", compiled and conducted on All India Radio, Lucknow.

By outside scientists in the Institute

Professor H.J. Tobshall — Department of Geology, University of Erlangen, Germany; "*Sediments : sinks or sources of heavy metals?*" on April 26, 1995.

Professor V.K.Gaur — National Aerospace Laboratory, Bangalore; "*Antarctica—The land of Science*" on September 10, 1995 (First Golden Jubilee Year Lecture).

Dr K.K. Sappal — School of Applied Geology, Curtin University of Technology, Perth, Australia; "*Organic petrology of some selected coals of western Australia*" on September 19, 1995.

Dr J.M. Dickins — Australian Geological Survey Organization, Canberra, Australia; "*The events of the Permian-Triassic boundary and their implications*" on September 21, 1995.

Professor P. Ghosh — Sanjay Gandhi Post-Graduate Institute of Medical Sciences, Lucknow; "*Heart Surgery*" on October 30, 1995.

Professor D.D. Pant — Former Head, Department of Botany, Allahabad University, Allahabad; "*The plants of Glossopterids—A reappraisal and a review*" on March 22, 1996 (Second Golden Jubilee Year Lecture).

Recognition

R.S. Tiwari

— Invited Speaker at Plenary Session and Chaired a Technical Session at International Conference on "Diversification and Evolution of Terrestrial Plants in Geological Times" held at Nanjing, China.

— Chaired a Scientific deliberation at National Symposium on Researches in Pteridology held at Jodhpur.

H.K. Maheshwari

— Chaired the "8th Savitri Sahni Smarak Lecture" delivered by Dr John Anderson of South Africa on 19th September 1995.

— Presided over the Ceremonial Function held to award Birbal Sahni Centenary Medal to Professor M. Kedves of Hungary on the Annual Day of Birbal-Savitri Sahni Memorial Museum on January 22, 1996; presented momentos to Dr Eva Kedves of Hungary and Dr A.N. Pathak of UPCST.

P.K. Maithy

— Chairman, "J. Sen Memorial Lecture" delivered by Professor T.K. Roychowdhary at University College of Science, Calcutta University, Calcutta.

— Chairperson, "Palaeobotany and Palynology Session", Diamond Jubilee Celebration, National Botanical Society, Calcutta.

N. Awasthi

— Awarded "Visiting Fellowship" by Osaka City University, Osaka, Japan.

S.A. Jafar

— Judge for English debate competition of CMS teachers, City Montessori School, Gomti Nagar, Lucknow.

Chhaya Sharma

M.S. Chauhan

— Contact Person and Organiser of the Symposium on the theme "Quaternary Palynostratigraphy of the Himalayas" for 9th International Palynological Congress to be held at Houston, U.S.A. in June, 1996.

Shyam C. Srivastava — Declared to be conferred : Dr Greguss Pal Centenary Medal *Auspices* : Botany Department, J.A. University, Szeged, Hungary; "Commemorative Medal" *Auspices*: CBEM, J.A. University, Szeged, Hungary; and "Silver Centenary Medal" *Auspices*: Hungarian Botanical Society, Hungary.

— Chaired the scientific deliberation in ICTPG, Nanjing, China.

— Chaired the Symposium : Researches in Pteridology, Jodhpur.

A.K. Srivastava — Nominated Convener of Palaeobotanical Session (Macroflora) at "13th International Congress on Carboniferous-Permian" held at Krakow, Poland.

Rahul Garg — Nominated Member, Editorial Board, Journal of the Palaeontological Society of India.

B.K. Misra — Invited by the Convenor, Xth Convention of Indian Geological

B.D. Singh Congress to deliver special lectures at Pre-Congress short course "*Applied coal and organic petrology*", held at Indian School of Mines, Dhanbad.

Asha Khandelwal — Awarded " Second Prize" by B.S.I.P. for doing the maximum

M.S. Rana official work in Hindi.

Samir Sarkar — Awarded "First Prize" in debate competition on the theme "Hindi Rashtriya Swabhiman ki Bhasha Hai" organized by Rajbhasha Karyanvayan Samiti of the Institute on the occasion of Hindi Diwas.

A. Bhattacharyya — Awarded INSA Visiting Fellowship for three months to work at the Earth Science Department, Physical Research Laboratory, Ahmedabad on Stable isotope in tree rings and lake sediments.

A. Rajanikanth — Resource Person and Guest Lecture, Workshop on the scope of Palaeobotany and Palynology in the University Botanical Curriculum, Madras.

Mukund Sharma — Awarded Chinese Government Scholarship 1995 by Department of Education, Ministry of Human Resources, Govt. of India.

— Awarded Certificate in Science Journalism by Jeevaniya Society and Lucknow University.

B.D. Mandaokar — Awarded "Second Prize" in debate competition on the theme "Hindi Rashtriya Swabhiman ki Bhasha hai" organized by Rajbhasha Karyanvayan Samiti of the Institute on the occasion of Hindi Diwas.

Asha Gupta
Kavita Kumar
R.L. Mehra — Awarded "Third Prize" by B.S.I.P. for doing the maximum official work in Hindi.

A.K. Ghosh — Judge, State Level National Childrens' Science Congress 1995 at Regional Science Centre, Lucknow.

Vandana Choudhary — Awarded "First Prize" for the best Poster presentation of the DST sponsored project entitled "Reconstruction of past climatic changes in the Eastern Himalaya using tree-ring data" (Principal Investigator : A. Bhattacharyya).

V. Nirmala — Awarded "Third Prize" in debate competition on the theme "Hindi Rashtriya Swabhiman ki Bhasha hai" organized by Rajbhasha Karyanvayan Samiti of the Institute on the occasion of Hindi Diwas.

Dhoom Singh — Awarded "First Prize" by B.S.I.P. for doing the maximum official work in Hindi.

Representation in Committees/Boards

R.S. Tiwari	• Chief Editor, "*The Palaeobotanist*" (up to January 1996)
	• Co-Editor, "*Asian Journal of Plant Sciences*"
	• Member, Editorial Board "*Biological Memoirs*"
	• Editor, "*Quarterly Journal of Geological Association and Research Centre*"
	• Corresponding Member, Committee for Quantitative Stratigraphy
	• Member, Executive Council, The Palaeobotanical Society, Lucknow
	• President, International Society of Applied Biology
	• Member, National Organising Committee, "Symposium on Earth Sciences in Environmental Assessment and Management", GSI, Lucknow
	• Vice-Chairman, Organising Committee and Member of the Presidium, ICTPG, Nanjing, China
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, Editorial Board, "*The Palaeobotanist*"
	• Editor, "*Indian Association of Palynostratigraphers*"
	• Member, Committee for Fossil Plants, International Association for Plant Taxonomy
	• Member, Executive Committee, International Council for Biodeterioration of Cultural Property
P.K. Maithy	• Convener, "Golden Jubilee Conference : Physical and biological changes across the major geological boundaries", B.S.I.P., Lucknow

	• Member, "Conference on Biology and Sedimentology of Indian Precambrian Sediments" organised by Palaeontological Society of India
N. Awasthi	• Vice-President, The Palaeobotanical Society, Lucknow
Anand-Prakash	• Member, Executive Council, The Palaeobotanical Society, Lucknow
	• Member, Solid Mineral Fuels Sectional Committee, Bureau of Indian Standards, New Delhi
	• Treasurer, Indian Association of Palynostratigraphers
Anil Chandra	• Member, Executive Council, Palaeontological Society of India
Shaila Chandra	• Vice-President, Indian Society of Geoscientists
	• Coordinator, International Project "Gondwana Alive"
	• Councillor, The Palaeobotanical Society of IOP
H.P. Gupta	• Secretary, The Palaeobotanical Society, Lucknow
	• Business Manager, Indian Association of Palynostratigraphers, Lucknow
	• Councillor, The Palaeobotanical Society in IFPS
	• Member, Man & Environment, Ahmedabad
S.A. Jafar	• Organizing Secretary, Lucknow Chapter, Zaheer Science Foundation, New Delhi
Chhaya Sharma	• Vice-President, International Council for Biodeterioration of Cultural Property
	• Member, Advisory Committee of "*Journal of Bengal Natural History Society*"
Suresh C. Srivastava	• Chief Editor, "*Geophytology*"
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. 1995

	• Member, Organising Committee, Seminar on "Ozone Depletion and Conservation of Endangered Species" (under MOE & F Scheme)
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
	• Member, Editorial Board "*Journal of Living World*"
Shyam C. Srivastava	• Convener-Secretary, Birbal-Savitri Sahni Foundation, Lucknow
	• Member, IOP Birbal Sahni Medal Committee
	• Honorary Member, Palaeobotany Section, Botanical Society of India
Archana Tripathi	• Member, Jurassic Microfossil Group, International Sub-commission 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
	• Voting Member, International Working Group on Carboniferous Stratigraphy
Usha Bajpai	• Member, Managing Council, Indian Association of Palynostratigraphers
H.A. Khan	• Member, Consultative/Advisory Committee—Minority Coaching Institute, Lucknow University
	• Editor, "*Indian Journal of Bioresearch*"
Asha Khandelwal	• Member, Executive Council, Indian Aerobiological Society
B.K. Misra	• Member, Solid Mineral Fuels Sectional Committee, Bureau of Indian Standards

	• Joint Secretary, Indian Society of Geoscientists
Rakesh Saxena	• Associate Member, International Committee for Coal and Organic Petrology
	• Member, Latin American Association of Organic Geochemistry, Brazil
R.R. Yadav	• Member, Sale Promotion Committee, "*Geophytology*", The Palaeobotanical Society, Lucknow
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*", The Palaeobotanical Society, Lucknow

Deputation/Training/Study/Visit Abroad/in Country

Chhaya Sharma

After attending "10th Himalayan-Karakorum-Tibet Workshop" held at Ascona, Switzerland in April, 1995, visited Paris and met Dr S.I. Rasool, Chairman, IGBP-DIS to discuss about the proxy climate data generated through the palynostratigraphy of Himalayan lake sediments.

After attending 14th Symposium of APLF on "Palynology and Global Changes" held at Paris in September, 1995 visited Institute de Palaeontologie Hamaine.

Attended Brainstorming Session on "Land Use/Cover Change (LUCC)", sponsored by NC-IGBP at NRSA, Hyderabad on February 17, 1996. Also attended NC-IGBP Meeting as a special invitee during the visit.

G. Rajagopalan, Chhaya Sharma & A. Bhattacharyya

Attended Brainstorming Session on "Past Global Changes (PAGES)" held at IITM", Pune on May 1, 1995.

A.K. Srivastava

After attending the "International Congress on Carboniferous-Permian" held at Krakow in August-September, 1995 visited Szafer Institute of Botany, Krakow, Poland, J.A. University, Szeged and Natural History Museum, Budapest, Hungary.

Shyam C. Srivastava

After attending the "International Conference on Diversification and Evolution of Terrestrial Plants in Geological Times" held at Nanjing, China in September, 1995 visited Institute of Botany, Beijing and delivered a series of lectures on Gondwana Palaeobotany of India.

A. Rajanikanth

After attending the "International Conference on Diversification and Evolution of Terrestrial Plants in Geological Times" visited Nanjing Institute of Geology and Palaeontology, Nanjing and Institute of Botany and Peking University, Beijing and interacted with scientists. Also delivered a lecture at the Institute of Botany, Beijing and observed megafossil specimens of Mesozoic sediments of China.

N. Awasthi

Visited Department of Geoscience, Life Science, Osaka City University, Osaka; National Science Museum Osaka; Department of Geology and Botany, Kyoto University and Wood Research Institute, Kyoto; Lake Biwa Museum Site, Shiga Prefecturi; Department of Geology, Shimane University, Shimane and National Science Museum, Tokyo from November 25 to December 20, 1995 under the Visiting Fellowship awarded by Osaka City University, Osaka, Japan.

A. Bhattacharyya

Attended "Brainstorming Seminar on Himalayan Experiment (HIMEX)" held at the Indian Institute of Technology, New Delhi from December 8-10, 1995.

Participated in an expedition to Dokriani Bamak Glacier with collaboration of J.T. Gergan, WIHG, Dehradun under DST Project "Glaciology Expedition to Dokriani Glacier". Tree ring samples (154) from *Abies pindrow* were collected to analyse variations of tree growth in relation to climatic and glacier fluctuations.

G. Rajagopalan, S.A. Jafar & C.M. Nautiyal

Attended one day Workshop on "Intellectual Property Rights and Patenting Laws", sponsored by DST, New Delhi and held at Academic Staff College, Lucknow University, Lucknow on December 20, 1995.

27 Scientific, 5 Technical and 22 Administrative Personnel

Attended two day "Hindi Karyashala" organised by the Institute as one of the objective of Golden Jubilee Year Celebrations, held at B.S.I.P. from December 21-22, 1995.

Archana Tripathi, Vijaya & Ratan Kar

Attended field workshop on "Recent Advances in Stratigraphy, Tectonics and Magmatic History of the eastern part of Rewa Gondwana Basin" organised by G.S.I., Coal Wing with base at Ambikapur, Surguja District, Madhya Pradesh held from January 16-21, 1996.

Asha Khandelwal & Deepak Kohli

Attended annual Review Meeting of "All India Coordinated Project on Aeroallergens and Human Health" sponsored by the Ministry of Environment and Forests, Government of India held at Y.S. Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh from January 23-25, 1996.

R.K. Kar, A. Bhattacharyya, Vandana Chaudhary, Poonam Sharma & R. Singh

Attended "VII Group Monitoring Meet on Earth Sciences", organised by D.S.T. held at Jaipur from January 27-29, 1996.

Mukund Sharma

Successfully completed the course on "Science Journalism" organised by Jeevaniya Society sponsored by Lucknow University and NCSTC, D.S.T., New Delhi from February 11 to May 20, 1995.

Kavita Kumar & V.K. Nigam

Attended 20th All India Conference of the "Indian Association of Special Library and Information Centre (IASLIC)" held at Lucknow University, Lucknow from December 26-29, 1995.

V.K. Singh

Attended 27th All India Course on "Vacuum Science and Technology—96" held at Bhabha Atomic Research Centre, Bombay from February 26 to March 1, 1996.

Samir Sarkar

10th Himalayan-Karakorum-Tibet Workshop held at Ascona, Switzerland from April 4-9, 1995.

Deputation to Conferences/Symposia/Seminars/Workshops

R.R. Yadav **A. Bhattacharyya** **S.K. Bera**	• *"International Himalayan-Tibetan Plateau Palaeoclimate Workshop"* held at Kathmandu, Nepal from April 2-7, 1995.
Chhaya Sharma **Samir Sarkar**	• *"10th Himalayan-Karakorum-Tibet Workshop"* held at Ascona, Switzerland from April 4-8, 1995.
P.K. Maithy	• *"Diamond Jubilee Celebration National Society"* held at Calcutta University, Calcutta from April 11-12, 1995.
H.A. Khan	• *"Symposium on Environmental Dimensions of Palynological Sciences"* held at Trivandrum from April 11-12, 1995. • *"Botany : 2000 Asia"* held at Dhaka, Bangladesh from February 6-8, 1996.
C.M. Nautiyal **A. Rajanikanth**	• *"Seminar on Ozone Layer Depletion and Conservation of Endangered Species"* held at Regional Science Centre, Lucknow on June, 11, 1995.
H.P. Gupta	• *"International Geomorphological (IAG-SEA) Conference"*, held at Singapore from June 18-23, 1995.
Mukund Sharma	• *"Major Goals in Earth Sciences, Interaction Meet with Earth Scientists"* held at Jammu University, Jammu from August 21-23, 1995. • *"Contact Programme for Excellence in Diagrammatics and Cartography in Earth Sciences"* held at Pune University, Pune from February 22-29, 1996.
C.M. Nautiyal	• *"National Workshop on Mass Spectrometry"* held at Regional Research Laboratory, Trivandrum from August 21-25, 1995. • *"Interdisciplinary Seminar"* held at INSA, New Delhi from October 4-5, 1995.
A.K. Srivastava	• *"XIII International Congress on Carboniferous-Permian"* held at Krakow, Poland, from August 28-September 2, 1995.

R.S. Tiwari **Shyam C. Srivastava** **A. Rajanikanth** **Rajni Tewari**	• *"International Conference on Diversification and Evolution of Terrestrial Plants in Geological Times"* held at Nanjing, China from September 4-8, 1995.
Chhaya Sharma	• *"14th Symposium of APLF on Palynology and Global Changes"* held at Paris, France from September 18-20, 1995.
R.S. Tiwari **Jayasri Banerji** **Shyam C. Srivastava** **A.K. Srivastava** **Archana Tripathi** **Vijaya** **B.N. Jana** **M.R. Rao** **Neeru Prakash**	• *"National Symposium on Researches in Pteridology"* held at Jodhpur University, Jodhpur from October 5-7, 1995.
A. Bhattacharyya	• *"Group Meeting on Seismotectonic and Geodynamics of the Himalaya"* held at Roorkee from October 12-14, 1995.
R.K. Kar	• *"Group Discussion on the Anjar Intertrappean K/T Section"* held at Physical Research Laboratory, Ahmedabad from November 8-11, 1995.
K.S. Saraswat **Chanchala Srivastava** **A.K.S. Pokharia**	• *"Group Discussion : Scientific Aspects of Pre- and Proto-Historic India"* held at B.S.I.P., Lucknow, November 15, 1995.
60 Scientists of the Institute	• *"Golden Jubilee Conference : Vegetational Dynamics of the Past and Present, Palaeobotanical Society"* held at BSIP, Lucknow from November 16-18, 1995.
G. Rajagopalan	• *"First Solid State Nuclear Track Detectors (SSNTD) National Workshop"* held at D.V. College, Orai from November 25-26, 1995.
A. Rajanikanth	• *"Workshop on Scope of palaeobotany and palynology in the University Botanical Curriculum"* held at Madras Christian College, Madras in December, 1995.

	• National Seminar on *"Cretaceous Sedimentary Environments"*, University of Madras, Madras, March, 1996.
Asha Gupta	• *"National Conference on Bryology"* held at NBRI, Lucknow from December 14-16, 1995.
K.S. Saraswat **G.P. Srivastava** **A.K.S. Pokharia** **P.K. Bajpai**	• *"83rd Session of Indian Science Congress"* held at Patiala from January 3-8, 1996.
S.A. Jafar	• *"VIII National Workshop on Electron Microscopy"* held at R.S.I.C, Panjab University, Chandigarh from January 10-12, 1996.
B.K. Misra **B.D. Singh**	• *"X Convention on Indian Geological Congress and Special Workshop—Applied Coal Petrography"* held at Indian School of Mines, Dhanbad from February 1-3, 1996.
G. Rajagopalan **B. Sekar**	• *"First Regional Geosas Workshop on Quaternary Geology of South Asia"* held at Anna University, Madras from February 21-25, 1996.

Papers presented at Conferences/Symposia/Meetings

Agarwal, A.—A fossil wood of *Sonneratia* from the Neyveli lignite deposits, Tamil Nadu, India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Anand-Prakash, Srivastava, G.P. & Kar, R.—Imprints of Neotectonic activity in Mahuadanr Valley, Palamu, Bihar. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Antal, J.S. & Prasad, M.—Some more leaf-impressions from Darjeeling foot-hills, West Bengal : their palaeoecological and phytogeographical significance. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Awasthi, N. & Mehrotra, R.C.—Evolution and diversification of angiosperms in north-east India during Tertiary. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November, 1995.

Awasthi, N., Mehrotra, R.C. & Khare, E.G.—A new Borassoid palm root from the Deccan Intertrappean beds of Wardha District, Maharashtra. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November, 1995.

Banerji, J.—Recent records of Mesozoic ferns from Rajmahal Basin, Bihar. *Nat. Symp. Res. Pteridology*, Jodhpur, October 1995.

Banerji, J.—Early Cretaceous megaflora from Murlipahar, Rajmahal Basin, India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November, 1995.

Bera, S.K.—Pollen interplay in and around Dokriani Glacier, Uttarkashi, Garhwal Himalaya. *Int. Himalayan-Tibetan Plateau Palaeoclimate Workshop*, Kathmandu, April 1995.

Bera, S.K. & Gupta, H.P.—Late Holocene vegetation development in Annamalai Hills, Tamil Nadu, south India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November, 1995.

Bera, S.K., Gupta, H.P. & Farooqui, A.—Berijam Lake : 20,000 years sequence of palaeofloristics and environment in Palni Hills, south India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November, 1995.

Bhattacharyya, A., Chaudhary, V. & Yadav, R.R.—Tree-ring analysis of conifers from the eastern Himalayan region. *Int. Himalayan-Tibetan Plateau Palaeoclimate Workshop*, Kathmandu, Nepal, April 1995.

Bhattacharyya, A. & Yadav, R.R.—Dendrochronological reconnaissance of *Pinus wallichiana* to study glacial behaviour in the North-West Himalaya. *Int. Himalayan-Tibetan Plateau Palaeoclimate Workshop*, Kathmandu, Nepal, April 1995.

Chandra, A.—Biostratigraphic significance of diatoms from the Late Cenozoic rocks of Kamorta, Andaman and Nicobar Islands, India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Chandra, A.—Diatoms from the Neogene sediments of Nancowry Island, Andaman and Nicobar and their stratigraphical significance. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November, 1995.

Chandra, A. & Mandal, J.—Palynological findings from the Palaeogene rocks of Baratang Island (Andaman), India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Ghosh, A.K. & Maithy, P.K.—Porostromata algae from the Cretaceous of Sendurai, Tiruchirapalli District, Tamil Nadu. *Diamond Jubilee Celebration, Nat. Bot. Soc.*, Calcutta.

Guleria, J.S.—On some fossil woods from the Neogene sediments of Bhavnagar, Gujarat, western India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Guleria, J.S. & Bande, M.B.—Diversification, radiation and modernisation of angiosperms in India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Gupta, A.—Fossil and modern bryophytic spores—Diversity in morphology, based on palaeopalynological studies. *Nat. Conference Bryology*, N.B.R.I., Lucknow, December 1995.

Gupta, H.P.—Palaeoenvironment of Mahanadi Delta, India since 0.1 million years as reflected by palynostratigraphy. *IAG-SEA Conference*, Singapore, June 1995.

Jana, B.N.—A comparative study of pteridophytic spore remains of Upper Mesozoic sediments of Mahanadi and Kutch basins. *Nat. Symp. Res. Pteridology*, Jodhpur, October 1995.

Jha, N.—Palynology of subsurface Permian sediments in Koyagudem area, Godavari Graben, Andhra Pradesh. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Khan, H.A.—Palynological study of some Indian Nymphaeaceae with reference to Silent Valley, Kerala, India. *Symp. Environ. Dimen. Palynol. Sci.*, Trivandrum, April 1995.

Khan, H.A.—Tree flora of Silent Valley and pollen morphology of some important species. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobot. Soc., Lucknow, 16-18 November 1995.

Khan, H.A.—Pollen morphology of Apocynaceae with respect to plant taxonomy - a review. *Botany 2000 Asia*, Dhaka, February 1996.

Khandelwal, A., Chatterjee, S. & Prasad, R.—Significance of fungi in the house dust of asthmatic patients in Lucknow. *Golden Jubilee Conference Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Khandelwal, A., Gupta, H.P., Rao, V.R.J. & Rajagopalan, G.—Palaeomangroves in Andaman and Nicobar Islands since 20,000 yrs B.P. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Kohli, D. & Gupta, H.P.—Palaeoenvironment of Mahanadi delta since middle-late Pleistocene as reflected by palynostratigraphy. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Kumar, P.—Permo-Triassic palynofossils and environment of Satpura Basin, Madhya Pradesh. *Golden Jubilee Conference Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Maithy, P.K. & Babu, R.—Proterozoic carbonaceous macrofossils and organic-walled microfossils from the Halkal Formation, Bhima Group. *Diamond Jubilee Celebr., Nat. Bot. Soc.*, Calcutta, April 1995.

Maithy, P.K., Kumar, S., Babu, R. & Sharma, S.—Oxygen producing photosynthetic microfossils from the Iron Ore Supergroup (3.0 billion years old), Noamundi, Orissa. *Diamond Jubilee Celebr., Nat. Bot. Society*, Calcutta, April 1995.

Mandaokar, B.D.—Palynological investigation of coal-bearing sediments of Tikak Parbat Formation from Dilli River section, Dibrugarh District, Assam, India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobot. Soc., Lucknow, 16-18 November 1995.

Misra, B.K.—Fluorescence alteration behaviour of vitrinite in Late Palaeocene bituminous coals from Meghalaya, India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Misra, B.K.—Fluorescence alteration behaviour of perhydrous vitrinite and spectral fluorescence analysis of sporinite and alginite macerals in some Late Palaeocene coals from Meghalaya, India. *X Conv. Indian Geol. Congr., Spec. Workshop Applied Coal Petrography*, Dhanbad, February 1996.

Misra, B.K., Singh, B.D. & Singh, A.—Maceral alginite (algae) in Indian coals and lignites. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Nanda, M.—Early Eocene palynological assemblage from the subsurface of Mannargudi area, Tamil Nadu. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Nautiyal, C.M.—Mass Spectrometry in Palaeobotany. *Nat. Workshop Mass Spectrometry*, Trivandrum, August 1995.

Prakash, N.—The genus *Phlebopteris* in the Indian Gondwana. *Nat. Symp. Res. Pteridology*, Jodhpur, October 1995.

Rai, J., Anand-Prakash & Saxena, R.—Maturation (rank) trend in Talcher coals, Orissa, India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Ram-Awatar—Palynological sequences through Gondwana sediments in South Rewa Basin, Madhya Pradesh. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Rao, M.R.—Palaeoecological and stratigraphical significance of pteridophytic spores in the Kerala Basin. *Nat. Symp. Res. Pteridology*, Jodhpur, October 1995.

Saraswat, K.S.—Harappan plant economy in north-western India. *Group Discussion : Scientific Aspects of Pre- and Proto-Historic India*, B.S.I.P., Lucknow, November 1995.

Sarate, O.S.—Biopetrology of Koyagudem coals, Godavari Basin, Andhra Pradesh, India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Sarkar, S.—Palynostratigraphy and palaeoenvironment of the Subathu Formation (Eocene) of Lesser Himalaya , Himachal Pradesh, India. *10th Himalayan-Karakorum-Tibet Workshop,* Ascona, Switzerland, April 1995.

Sarkar, S.—Palynology and palaeoenvironment of Dharamshala sediments around Karoda Village, Bilaspur District, Himachal Pradesh, India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Saxena, R., Rai, J. & Anand-Prakash—Evidence of palaeo-wildfire from Talcher coals (Permian), Orissa, India. *Golden Jubilee Conference : Vegetational Dynamics of*

the Past and Present, Palaeobotanical Society, Lucknow, 16-18 November, 1995.

Saxena, R.K. & Rao, M.R.—Palynological investigation of the Boldamgiri Formation (Early Miocene) in type area, Garo Hills, Meghalaya. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Saxena, R.K., Tripathi, S.K.M. & Prasad, V.—Palynofloral investigation of the Tura Formation (Palaeocene) in Nongwal Bibra area, East Garo Hills, Meghalaya. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobot. Soc., Lucknow, 16-18 November 1995.

Sharma, C.—Vegetation and climate during Quaternary Period in western Himalaya. *10th Himalayan-Karakorum-Tibet Workshop*, Ascona, Switzerland, April 1995.

Sharma, C.—Quaternary climatic changes in Himalaya. *14th Symp. APLF "Palynology and global changes"* Paris, France, September 1995.

Sharma, C. & Chauhan, M.S.—Recent pollen spectra from Sikkim Himalaya. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Sharma, M.—Precambrian palaeobiology in India : Retrospective and perspective. *Major Goals in Ear. Sci., Interaction Meet with Earth Scientist*, Jammu, August 1995.

Singh, A. & Misra, B.K.—Fluorescence microscopic investigations of the Main Lignite Seam from Neyveli Lignitefield, Tamil Nadu, India. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Singh, B.D. & Misra, B.K.—Biopetrology of Permian coal seams from the Rajmahal Basin (Bihar): Hura Coalfield. *X Conv. Indian Geol. Congr., Spec. Workshop Applied Coal Petrography*, Dhanbad, February 1996.

Singh, K.J.—Permian coniferous plants from India and their stratigraphic significance, *XIII Int. Congr. Carboniferous-Permian*, Krakow, Poland, August-September 1995.

Singh, K.J. & Chandra, S.—Plant fossils from the exposure near Gopal Prasad Village, Talcher Coalfield, Orissa and remarks on the age of the bed. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Srivastava, A.K.—Late Palaeozoic floral succession in India. *XIII Int. Congr. Carboniferous-Permian*, Krakow, Poland, August-September 1995.

Srivastava, A.K.—Morphology and taxonomy of Lower Gondwana pteridophytes of India. *Nat. Symp. Res. Pteridology*, Jodhpur, October 1995.

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

Coalfield. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Srivastava, R. & Awasthi, N.—Fossil woods from Neogene of Warkalli beds of Kerala coast and their palaeoecological significance. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Srivastava, Shyam C.—Microsporangia from Triassic of (Nidpur) India displaying pteridophytic affiliation. *Nat. Symp. Res. Pteridology*, Jodhpur, October 1995.

Srivastava, Shyam C. & Prakash, N.—Population of *Dicroidium* leaves from Triassic of Indian peninsula and its Gondwanic diversification. *Int. Conference : Diversification and Evolution of Terrestrial Plants in Geological Times*, Nanjing, China, September 1995.

Tewari, Rajni & Srivastava, A.K.—Plant fossil assemblages from the Barakar Formation of Jharia Coalfield, Bihar. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Tewari, R.—Glossopterid fructifications from Upper Permian of India—A morphographical correlation. *International Conference on diversification and evolution of Terrestrial plants in Geological time* held in Nanjing, China, during 4-8 September 1995.

Tiwari, R.S., Tripathi, A. & Nandhgopal, R.—Computer aided programme - "DCB" for retrieval of references. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Tripathi, A.—Diversity in pteridophytic spore population in the Intertrappean sequence in Rajmahal Basin and palaeoclimatic interpretation. *Nat. Symp. Res. Pteridology*, Jodhpur, October 1995.

Tripathi, A.—Palynology of subsurface Supra-Barakar sediments in Talcher Coalfield, Orissa. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Tripathi, S.K.M. & Kumar, M.—Pollen of *Alangium* from Tertiary sediments of India and their stratigraphic and palaeogeographic distribution. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Vijaya—Pteridophytic spores through Permian and climatic simulation. *Nat. Symp. Res. Pteridology*, Jodhpur, October 1995.

Vijaya—Palynoflora from subsurface Early Cretaceous Intertrappean beds in Domra subbasin, West Bengal. *Golden Jubilee Conference : Vegetational Dynamics of the Past and Present*, Palaeobotanical Society, Lucknow, 16-18 November 1995.

Yadav, R.R. & Bhattacharyya, A.—Tree ring analysis of fir (*Abies pindrow*) from sub-alpine forest near Pindari Glacier, western Himalaya. *Int. Himalayan-Tibetan Plateau Palaeoclimate Workshop*, Kathmandu, Nepal, April 1995.

Field Excursions

Following field-trips/consultation/discussion/visits were undertaken by the scientists and technical staff of the Institute :

P.K. Maithy & R. Babu

Visited around Zinna and Biohari (Rohtas Limestone Formation, Semri Group) and Bainkuiyan (Lower Bhander Limestone Formation) exposed around the Khemri-Kotar Hill, Satna District, Madhya Pradesh.

P.K. Maithy, R. Babu &.S. Sharma

Visited Archaean beds exposed at Noamundi and Barbil areas for the collection of cherts, rocks showing geological and organo-sedimentary structures.

P.K. Maithy & A.K. Ghosh

Visited Cretaceous-Tertiary localities of Tiruchirapalli District, Tamil Nadu. In all, about 120 samples of coralline limestones were collected from Ariyalur, Kallankurchi, Anandvadi, Niniyur, Sendurai, Peryarkurchi, Mattur, Ottakovil, Varagur, Dalmiapuram, Chokkanathapuram and Radyapalam. The lithocolumns were measured properly in the mines or in the outcrop sections and the samples were collected respectively.

M. Shukla & M. Sharma

Visited Bhima and Kurnool basins for systematic sampling of shales, limestones and sandstones.

Mukund Sharma

Visited Bastar region for systematic collection of samples of limestone, shale and sandstone, exposed around Jagdalpur area.

A.K. Srivastava

Visited sequences of Carboniferous and Permian of the Upper Silesian Coal Basin and the Lublin Coal Basin of Poland and Czech Republic during pre-Congress-13th ICCP field trip. Collected Lower Permian and Carboniferous plant fossils from fresh water limestone deposits of Kaniowice outcrop and from bore-core samples at DPB Company, Paskow.

B.K. Misra & A. Singh

Visited Indian Institute of Technology, New Delhi for discussion with Dr D.K. Sharma, Chief Scientific Officer at the Centre for Energy Studies about the collaborative work under the Institute's consultancy programme.

B.K. Misra & B.D. Singh

Visited Central Fuel Research Institute, Dhanbad for consultation and discussions

Sandstone-shale-carbonaceous shale sequence of Raniganj Formation exposed in Banki River section, Tatapani-Ramkola Coalfield, Madhya Pradesh.

with scientists about hydrogenation potentiality of Indian Gondwana coals. The aspect and other related activities were also discussed with scientists from Central Mine Planning and Design Institute, Ranchi who were in Dhanbad for attending the Indian Geological Congress.

O.S. Sarate

Visited Koyagudem Coalfield and other areas of Godavari Valley, Andhra Pradesh for field details and collection of coal samples.

A. Tripathi, Vijaya & R. Kar

Visited Korba Coalfield, Madhya Pradesh and collected coal/shale samples for palynological studies.

Visited Tatapani-Ramkola Coalfield, Madhya Pradesh for collection of palynological samples.

A. Tripathi & G.P. Srivastava

Visited Rajmahal area and collected bore-core and outcrop materials for palynological studies from Nipania, Pachwara and Mahuagarhi coalfields.

G.P. Srivastava

Collected impressions of leaves, flower and fossil resin from Mahuadanr Valley, Palamu, Bihar.

Vijaya, Sun Keqin & Ram-Awatar

Visited Johilla Coalfield and Nidpur area in South Rewa Gondwana Basin for survey and collection of coal and shale samples for microfossil analysis.

P. Kumar

Visited M.E.C. Ltd. camp, Amarwada and collected bore-cores as well as samples from exposed surfaces from Jambodweep, Singanama, Tamia in Hoshangabad and Chhindwara districts, Madhya Pradesh.

Again visited Anhoni, Renikhera and Deori areas in Hoshangabad District for collection of samples and M.E.C. Ltd. and G.S.I., Nagpur for discussions and further programming.

N. Jha & R. Kar

Visited Geological Survey of India, Calcutta for scientific discussion and consultation of literature.

Visited Kothagudem area in Godavari Graben for collection of samples.

Ram-Awatar

Proposed a field trip to collect the samples from Spiti area (Tethys Himalaya) but due to the heavy landslides could not proceed beyond Kulu (H.P.).

Visited Sohagpur Coalfield (M.P.) and collected bore-holes as well as outcrop samples for palynological studies.

Visited Geological Survey of India, Calcutta for collecting the geological maps and lithologs.

K.L. Meena

Visited Talcher Coalfield, Orissa for collection of samples from bore-holes TCP-39, TCP-41, TNA-7, TCS-6 and TKE-2 for palynological analysis.

J. Pandey

Visited South Rewa Gondwana Basin and collected 94 outcrop samples for palynological analysis from District Shahdol. In addition, 25 samples of fossil woods were also collected from three different localities.

C. Sharma, M.S. Chauhan & M. Shukla

Visited various localities in Uttarkashi, Garhwal Himalaya and collected sedimen-

Fossiliferous beds of Kasauli Formation (Early Miocene), Himachal Pradesh.

tary profiles, surface samples, C-14 dating samples and samples for DNA study.

M.S. Chauhan

Visited Wadia Institute of Himalayan Geology, Dehradun to finalize the joint palaeoclimatic work carried out on Spiti Valley, Himachal Pradesh.

J. Banerji & B.N. Jana

Visited various localities in Rajmahal Basin for collection of plant megafossils.

K. Ambwani

Visited Tamil Nadu and collected 120 rock samples for palynological studies from the Tertiary sediments of Neyveli lignitefield. A survey to the localities of nearby areas was also carried out. Collection of polleniferous material from the living palms and other monocotyledonous plants from Western Ghats of India was also done for detailed SEM studies.

J.P. Mandal

Visited Akri, Matanomadh, Panandhro and nearby areas of Kutch and collected samples for palynological studies.

R.S. Singh

Visited Ratnagiri and Cannanore areas for collection of palynological samples from Tertiary sequences.

Visited Jabalpur and Nagpur areas for collection of Deccan Intertrappean sediments for palynological studies.

Madhav Kumar

Visited North Cachar Hills and Nagaon districts of Assam to collect rock samples for palynological studies.

B.D. Mandaokar

Visited Disang, Tipong colliery, Miao and adjacent areas of Tinsukia and Chauglang districts of Assam and Arunachal Pradesh for collection of samples.

Visited south Saurashtra, Gujarat to collect samples for palynological studies from various localities.

K.J. Singh

Visited various plant fossil localities and exposures of Lower Carboniferous to Cretaceous age in the Carpatian Mountains in Slovak Republic during pre-congress—13th ICCP excursion programme.

Visited Geological Survey of India, Calcutta and consulted Type and Figured specimens described by Feistmantel, belonging to various plant taxa of Lower Gondwana age. All these genera with various species were photographed.

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

Visited Cherrapunji and Mawsynram areas to study Late Cretaceous-Palaeogene sequences of Khasi Hills, Meghalaya and collected samples for phytoplankton studies.

R.K. Kar, M. Nanda & P. Sharma

Visited Neyveli Lignite Mine and Mannargudi (Tamil Nadu) and Warkala (Kerala) areas and collected rock samples for palynological studies.

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

Visited Kasauli, Kumarhatti, Dagshai and Dharamshala in Himachal Pradesh to collect plant fossils.

J.S. Guleria, S.K. Bera, M. Kumar & D.C. Saini

Visited Katni, Balaghat and Seoni districts of Madhya Pradesh and collected geobotanical samples, herbarium specimens and plant fossils.

In situ fossil wood of *Bauhinium* Prakash & Prasad 1984 in a sandstone in Ramthi River, Darjeeling District, West Bengal.

J.S. Antal

Visited the Himalayan foot-hills of Darjeeling District, West Bengal and collected plant megafossils comprising impressions of angiospermous leaves, flower, fruits and fossil woods.

A. Rajanikanth

Visited Early Cretaceous sequences of Pranhita-Godavari Graben for collection of fossils associated with Gangapur Formation.

Participated in a field excursion to various Cretaceous sequences of Cauvery Basin (Therani, Kallakudi, Uttatur, Trichinopoly, etc.) organised by the Geology Department, University of Madras.

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

Visited Balu, district Kaithal, Haryana and Raja Nal-Ka-Tila, District Sonbhadra, Uttar Pradesh and collected plant remains from archaeological excavations.

Anil Chandra

Visited Geology Department, Punjab University, Chandigarh for EDAX studies.

Consultancy/Training Programmes

In continuation to provide "Consultancy Services" in various aspects of palaeobotany, palynology, coal/lignite petrology, radiometric dating and microscopy, the services provided to following personnel/organisations :

Dr G.K. Suchindan	—	Centre of Earth Science Studies, Trivandrum.
Professor P.K. Banerjee	—	Emeritus Scientist, C.S.I.R., Jadavpur University, Calcutta.
Mr R.M. Badve	—	Agharkar Research Institute, Pune.
Dr C.P. Rajendran	—	Centre of Earth Science Studies, Trivandrum
Dr Sheila Misra	—	Deccan College, Pune.
Mr A.K. Saha	—	Centre for Study of Man and Environment, Calcutta.
Dr I.S. Chamyal	—	M.S. University of Baroda, Baroda.

The Institute chalked out a programme of In-house Seminars with the objective to generate awareness amongst the scientists about what their colleagues are doing and also to invite rigorous discussion for positive direction, possibilities of collaboration, etc., if required, for the projects on which various scientists are working. Under this programme following three Birbal Sahni Research Scholars have delivered their lectures on :

Ratan Kar	—	"*Stratigraphy and geological setting of Tatapani-Ramkola Coalfield, M.P.*" (on May 15, 1995).
A.K.S. Pokharia	—	"*On the Archaeobotanical approach in the economy of Kushan Culture in Panjab*" (on June 1, 1995).
Manisha Nanda	—	"*Palaeocene palynostratigraphy of Meghalaya*" (on August 25, 1995).

The Institute sponsored a 65 days "Professional Course in Geology" at the Geology Department, Lucknow University, Lucknow from 28 May-29 August, 1995 for the following young scientists:

S.K.M. Tripathi	Asha Gupta
Chanchala Srivastava	Vandana Prasad
R.C. Mehrotra	Jitendra Pandey
Alpana Singh	Amit K. Ghosh
Rajni Tewari	Anjum Farooqui
A. Rajanikanth	A.K.S. Pokharia
B.D. Mandaokar	Shinjini Sarana

The training course conducted through lectures and laboratory studies included general geology, structural geology, mineralogy and petrology, sedimentology, stratigraphy and palaeontology. Two field excursions one in Nainital area and another to Son Valley (Chopan-Mirzapur-Singrauli areas) were also organised under this course to provide basic idea of geological study of an area, selection of sections, section measurements, sampling, preparation of litholog and collection of fossils, etc.

Professor Sun Keqin — Palaeobiological Section, Department of Geology and Mineral Resources, China University of Geosciences, Beijing was trained in Gondwana spore-pollen morphotaxonomy, and technique in palynological preparations for microscopic observations during his visit to the Institute from October 24-March 16, 1995.

Technical Assistance rendered

Radiocarbon dating of samples

Geological Survey of India, Northern Region, Lucknow

Physical Research Laboratory, Ahmedabad

Wadia Institute of Himalayan Geology, Dehradun

Kumaon University, Nainital

Indian Institute of Science, Bangalore

Professor P.K. Banerji, Emeritus Scientist, CSIR, Jadavpur University, Calcutta

Centre for Study of Man and Environment, Calcutta

National Institute of Oceanography, Goa

National Geophysical Research Institute, Hyderabad

Lumbini Development Trust, Kathmandu, Nepal

Departments at the Institute (Heads)

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

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

Department of Mesophytic Evolutionary Botany
(Dr Shaila Chandra)

Department of Cenophytic Evolutionary Botany
(Dr N. Awasthi)

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 R.K. Kar, up to 31.01.1996; Dr S.A. Jafar)

Department of Post-Gondwana Palynostratigraphy of Extra-Peninsular India
(Dr R.K. Kar, up to 31.01.1996; Dr Anil Chandra)

Department of Planktonology
(Dr K.P. Jain)

Department of Biodiagenesis
(Dr Anand-Prakash)

Department of Radiometric Dating
(Dr G. Rajagopalan)

Units

Library

The services of the library were also made available to scientists/teachers/students of other organisations and universities both in India and abroad. Now the total number of registered borrowers is 199. At present, 66 current periodicals are being procured on exchange basis and 78 current periodicals are subscribed by the library.

The holdings of the library are as under :

Particulars	Additions during 1995-96	Total
Books	164	4,968
Journals	—	10,086
Reprints	123	35,054
Reference Books	5	244
Ph.D. Theses	—	83
Reports	—	46
Maps & Atlases	1	61
Microfilms/Fisches	—	294
Hindi Books	36	119

Reprints Section

Reprints of research papers purchased	32
Reprints sent out in exchange	1,526
Professor Sahni's papers sent out	123
Institute publications sent out	197
Institutions on exchange list	58
Individuals on exchange list	400

Computer aid to Library

The use of computer at library counter is being done successfully. It is on LAN under UNIX O/S. The Software employed in UNIFY RDBMS and the utilities were programmed in 'C' developed by the Institute Staff, giving different level of securities. Data entry is in progress and about 8,000 records have already been entered. Documentation,

Data Management and Report Generation are also done on the computer to improve the working style of the library.

Xeroxing facility

Xeroxing facility was extended to the Institute employees and to the outsiders also.

Lamination

To preserve the old and rare literature of the library 38 books were laminated.

This year the library facility was provided to the following organisations :

Lucknow University, Lucknow
Utkal University, Vani Vihar, Bhubaneshwar
Professor Sun Kequin, Beijing, China
Government Autonomous Science Degree College, Rewa, M.P.

Herbarium

The main aim of the Herbarium is to develop repository of reference collection of modern plant materials and their preparation, which are useful for comparative study of fossil specimens. About 700 plant specimens, wood blocks of 10 species and 20 samples of fruits and seeds were collected from different localities in Madhya Pradesh. About 500 plant specimens were identified, mounted on herbarium sheets, registered and systematically incorporated in the almirah. Also about 100 herbarium sheets were checked for their correct identification.

The entire herbarium materials lodged on ground floor in the Herbarium were shifted to mezanin. Show cases were designed, prepared and fixed for display of different extant plant materials. Seeds and fruits having special interesting features were displayed in some show cases. About 20 mounts of leaf venation pattern were prepared. To make Herbarium more beautiful, attractive and educative, about 30 coloured blow-ups of different plants and vegetation of different habitats were prepared and displayed. Each and every exhibit was labeled with bilingual (Hindi & English) labels. The rearrangement of pollen slides is in progress. Revision and correction of inventory of Carpothek is being done. Prepared about 200 cards for inventory of xylarium. Feeding of data in computer for inventory of xylarium is under progress.

Herbarium Holding

The extant plant materials collected by the Herbarium staff of the Institute during this year are as under :

Particulars	Addition during 1995-1996	Total
Herbarium		
Herbarium sheets of plant specimens	500	14,675
Herbarium sheets of leaf specimens	100	415
Xylarium		
Wood blocks	10	3,998
Wood discs	-	32
Wood core samples	-	440
Wood slides	30	3,868
Sporothek		
Pollen slides	10	11,499
Carpothek		
Fruits & Seeds	100	2,456

Under the aegis of Indo-Kyrgyz Science and Technology Co-operation Agreement, a five member Science and Technology delegation from the National Academy of Science of Kyrgyzstan visited the Herbarium.

Scientists from Germany, Japan and China also visited the Herbarium.

Herbarium facilities provided to :

Dr (Mrs) Veena Chandra	—	Forest Research Institute, Dehradun (U.P.)
Dr A.K. Saini & Dr Vimal Kukreti	—	Department of Chemistry, Government College, Rishikesh (U.P.)
Sri K.K. Pandey	—	Department of Botany, Kamla Nehru Institute of Science and Technology, Sultanpur
Sri R.K. Singh	—	Department of Botany, Gorakhpur University, Gorakhpur

Distinguished Visitors

Professor S.K. Singh	—	Department of Botany, Gorakhpur University, Gorakhpur
Dr S.C. Tripathi	—	Department of Botany, Gorakhpur University, Gorakhpur
Professor S.S. Saini & Dr. K.C. Sahni	—	Department of Botany, Punjabi University, Patiala.

Institutional Visitors

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

Uttar Pradesh Sainik School, Lucknow

Rani Laxmibai Memorial School, Lucknow.

City Montessori School, Aliganj, Lucknow.

Teachers attending Training Course, organised by Kendriya Vidyalaya, Aliganj, Lucknow.

Museum

This year's main attraction was Golden Jubilee Celebration which was inaugurated on 10th September 1995. Founder's room was recreated and the articles associated with Professor Birbal Sahni were relocated and placed systematically in such an order so as to give a look of period setting. The picture gallery was erected which depicts the important events of the Institute's history. The Founder's room and the picture gallery were inaugurated by Professor V.S. Ramamurthy, Secretary to the Government of India, Department of Science and Technology, New Delhi. These two things have become additional attraction to the visitors.

The Institute participated in an exhibition organised by the Department of Science and Technology during the 83rd Session of Indian Science Congress at Patiala. About five thousand persons visited and took keen interest in the Institute's exhibits.

National Science Day was celebrated as usual on 28th February, 1996 The theme of this year's celebration was "India can do it". It was observed as open house. The visitors were taken round the Museum and different laboratories. A scientific poster competition was also organised for the school children in which 57 students participated. Educational films were also screened for the benefit of the visitors.

Fossil specimens were gifted to 21 educational Institutions in the country under the special programme "Palaeobotany for Education".

Teachers and students of various Colleges and Institutions visited the Museum. Citizens from countries like France, Poland, Australia, Kyrgyzstan visited the Institute, besides from our own country.

Type and Figured Specimens/Slides/Negatives

The scientists of the Institute deposited the specimens/ slides/ negatives of their research papers in the Museum.

Particulars	Additions during 1995-1996	Total
Type and figured specimens	81	5,368
Type and figured slides	119	11,117
Negatives of the above	200	14,559

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	—	886

Palaeophytic Evolutionary Botany	634	4
Mesophytic Evolutionary Botany	987	—
Cenophytic Evolutionary Botany	783	1
Pre-Gondwana and Gondwana Palynostratigraphy of India	—	391
Post-Gondwana Palynostratigraphy of Peninsular India	—	530
Quaternary Biogeography and Archaeobotany	—	283
Biodiagenesis	193	243
Planktonology	—	382

Presentation of Fossil Specimens

Department of Botany, Srivyasa N.S.S. College, Kerala.
Department of Geology, Shivaji University, Kolhapur, Maharashtra.
Department of Botanical Sciences, Guru Nanak Dev University, Amritsar, Punjab.
Govt. College, Nelakandapally, Khammam, Andhra Pradesh.
Ghospur Union Netaji Vidyapith, Hooghly, West Bengal.
Department of Earth Sciences, Pondicherry University, Pondicherry.
Department of Botany, Maharaja Sayaji University, Baroda, Gujarat.
Government Museum, Egmore, Madras, Tamil Nadu.
Aurara's Degree College, Chikkadpally, Hyderabad, Andhra Pradesh.
Department of Geology, Goa University, Goa.
Gargi College, University of Delhi, New Delhi.
Mukund Lal National College, Yamuna Nagar, Haryana.
Department of Geology, Govt. Autonomous Science College, Jabalpur, Madhya Pradesh.
Department of Botany, Govt. Motilal Vigyan Adarsh Mahavidyalaya, Bhopal, Madhya Pradesh.
Department of Botany, Quaid-E-Millat Govt. College for Women, Madras, Tamil Nadu.
Government College, Gulbarga, Karnataka.
Department of Botany, D.A.V. Degree College, Kanpur, Uttar Pradesh.
Z.P.S. School, Julurupad, Andhra Pradesh.
P.G. College, Bhandara, Maharashtra.
Government Inter College, Thal, Pithoragarh.
P.G. College, Pithoragarh.

Institutional Visitors

I.T. College, Lucknow.
Oak Grove Girl's School, Mussoorie.

City Montessori School, R.D.S.O. Colony, Lucknow.
Lucknow University, Lucknow.
Colvin Taluqdars College, Lucknow.

Electronic Data Processing Unit

This unit was involved in the following activities :

Planning and up-keep of the Magnum and Personnel Computers (PC-AT 486DX-3,PC-AT 486SX-6,PC-AT 286-2,PC-XT-6,PC-7); updating of Library Information Management System; Software development for Scientific, Administration and Accounts Section; Technical support to staff; Basic maintenance of the systems; Hardware and Software acquisition, and Planning for the coming year.

The Library Information Management System has been working very well and updating have been carried out from time to time so as to recover the data in case of failures of hard disc.

Programming of budget casting for the year, monthly accounts, report and cash book in SOFTBASE 2 was also carried out for Accounts Section. Designing and Laser printing of various charts, banners, displays, slides and posters were done for the Scientific and Technical staff who participated in the Indian Science Congress, various conferences, symposia, etc. for oral and poster presentation of data.

Following Hardware and Softwares were acquired for the Computer Section during the year :

Hardware :

High Resolution Laser Printer (Model HP Laserjet 5MP)
Color Deskjet Printer (Model Modi JP450)
Black/White Scanner (Model HP Scanjet 3P)
Compact Disk Drive (Model Sony CD-ROM 55E)
Three PC-AT 486DX Systems have been upgraded with 1GB HDD and 12MB RAM for the effective usage of Window'95 and MS-Office 4.3.

Software :

Microsoft Visual C++ V 2.0 on CD-ROM, A developmental tool.
Microsoft Office Professional 4.3, Integrated software having a Wordprocessor, Spreadsheet, Relational Database and Presentation tool.
Microsoft Windows 95, a Graphical Operating System.

With the acquisition of above peripherals and softwares, high quality outputs of charts, graphs, posters, banners, OHP transparencies, slides, text, etc. for presentation and publishing is being done. Also, the development work under Windows has been taken up to make the utilities more user friendly.

The following jobs were taken up for Golden Jubilee Year celebrations:

A Folder was designed for distribution during inauguration, Golden Jubilee Lecture functions and Golden Jubilee Conferences being held by the Institute during September 1995-September 1996.

Address databases of the scientists of the Institute, scientific Institutions in Lucknow and other interested scientists in India and abroad was made for sending the brochure, invitations, etc,.

The scientists were helped to prepare reports for submission and presentation during Research Advisory Council meetings.

The Institute acquired E-mail through Sirnet, a scientific network run by INSDOC. Necessary Hardware and Software arrangements were made as per the instruction by INSDOC to install E-mail. Training was also given to the staff to operate E-mail .

Publications of the Institute

Journal—The Palaeobotanist

Volume 43, Number 1 and 2 and a Special Golden Jubilee Volume 44 of the journal were published. The manuscripts of the remaining issue of Volume 43 were also processed. All the Abstracts in English of each contribution in these Volumes were also translated into Hindi, which is a special feature of the journal. Both these publications were released on 9th September, 1995, a memorable day of the Golden Jubilee Year of the Institute.

Some contributions of the second Special Golden Jubilee Volume 45 of The Palaeobotanist were also edited.

40th Sir Albert Charles Seward Memorial Lecture

Fortieth Sir Albert Charles Seward Memorial Lecture entitled "Some environmental aspects of present distribution of plants", delivered by Dr M.A. Rau, was edited and published in a regular issue of The Palaeobotanist.

A special publication—*Coaliferous fuel resources of India : Parameters of studies in palynology & biopetrology*

This book was published as a Special Publication during the Golden Jubilee Year of the Institute. It comprises about 275 pages with eleven contributions having line drawings and black and white as well as coloured photographs and was released on 9th September, 1995.

Annual Reports

The Annual Reports for the year 1994-95, both in English and Hindi, were published which comprise about 180 pages each. They were sent to the Department of Science and Technology, New Delhi and other organisations.

Sale of the Institute's publications

This year the publications of the Institute netted an income of Rs. 2,45,375.40, out of which US $ 5,931.00 were earned in foreign exchange.

Distinguished Visitors

Professor Yash Pal,
New Delhi

Professor V.S. Ramamurthy,
Secretary, Department of Science and Technology, New Delhi

Dr V.K. Srivastava,
Director, Department of Science and Technology, New Delhi

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

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

Dr (Mrs) C. Virgili,
Director, Colegie de Espana,
University of Paris, France

Dr D.P. Agarwal,
Physical Research Laboratory, Ahmedabad

Professor P. Singh,
Banaras Hindu University, Varanasi

Dr M. Velayaben,
Dy. D.G., ICAR, New Delhi

Sri M.S. Kalra,
Department of Science & Technology, New Delhi

Dr Krishna Sappal,
Curtin University, Perth, Western Australia

Professor T. Ramana,
Department of Biochemistry, Andhra University, Andhra Pradesh

Professor Dr Leun Shedrik,
Poliola Academy of Science, Poland

Tutuer Kuichiuev
Kyrgyzstan

Status of Official Language

In pursuance of the Government of India's Official Language policy various steps were taken to promote the usage of Hindi in Office-work. The Institute is the Convener of the City's Implementation Committee of Official Language Unit-11. The meetings of the Committee are held regularly.

`Hindi Pakhwara' was organised in the Institute from September 14-28, 1995. On this occasion several competitions like Hindi Typing, Debate and a Kavya Sandhya, etc. were organised and prizes were distributed to the winners. Six officers/employees were encouraged with incentive awards for doing official work in Hindi. On this occasion a compilation *`Pankhudian'* (in Hindi) was released.

A two-day Hindi Workshop on December 21-22, 1995 was also organised. Forty eight members of the Institute—Scientific, Technical and Administrative, were trained for doing official work in Hindi and 22 other trainees from other organisations under Unit-11 and other sister institutions participated in the Workshop. Sri R.D. Ram, Director, All India Radio, Lucknow inaugurated the workshop and Professor S.P. Dixit, Head of the Department of Hindi and Modern Indian Languages, Lucknow University was the Chief Guest.

The facility for working in Devnagri has been provided on available computers. Seven per cent of the work is done on computers in Hindi. Twenty five PC and two Softwares 'Akshar' and 'Davebase' were purchased. Various forms have also been made bilingual. A post of Hindi Translator was also created to promote the usage of Hindi in the office work. This year, 36 new books have been added to the list of Hindi books in the Library of the Institute.

Reservations and Concessions

To provide adequate representations to the Scheduled Castes and Scheduled Tribes in the services/posts, the Institute adopted the broad features of the scheme of reservation drawn by the Government of India for autonomous bodies and is being followed by the Institute.

27 per cent reservation in services/posts under the Institute to be filled through direct recruitment for Other Backward Classes has been adopted by the Institute as per Government of India orders issued from time to time.

Three per cent reservation orders for the physically handicapped persons in Group 'C' and 'D' posts is also applicable as per Government of India orders issued from time to time as indicated below:

1.	Blind	—	1%
2.	Deaf	—	1%
3.	Orthopaedically handicapped	—	1%

Scientific Personnel

Director

R.S. Tiwari, Ph.D., F.Pb.S., F.I.A.P., F.P.S., F.S.G. (Retired w.e.f. 31.01.1996)

Deputy Directors

G. Rajagopalan, Ph.D., F.Pb.S., F.S.G. (Acting Director w.e.f. 01.02.1996)
Nilamber Awasthi, Ph.D., F.Pb.S., F.I.A.P.
K.P. Jain, Ph.D., F.Pb.S., F.I.A.P., F.P.S.
R.K. Kar, Ph.D., F.Pb.S. (Retired w.e.f. 31.01.1996)
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.
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.
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.
Suresh C. Srivastava, Ph.D., F.I.A.P., F.Pb.S.

Assistant Directors

Krishna Ambwani, Ph.D., F.S.G., F.P.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.
Manoj Shukla, Ph.D., F.G.S.
Jaswant Singh Antal, Ph.D.
A.K. Srivastava, Ph.D., F.S.G., F.I.C.S.
G.P. Srivastava, Ph.D.
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.
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.
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.
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.
Neeru Prakash, Ph.D.
Mahesh Prasad, Ph.D.
Vandana Prasad, Ph.D.

Jyotsana Rai, Ph.D.
A. Rajanikanth, Ph.D., F.G.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.
K.J. Singh, Ph.D.
Rashmi Srivastava, Ph.D.
Rajni Tewari, Ph.D.
G.K. Trivedi, Ph.D., F.P.S.

Emeritus Scientist

H.P. Singh, Ph.D., F.Pb.S. (Up to 30.06.1995)

Birbal Sahni Research Scholars

Ratan Kar, M.Sc.
Manisha Nanda, M.Sc.
A.K.S. Pokharia, M.Sc.
Shinjini Sarna, M.Sc.
S.M. Singh, M.Sc.

Sponsored Project (DST)

Poonam Sharma, M.Sc. (JRF)
Reema Singh, M.Sc. (JRF)
Vandana Chowdhary, M.Sc. (JRF)
Sheenu Sharma, M.Sc. (PA)

Sponsored Project (Ministry of Environment)

Rashmi Tewari, M.Sc., Ph.D. (RA)
Shantanu Chatterjee, M.Sc. (JRF)
Deepak Kohli, M.Sc. (JRF)
L.M. Joshi (TA)

Technical and Administrative Personnel

Publication

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. (Console Operator)

Museum

P.K. Bajpai, B.F.A. (T.O.—Artist)
J.N. Nigam, B.A., B.Lib.Sc. (J.T.O.)
Kamla M. Chhabra, M.Sc. (J.T.O.)
Diwakar Pradhan, B.Sc. (J.T.O.)
Prem Prakash, B.Sc. (S.T.A.)
S.N. Meena, B.Sc. (J.T.A.)

Herbarium

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

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.)
Madhabi Chakraborty, M.Sc. (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.)
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.)

Technical Services

Kamal Narang, B.Tech. (Programmer—Computer)
K. Nagapooshanam, B.Tech. (Programmer—Computer)
Madhukar Arvind, B.Sc. (J.T.A.—Computer)
R. Nandhagopal, B.Sc., P.G.D.C.A., C.S.A. (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 (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

H.S. Srivastava, B.Com.
Bhagwan Singh
I.J. Mehra, B.A.
B.K. Jain, B.A.
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

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

Lower Division Clerks

S. Murukan Pillai, B.A.
N. Unnikannan
Shail S. Rathore, B.A.
Renu Srivastava, M.A.
S.S. Panwar, B.A.
Mishri Lal, M.A.
A.K. Srivastava, B.A., B.Ed.
Rameshwar Prasad

Drivers

Nafees Ahmed
D.K. Misra
V.P. Singh

M.M. Misra
Balbir Singh (Retired w.e.f. 08.12.1995)

General Help

Sarju Prasad (Daftari)
Sia Ram (Duplicating Machine Operator)
Mohammad Shakil (Binder)

Attendants

Raja Ram
Satruhan
Sunder Lal
Prem Chandra
Ram Singh
K.C. Chandola
Haradhan Mahanti

Peons

Shree Ram
K.N. Yadav
Bam Singh
Kailash Nath
Ram Kishan
Munni
Maya Devi
Mani Lal Pal
Ram Ujagar
K.K. Bajpai, B.A.
Dhan Bahadur Kunwar
Mahadev Prasad
Hari Kishan
S.C. Mishra
Ram Dheeraj

Chowkidars

Ram Dhari
Ram Deen
Kesho Ram

Bishnu Dutt (Retired w.e.f. 31.10.1995)

Malis

Rameshwar Prasad Pal (Skilled)
Ram Chander (Unskilled)
Ram Kewal (Unskilled)
Mathura Prasad (Unskilled)

Appointments and Promotions

Appointments

Sri S.P. Chadha, P.S. to Director re-employed w.e.f. 01.11.95 for one year

Smt. M. Jagath Janani, Stenographer w.e.f. 29.12.95

Sri Rajesh Kumar Awasthi, Peon w.e.f. 24.11.95

Sri Ramesh Kumar, Peon w.e.f. 24.11.95

Sri Vishwanath Santaram Gaikwad, Peon w.e.f. 24.11.95

Sri Deepak Kohli, Junior Research Fellow (Sponsored Project) w.e.f. 27.10.95

Km. Reema Singh, Junior Research Fellow (Sponsored Project) w.e.f. 19.12.95

Promotions

Dr N. Awasthi, A.D.(SG) to Deputy Director w.e.f. 01.04.95

Dr R.K. Kar, A.D.(SG) to Deputy Director w.e.f. 01.04.95

Dr (Miss) J. Banerji, A.D. to Assistant Director (SG) w.e.f. 01.04.95

Dr K.S. Saraswat, A.D. to Assistant Director (SG) w.e.f. 01.04.95

Dr Vijaya, S.S.O. to Assistant Director w.e.f. 01.04.95

Dr J.S. Guleria, S.S.O. to Assistant Director w.e.f. 01.04.95

Sri B. Sekar, T.O. to Senior Technical Officer w.e.f. 01.04.95

Sri P.K. Bajpai, J.T.O. to Technical Officer w.e.f. 01.04.95

Sri Diwakar Pradhan, S.T.A. to Junior Technical Officer w.e.f. 01.04.95

Sri P.C. Roy, S.T.A. to Junior Technical Officer w.e.f. 01.04.95

Sri R.C. Misra, J.T.A. to Senior Technical Officer w.e.f. 01.04.95

Sri Pradeep Mohan, J.T.A. to Senior Technical Assistant w.e.f. 01.04.95

Sri Ramesh Chandra, Assistant to Accountant w.e.f. 01.06.95

Sri R.K. Kapoor, U.D.C. to Assistant w.e.f. 21.06.95

Sm. V. Nirmala, U.D.C. to Assistant w.e.f. 21.06.95

Sri Dhoom Singh, L.D.C. to Upper Division Clerk w.e.f. 22.06.95

Smt. Ruchita Bose, L.D.C. to Upper Division Clerk w.e.f. 22.06.95

Smt. P. Thomas, L.D.C. to Upper Division Clerk w.e.f. 22.06.95 (A.N.)

Smt. Usha Chandra, Telephone Operator to Upper Division Clerk w.e.f. 22.06.95 (A.N.)

Retirements

Sri S.P. Chadha, P.S. to Director retired on 31.10.95
Sri Bishnu Dutt, Chowkidar retired on 31.10.95
Sri Balbir Singh, Driver retired on 08.12.95
Dr R.S. Tiwari, Director retired on 31.01.96
Dr R.K. Kar, Deputy Director retired on 31.01.96

Obituaries

Sri Vishnu Kumar, Chowkidar expired on 04.06.95
Sri H.N. Boral, Senior Technical Officer expired on 05.12.95
Sri P.S. Saluja, Mechanic expired on 22.01.96

Research Projects and Programmes

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

Programme 1.1 : **Palaeobiology of Vindhyan Basin**

Objective : *To identify metaphytes and metazoan body fossils, ichnofossils and their relics from the Proterozoic succession and their evolution and diversification*

: *To identify organo-sedimentary structures found in association of metaphytes and metazoans and to decipher environmental conditions*

: *To determine the significance of metaphytes and metazoans in biostratigraphy*

Macroscopic biota comprising *Chuaria - Tawuia - Krishnania* were studied from the argillaceous sediments of Rohtas Formation, in Bihar, Uttar Pradesh and Madhya Pradesh. The sediments represent topmost part of the Semri Group. Two distinct carbonaceous impressions were identified, both belonging to the family Bryopsidaceae (Chlorophyta). The feather-shaped forms compare morphologically to *Bryopsis* and branched filamentous forms bearing lateral spheroidal structures to *Derbesia*. This evidence supports the presence of Chlorophyta even during ± 1000 Ma years before.

New collection was done from the Lower Bhander Limestone Formation exposed around Bainkuiyan, Madhya Pradesh. Another problematic trace fossil showing fine curvature was marked. Additionally a macroscopic form *Sekwia* Hofmann (reported from the Vendian of Canada) was recorded. The presence of *Sekwia* was previously not known from the Indian Precambrian. Examined tubular forms of ichnofossils previously described from the Kaimur. The septate tubular form indicates that it may be representing resting stage of metazoan.

Studied 30 samples exposed around Judwani area, Semri Group of Madhya Pradesh both in thin section and maceration. The acritarch and cyanophycean forms are poorly preserved and highly distorted.

P.K. Maithy & Rupendra Babu

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

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

Morphotaxonomical work on the organic remains has been completed. Data pertaining to size, shape and nature of the remains have been generated. The circular, discoidal forms range from 1.00 to 10.00 mm. The filamentous forms show maximum length of 40 mm and width ranges from 0.5 to 5.00 mm. A terminal disc like structure, incipient segmentation and akinites like inflated cells have been noticed in several filamentous forms. Scanning electron microscopic work on the skeletelised remains from the Sahabad Limestone Formation have been undertaken. Trace fossils and organic remains are assessed for their biostratigraphical significance. Work on the problematic forms is under progress.

The major achievement of the work is the maiden record of shelly fauna from Sahabad Limestone Formation. Besides, a trace fossil zone has been identified in Halkal Shale Formation of Bhima basin during field work. Similarly organic remains akin to *Chuaria* have been collected from Owk Shales Formation, Kurnool Group. The study indicates that the sediments are deposited between Vendian and beginning of the Cambrian. On the basis of present set of data on the Bhima Basin it can be concluded that the sediments belong to latest part of the Terminal Proterozoic.

Manoj Shukla & Mukund Sharma

Programme 1.3 : **Calcareous skeletal algae from Indian Phanerozoic sediments**

Objective : *To study the morphology of skeletal algae and their significance in biostratigraphy*

Thin sections of coralline and nodular limestones were studied from the Turonian of Bagh beds (Dhar District, Madhya Pradesh) and it was observed that in relation to the study of calcareous algae, only the samples of coralline limestone were productive, whereas the nodular limestones were barren. Coralline limestones collected from the limestone quarry of Ghursal Village, Zirabad, Sitapuri, Baria, Sukar Nala and Dhanora localities of Man River Section (Dhar District) yielded skeletal algae, chiefly belonging to Dasycladaceae alongwith the association of faunal remains like echinoid spines, bryozoans and foraminifers. The algal taxa identified are *Neomeris, Linoporella, Halimeda, Bouenia, Acicularia, Neomizza* and *Cymopolia.*

While examining the thin sections of coralline limestones for the study of algal assemblages from the Bagh beds, in a number of cases it has been noticed that misidentification of other skeletal remains like echinoids, bryozoans, ostracodes and foraminifers as skeletal algae was done previously. An improved technique using petrographic study (by polarising microscope) and specific carbonate staining have been employed to solve the problem of misidentification. According to the present observation restoration of

algal assemblages from the Bagh beds (Man River Section) has been done.

P.K. Maithy, B.N. Jana & A.K. Ghosh

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**

Objective : *To study morphotaxonomy, evolution and stratigraphical distribution of the flora*

: *To decipher ecological and climatological regimes*

Plant fossil assemblages from outcrop sections of Sukri River and fire clay quarries situated around Kuriaon, Luti, Bijra, Churia and Sirka areas of Auranga Coalfield were studied. The flora is represented by the species of *Neomariopteris, Glossopteris, Saportaea, Psygmophyllum, Cordiacarpus* type seeds, scale leaves and *Vertebraria* axes. Genus *Glossopteris* is represented by the maximum number of species. The assemblages are comparable with the known flora of Upper Barakar Formation.

One of the specimens with part and counterpart collected from Churia fire clay quarry indicates preservation of two narrow-elongate shaped *Glossopteris* leaves across the bedding plane. Often vertically preserved *Vertebraria* axes are also recorded in the associated sediments of fire clay quarries. Palaeoecological significance of such state of preservation is being carried out.

A.K. Srivastava

Finalized the systematic description, morphotaxonomy and comparison of plant fossils studied from Sukri River Section, near Tubed Village, Jagaldagga-Bagdagga nala sections and Sikni open cast project of Auranga Coalfield.

A.K. Srivastava & Rajni Tewari

Investigations including observations, description, identification and comparison of plant fossil assemblages from different collieries, viz., Tetulmari, Nichitpur, Bansjora and Moodidih of Area 5 (Sijiwa area) of Jharia Coalfield were carried out. The flora is essentially dominated by species of the genus *Glossopteris* (15 spp), probably a new species. The assemblage from Tetulmari Colliery, additionally shows presence of *Phyllotheca indica* and equisetaceous stems. The collection from Bansjora Colliery includes scale leaves and *Noeggerathiopsis hislopii*.

Rajni Tewari

Morphological and systematic analyses of the plant fossil assemblages collected from different open cast projects of Area 6 (Kusunda area) of Jharia Coalfield were compiled and finalized.

Rajni Tewari & A.K. Srivastava

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

Objective : *To study morphotaxonomy, floristics, biostratigraphy and palaeoclimate of the Permian Gondwana formations in the area*

: *To study fructifications in order to understand the evolutionary aspect of pteridophytes and gymnosperms*

Sorting, identification and photodocumentation of plant fossils from Madhupur area near Hinjrida Ghati, Angul District, Orissa were completed. The identified plant taxa are 20 species of *Glossopteris*, one species each of *Neomariopteris, Schizoneura, Macrotaeniopteris* and a lycopod. The fertile genera identified are one species each of *Eretmonia, Partha* and *Lidgettonia*. For the first time *Vertebraria* axes were collected from the area. For the first time from India, male fructification *Nesowalesia* is reported which is known only from Australia. The genus *Nesowalesia* is identified as a new species *Nesowalesia indica*. The identified plants indicate younger age than flora at Handapa area.

Shaila Chandra & K.J. Singh

Seventy-five Type specimens, described by Feistmantel from the Lower Gondwana formations and kept at G.S.I. Museum, Calcutta, were studied and photographed. Conifer specimens from South Balanda Colliery, Talcher Coalfield were compared with the Type specimens of *Voltzia heterophylla*. SEM and TEM studies of conifer cuticles are in progress.

K.J. Singh

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

Objective : *To carry out fine resolution, morphotaxonomical investigations and to decipher affinities and interrelation of different plant organs*

: *To attempt whole plant reconstructions*

Under the study of compressed cones, nearly 50-60 cone specimens (some of them with their counter parts) have been examined. More than 100 epidermal preparations have been made. After examining the cuticular preparations, the diagnosis of *Nidistrobus* has been elaborated and some forms which were included in *Nidistrobus* have been removed due to presence of distinct pollen grains. In addition, 4 new cone-taxa have also been identified because of possessing different kinds of sporangia and their pollen contents. Restoration of three types of microsporangiate-cones have been attempted. Reconstruction

of their microsporophyll have also been completed. Four distinct species of *Dicroidium* have been recognized among the leaves population of this taxon. A considerable number of fronds are still under identification.

Shyam C. Srivastava

Sorting, identification and photodocumentation of *Dicroidium* leaves were carried out. Taken out their peels, macerated and prepared their slides for microscopic study. The morphotaxonomic and cuticular study shows four types of species, viz., *Dicroidium nidpurensis, D. gopadensis, D. papillosum* and *D. odontopteroides*. Prepared about 50 text-figures and the work has been compiled and documented.

Neeru Prakash

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

Objective : *To analyse palynoassemblages with a view to interpret floral changes, boundary transitions and age determination at a finer level in the intra-formational succession of Son Valley coalfields*

: *To identify Talchir/Athgarh relationship in the Talcher Coalfield and Athgarh Basin*

The detailed palynological studies have revealed presence of taxa *Cornetipollis* Pocock & Vasanthy 1988 and *Monocrinopollis* Comet 1989 from Late Permian palynoflora

Acritarch taxa : **1**, *Muraticavea* Wilander 1974; **2**, *Tympanicysta* Balme 1980 from late Early Triassic sediments of Talcher Coalfield, Orissa.

recorded in bore-hole TP-8 of Talcher Coalfield. These pollen have angiospermoid exine characters. This provided evidence for the manifestation of angiospermous exine characters during latest Permian. The qualitative assessment of spores and pollen species in Kamthi sediments indicate presence of marker taxa, viz., *Lundbladispora raniganjensis, L. brevicula, L. microconata, Densoisporites complicatus, Ringosporites fossulatus, Goubinispora morandavensis, Lunatisporites pellucidus, L. tethyensis, Playfordiaspora cancellosa, P. annulata, Foveosporites triassicus, Nevesisporites velatus, Staurosaccites minutus*, etc. The composition suggests a Late Early Triassic age connotation in relation to Damodar Basin assemblages. The presence of acritarchs specially *Micrhystridium* in the Late Permian assemblage is noteworthy. The high frequency of taxa *Muraticavea* in association with other acritarchs is the first record from Triassic sediments of Peninsular India. The results of bore-hole TP-8 were compiled and finalized.

Archana Tripathi

The palynological analysis of bore-holes TP-9 (318-649-63 m depth) and TP-10 (385 m depth) reveals presence of palynoflora equivalent to Late Permian assemblages of DVC. The assemblage has dominance of *Striatopodocarpites* + *Faunipollenites* with appreciable frequency of *Densipollenites*. The marker taxa present are *Cyclobaculisporites, Reticulatisporites, Potonieitriradites, Navalesporites, Weylandites* and *Guttulapollenites*. This reveals the presence of Late Permian Raniganj coals in Talcher Coalfield. The Kamthi sediments of TP-10 (352.80 m depth) have shown presence of acritarchs in high frequency.

Archana Tripathi & K.L. Meena

The outcrop samples collected from Domnara Colliery of Mand-Raigarh Coalfield have been processed for spores and pollen. The palynological assemblage recovered is rather poor both in quality as well as quantity. The genus *Scheuringipollenites* shows its dominance in this assemblage. Other associated taxa are *Striatopodocarpites, Faunipollenites, Virkkipollenites, Parasaccites*, etc. This assemblage is comparable to other known Lower to Middle Barakar palynoassemblages.

A fairly rich megaspore assemblage has been recovered from the bulk macerates of the rock samples collected from Talbast area of Athgarh Formation in Orissa. The assemblage is characterised by the presence of genera like *Verrutriletes, Bacutriletes, Horstisporites, Minerisporites, Paxillitriletes*, etc. The dominance of the genus *Minerisporites* has been noticed. This megaspore assemblage is comparable to the megaspore assemblage from the Bhuj Formation of Kutch Basin.

B.N. Jana

Three palynological assemblages have been identified in bore-hole SPB-14 of Sohagpur Coalfield. In Assemblage-I, at depth 0.00-130.05 m (Middle Pali sediments) Late Permian palynofossils—*Faunipollenites, Striatopodocarpites, Crescentipollenites* alongwith *Gondisporites* and *Densipollenites* have been recorded. In Assemblage-II (depth 225.00-280.00 m, Lower Pali Member), striated as well as non-striated disaccates are in prominence in association with *Densipollenites* and few monosaccates. This assemblage

could be tagged with Barren Measures. In Assemblage-III (depth 290.40-466.00 m), an Upper Barakar palynotaxa *Scheuringipollenites, Barakarites, Dentatispora* and *Parasaccites* have been recorded.

In Chundi River Section, non-striate disaccates (*Falcisporites, Alisporites, Nidipollenites, Klausipollenites*) are in dominance in association with striated disaccate pollen grains. Besides, few younger elements—*Goubinispora, Densoisporites* have also been recorded in the assemblage, therefore, a Late Permian-Early Triassic age has been assigned to the sediments. From Ultidhara Section (Gulgul Nadi) Late Permian palynofossils have been recorded as the striated disaccate pollen grains are in dominance in these sediments. The palynotaxa recorded from "Dhanda Pahar" (? Parsora Formation) are *Crescentipollenites, Alisporites, Goubinispora, Distriatites, Densipollenites* and *? Densoisporites* (rare in occurrence), suggest an Early Triassic age.

Ram-Awatar

Photodocumentation and quantitative analysis of pollen-spores from bore-hole IBSH-6 have been completed. Prepared the histograms, lithologs and location map. On the basis of quantitative analysis and correlation of palynoassemblages with other basins the age of Kamthi strata in Belpahar area, Orissa is suggested to be Late Permian.

K.L. Meena

Twenty three samples collected from bore-hole SPT-13, drilled by GSI in south of Rampur Village, District Shahdol, have been analysed for palynodating and palaeoecological investigations. Palynofossils recovered from 11 productive samples show abundance of striated disaccates such as *Striatopodocarpites, Faunipollenites* and *Striatites* along with characteristic genera *Satsangisaccites* and *Falcisporites*. Monosaccate grains *Parasaccites, Densipollenites*, etc. were also fairly represented alongwith trilete bearing *Callumispora*. The assemblage is comparable to that of Raniganj palynoflora of Damodar Basin. The overall pollen-spore diversity as well as the morphographic features indicate a subhumid and moderately cool to warm temperate climate at the time of deposition.

Jitendra Pandey

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

Objective : *To make extensive and exhaustive collections of leaf specimens of Gondwana gymnosperms, study their morphology, make cuticular preparations, establish relationship between morphography and epidermal features, objectively identify each species based on cuticles of extant gymnosperms, ultrastructure of in situ pollen/spores for fine resolution taxonomy and affinities*

Ultrastructure of cuticular membrane in three types of corystospermaceous pinnae referred to *Dicroidium gouldii* (= *D. coriaceum sensu* Pal 1984), *Dicroidium* sp. and

Thinnfeldia indica Feistmantel : Cuticular membrane of an Early Cretaceous frond infected with fungal hyphae, showing various stages of degradation.

Thinnfeldia indica Feistmantel has been investigated. In the genus *Dicroidium*, the epidermal pattern of the two species shows minor variation under the light microscope, but at the ultrastructural level, the cuticular membranes of the two species show significant differences. The most significant difference is the presence of a polylamellate outermost zone in *D. gouldii* and the absence of the same in *Dicroidium* sp. The cuticular membrane of a *Thinnfeldia indica* leaf, that was infested with fungal hyphae, shows various stages of degradation at the ultrastructural level. Here the cuticular membrane is mainly amorphous with an uniformly dense matrix. The leaf-air interface shows irregular osmiophilic deposits which may represent remanants of the surface wax of the leaf. In certain regions, precursors of cutin accretions are present irregularly at subcuticular surface. These deposits may possibly be results of the breakdown of the cutin due to hydrolysing enzymes (?cutinase) secreted by the infesting fungi. This initial breakdown of the cuticular membrane by the

fungi is probably followed by bacterial attack.

H.K. Maheshwari & Usha Bajpai

Plant megafossils collected from the Hura Coalfield (Rajmahal Basin) and the Karanpura Coalfield were investigated. The megafossil assemblage from Hahajor, in the Rajmahal Basin comprises mainly *Glossopteris* spp., a few fragments of ferns and a robust kind of *Phyllotheca*. In the Karanpura Coalfield, the plant assemblage is dominated by leaves of the genus *Glossopteris*. Cuticular preparations were made from a large number of leaves of the genus. In most of the cases, the cuticle does not show any cellular details. In few cases, however, it is possible to study the cell outlines and the stomata. A specimen, apparently looking like that of an arthrophyte has also yielded well-preserved cuticles. Almost all the *Glossopteris* leaves investigated are large in size, with entire margin, obtuse apex and a very peculiar thick midrib and petiole. The preservational and depositional environment seems to be quite disturbed.

H.K. Maheshwari, Usha Bajpai & S.M. Singh

Plant fossils and samples were collected from Talchir Formation of North Karanpura and Karharbari and Barakar formations of South Karanpura coalfields. In Bokaro Coalfield, plant fossils were collected from Barakar Formation. Few specimens show good compressions and may yield cuticle for inner details.

S.M. Singh

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

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

Distributional pattern of spores in Permian sequence on Indian peninsula has been critically assessed, to understand the impact of changing climate. It has revealed that in Early Permian, glacial stress of C/P transition had its effect on the oldest Talchir vegetation which influenced the survival of pteridophytic plant group. Only very scanty occurrences of low ornamented trilete spores are on record. With the amelioration of climate through Permian, diversification in exine characters has been established, and prevailed maximum during Barakar and Raniganj formations in Late Permian.

Palynostratigraphic study of Intertrappean beds between 248.00 to 263.00 m depth, bore-hole PGD-2, Damodar Basin, has been completed. Occurrence of species *Crybelosporites stylosus, Januasporites spiniferous, Foraminisporis wonthaggensis,* in association with *Polycingulatisporites crenulatus, Taurocusporites segmentatus,* characterises the older level for this palynoassemblage in Early Cretaceous palynoflora. It has been assigned to *Crybelosporites stylosus* assemblage zone of Australia, Berriasian in age.

Vijaya

Detailed morphotaxonomic study on certain bisaccate pollen taxa from Euromerian and Indian Gondwana has been completed. It signifies the importance of exine structures in the identity of forms among the apparently similar looking forms. Based on exine-structure on body surface, the so far Indian Gondwana bisaccate pollen described as *Lunatisporites, Lueckisporites* and *Klausipollenites* have been given new names, i.e., *Arcuatipollenites, Dicappipollenites* and *Krempipollenites,* respectively. Besides, some of the pollen-spore taxa have also been commented upon, based on their type specimens, such as *Hexasaccites, Crucisaccites, Sulcatisporites, Crescentipollenites*, etc.

R.S. Tiwari & Vijaya

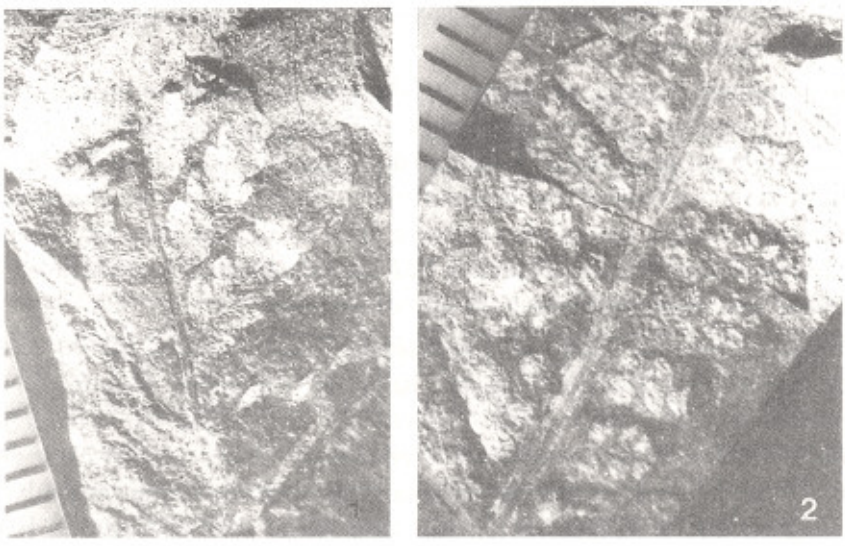
Programme 2.7 : Composition, relationship and age of the megafossil flora of Rajmahal Formation

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

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

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

Morphotaxonomic investigation of Murlipahar assemblage has been carried out. The megafloral assemblage comprises ten genera, viz., *Cladophlebis, Murlipaharopteris* gen. nov., *Phyllopteroides, Coniopteris, Thinnfeldia, Otozamites, Ptilophyllum, Taeniopteris, Elatocladus* and *Desmiophyllum*. On the basis of floral assemblage composition and the presence of *"Phyllopteroides laevis"*—an index Neocomian species of Eastern Australia,



Murlipaharopteris indica gen. et sp. nov.—1, sterile frond; 2, fertile frond from Murlipahar, Rajmahal Hills, Bihar (X 4)

Neocomian age has been suggested.

Preliminary study of Balidih assemblage is in progress and efforts are being made to get cuticle for exact identification of *Thinnfeldia* like fronds present in the assemblage. Section cutting of Sonajori chert blocks and their examination is in progress.

Jayasri Banerji

The megafossils collected from Dhokuti locality were sorted out for studies. This fossil assemblage shows the presence of genera like *Marratiopsis, Todites, Cladophlebis, Sphenopteris, Ptilophyllum, Pterophyllum*, etc.

Jayasri Banerji & B.N. Jana

Morphotaxonomy, photodocumentation and identification of plant megafossils of Sitalpur locality have been carried out. Recorded megafossils are *Cladophlebis, Ptilophyllum cutchense, P. acutifolium, Elatocladus* sp., *Brachyphyllum* sp. and *Araucarites*. The floral assemblage on the whole is dominated by cycadophytes and conifers.

Neeru Prakash

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

Objective : *To study selected horizons, mainly from bore-cores to fill the existing lacunae in the data for building a complete sequence*

: *To tag results with other data, such as megafloral and sedimentological information and geological set-up*

: *To determine age and palaeoclimatic condition as depicted by spore and pollen patterns*

The pteridophytic spore populations recorded in the Intertrappean beds were analysed. The spores pertaining to tree ferns Cyathiaceae, Dicksoniaceae, Osmundaceae and the non-arboreal rhizomatous fern Gleicheniaceae and Schizaeaceae, etc. are represented in the population. The diversity of spores shows increase in terms of qualitative richness progressively with them. The volcanic activity probably has provided better substrate and climate for the growth of pteridophytes. On the basis of representation of fern families in the palynological data a subtropical to temperate climate has been interpreted.

From the Late Permian sediments of Rajmahal Basin characteristic pollen having angiospermoid pollen exine characters having infrabaculate exine structure with two sulcus on each face of the body are recorded. These forms are described under new taxon *Daminites* gen. nov. Maceration of samples from bore-hole RCH-151 was done for recovery of palynomorphs.

Samples from three bore-holes were collected for dating of Dubrajpur sediments and the underlying coal horizon. The type section for Dubrajpur Formation in Sarwan Pahar was traversed for argillaceous sediments. The oolitic bed could be observed after the second brak in slope. It is a marker horizon and is significant for the first Intertrappean. A survey of the area near Kharikharal Village was made to assess feasibility for collection

of complete fossil tree trunk specimens for Institute's Museum. Samples representing Dubrajpur sediments from Lakhraphela Pahar and Intertrappean beds from Nipania were collected for palynological studies.

Archana Tripathi

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

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

Qualitative and quantitative estimation of coal macerals under blue light excitation (fluorescence mode) have been made on 44 particulate pellets from bore-hole HRC-CM/109 of Hura Basin. The relatively hydrogen-rich liptinite macerals show a manifold increase and comprise chiefly sporinite, alginite and liptodetrinite. Sporinite showed wide range of preservational stages from well-preserved to highly degraded and fragmented. Alginite is represented mainly by a layered algae— lamalginite. High concentration of hydrogen-rich microconstituents (liptinite and fluorescing or perhydrous vitrinite) in these subbituminous A to high volatile bituminous C coals render them amenable for hydrogenation.

Various compositional models, utilizing biopetrological data of coals from Chuperbhita (Bore-hole RCH-3) and Hura (Bore-holes HRC/CM-107 & 109) coalfields, have been prepared for assessing the coal types and conditions of deposition of seams. On the basis of coal types, presence of well-preserved cutinites (cuticles), macrosporinite (megaspore) and seeds it appears that the coal seams originated dominantly from woody hypo-autochthonous to autochthonous vegetation. It also indicates rapid seasonal fluctuations and aerobic (dry-oxic—inertinite-rich) to anaerobic (wet-reducing—vitrinite-rich) conditions.

B.D. Singh & B.K. Misra

Programme 2.10 : Palynology of the Gondwana Sequence in Satpura Basin

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

Palynological studies of Almod beds have been carried out. The significant palynomorphs in the assemblage are : *Striatopodocarpites, Faunipollenites, Satsangisaccites, Falcisporites, Klausipollenites, Scheuringipollenites, Densipollenites, Crescentipollenites, Guttulapollenites, Corisaccites, Lunatisporites, Playfordiaspora, Lundbladispora*, etc. This palynoassemblage contains Late Permian and Early Triassic palynomorphs.

Palynoassemblage from Tamia Ghat Road section contains Late Permian (Bijori Formation) palynoassemblage having the dominance of *Striatopodocarpites, Crescentipollenites, Distriatites, Corisaccites, Guttulapollenites* and *Playfordiaspora* and Early Triassic (Pachmarhi Formation) palynoassemblage contains *Falcisporites, Satsangisaccites*, palynomorphs as *Nidipollenites, Goubinispora Trochosporites,*

Weylandites, Playfordiaspora, Lundbladispora, etc. are either as common or poorly distributed.

Pramod Kumar

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

Objective : *To standardise palynoflora from different formations of Gondwana sequence*

: *To recognise biozones having stratigraphical significance*

: *To demarcate time boundaries with special reference to P/Tr boundary*

: *To decipher the nature and significance of evolution of various palynofloras*

Palynological study of samples from bore-hole MKD-25 of Kothagudem area has revealed the occurrence of Barakar palynozone at 476-478 m having *Scheuringipollenites* as dominant taxa and striate disaccates, chiefly *Faunipollenites* and *Striatopodocarpites*, as subdominant taxa. Raniganj palynoflora have been marked at 276-320 m having dominance of striate disaccates chiefly *Striatopodocarpites* and *Faunipollenites* and presence of some significant Late Permian taxa *Lunatisporites, Guttulapollenites, Corisaccites, Weylandites, Chordasporites* and *Falcisporites* in low percentage.

Occurrence of Talchir and Upper Karharbari palynoflora has been demarcated at 248-249 m and 179 m respectively in bore-hole SGM 11 from Gajulagudem area while Barakar palynoflora has been marked at 191.27-209 m in PC-38 from Punukulchilka area.

Suresh C. Srivastava & Neerja Jha

Programme 2.12 : Organic petrographic evaluation of coals from Godavari Graben

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

Completed the maceral, microlithotype and reflectance study of 24 coal samples of Khairagura area of Belampalli Coalfield. These coals are rich in vitrinite but differ from the Ramagundam and Mulug coals in having comparatively higher percentage of mineral matter. Resins and pyrite framboids have scanty distribution. The reflectance study has revealed that the maximum reflectance value in oil ranges between 0.48-0.57%. Thus the coals have attained sub-bituminous B to high volatile bituminous C rank. The preliminary fluorescence study has indicated the presence of seeds, sporangia, cuticles, spore masses and algal elements.

Carried out reflectance analysis of 36 coal samples representing Manuguru area. The study has revealed that these coals contain reflectance value ranging between 0.57-0.83%, which indicates that these coals have attained high volatile bituminous C to high

volatile bituminous A rank.

O.S. Sarate

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

Objective : To assess coal characterisation in Talcher Coalfield

A detailed biodiagenetic study of coals from Bharatpur, South Belanda and Ananta quarries has indicated that vitrinite group of macerals ranges between 13.6 to 76.8%, exinite 1.2 to 17.2%, inertinite 9.2 to 60.6% and mineral matter 4.0 to 57.8%. The relatively higher percentage of exinite contents characterizes the South Belanda and Ananta coals.

The general distribution pattern of macerals suggests the prevalence of reducing conditions. However, oxidizing and transitional phases were also present during the genesis of Talcher coals. Thus, four micropetrographic facies were identified, viz., vitric, fusovitric and vitro-fusic transitional/intermediate conditions. Study in fluorescence mode further indicates high incidence of liptinite group of macerals, perhydrous vitrinite and fluorescing inertinite in selected coals, imparting suitability for liquefaction. The presence of pyro-fusinite and degradofusinite is the characteristic feature of some coals. Well-preserved wood structures particularly middle lamella indicate the formation of certain fusinites due to peat fire.

A general megascopic study (45 samples) of coals from Kalinga and Gopal Prasad areas indicates that the coal is rich in thick and persistent durain bands. Vitrain bands are much less represented. Further work is in progress.

Anand-Prakash, Rakesh Saxena & Jyotsana Rai

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

Objective : To establish palynological succession in the subsurface Gondwana sediments, their palynodating and correlation

Samples from bore-hole PBS-1 were processed for recovery of palynofossils. Scout analysis of palynoflora from yielding samples was done. Important taxa were photographed. The study is in progress.

R.S. Tiwari, Archana Tripathi & Vijaya

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

Objective : To develop lithostratigraphic set up from various surface and subsurface sequences

: To reconstruct standard palynological succession, age determination and correlation with special reference to coal-bearing horizons

: To recognise range of stratigraphically significant taxa and evo-

lutionary trends of various palynofloras

: *To demarcate time boundaries with special reference to P/Tr boundary*

: *To document phytogeographic and palaeoenvironmental events*

Field work was carried out in Tatapani-Ramkola Coalfield with main emphasis on section measurements along different outcrops, preparation of litholog and photography. Preparation of geological sections based on field study has been completed.

Palynological studies of surface samples (TRS 16 DW & TRAG) from Barren Measures - Raniganj Formation (GSI) have been completed. However, in TRS 16 DW the palynoassemblage compares with the *Faunipollenites varius* assemblage zone representing Upper Barakar; while in TRAG the samples show a dominance of striate disaccates and are comparable to the *Striatites-Striasulcites* assemblage zone representing Raniganj Palynozone.

Bore-core of TRDM-1 and surface samples (TRDMS) from a nala cutting nearby were macerated for possible Barren Measures palynoflora. However, all palynomorphs were found to be charred due to dolerite intrusion.

Permo-Triassic boundary has been demarcated across 2 sections : Ledho nala and Iria nala. In Ledho nala, Panchet palynozone is marked by the presence of *Brachysaccus, Playfordiaspora, Goubinispora, Guttatisporites, Falcisporites, Lunatisporites* while Raniganj sediments show a dominance of striate disaccates and are comparable to *Faunipollenites-Striatites-Striatopodocarpites* assemblage zone. In Iria Nala Raniganj-Panchet transition has been marked by *Densipollenites magnicorpus* assemblage zone and *Klausipollenites* assemblage zone respectively. A palynological report has been prepared and sent to Coal Wing, Geological Survey of India.

Palynological studies of 8 surface samples from this coalfield, sent by M.E.C.L., Ranchi, was completed. All the yielding samples showed a dominance of striate disaccates and are comparable to the *Faunipollenites-Striatites-Striatopodocarpites* assemblage zone representing Raniganj palynozone. Palynological report on the study has been submitted.

Suresh C. Srivastava & Ratan Kar

Programme 2.16 : Palynological investigation of coal-bearing sequence in Deocha-Pachami area of Birbhum District, West Bengal

Objective : *To study the morphological diversity of spores and pollen*

: *To find out palynostratigraphic relationships between the coal-bearing and associated strata from various sectors of this newly established coal sub-basin and to compare them with corresponding strata of other coal basins in India*

Microscopic observation between the depth of 100 to 102 m in bore-hole DPD-15 reveals occurrence of *Aequitriradites, Januasporites, Leptolepidites*, and prominence of

genus *Callialasporites*.

Vijaya

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

Objective : *To systematically study morphology anatomy, ecology and related aspects of megafossils*

: *To detail out floristic diversification and observe evolutionary inter-relationships*

: *Taphonomic and cladistic analysis*

Fossil floral assemblage of Gangapur Formation has been studied. Two distinct fossil leaf assemblages were recognised. Taxa like *Equisetites, Gleichenia, Actinopteris, Rhizomopteris, Ptilophyllum, Pterophyllum, Satpuria, Araucaria, Brachyphyllum, Pagiophyllum* and *Elatocladus* characterise the Gangapur flora. Close affinity with Sehora flora of Satpura Basin is suggested. Comparative studies with other co-equivalent East Coast sediments exemplify differential preservation and occurrence of restricted niches.

Plant megafossils from shales/sandstones exposed on surface around Asifabad area, particularly 15 km north-west and 20 km south-east, in Godavari Graben, were collected. The assemblage included impressions and compressions of Podocarpaceae, Araucariaceae, Taxaceae and Bennettitales. The contact of Gondwanas and Deccan Traps was traced and lithological succession was constructed. Mostly gymnospermous leaf fossils were observed. Samples for palynological studies were also collected from the sections.

East Coast sedimentary basins in Krishna-Godavari, Palar and Cauvery basins were also visited for comparative studies.

A. Rajanikanth

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

Objective : *To study microconstituents for the assessment of coal characteristics*

Megascopic characteristics of coals collected from bore-holes TRS-15, TRS-16 and TRM-3 and outcrop sections were studied in detail. Photographs of various lithotypes having variable thickness were taken. The pyrite infillings, crack patterns in vitrain, lustre, etc. of lithotype bands were studied.

In all, 95 samples (91 from bore-holes and 4 from outcrops) were crushed and sieved and particulate pellets were prepared. Reflectance measurements on maceral vitrinite were made on 81 samples for rank determination of coals. The maximum reflectance (in oil) of the coals ranges from 0.50 to 0.67%, which indicates that these coals have attained high volatile bituminous C stage.

Anand-Prakash & Shinjini Sarana

PROJECT 3 : CENOZOIC PLANT BIOGEOGRAPHY OF PENINSULAR INDIA

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

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

: *To determine their age for reconstruction of vegetational history and phytogeography of peninsular India*

A number of petrified woods from Nawargaon area of Wardha District, Maharashtra were studied and compared with the extant taxa belonging to the family Flacourtiaceae, Tiliaceae, Sterculiaceae, Simaroubaceae, Burseraceae, Elaeocarpaceae, Sapindaceae, Anacardiaceae and Lecythidaceae. Amongst them, the important genera are *Homalium, Grewia, Sterculia, Elaeocarpus, Ailanthus, Euphoria, Dracontomelum, Barringtonia, Araucaria,* and *Podocarpus*. These taxa are also reported from Mohgaonkalan (Chhindwara District), Mahurzari (Nagpur District) and Shahpura (Mandla District) which suggest that central India witnessed uniform floral pattern and climate during Late Cretaceous-Early Tertiary.

N. Awasthi & E.G. Khare (Ph.D. work)

Programme 3.2 : Studies on the Tertiary floras of western India

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

Thirty petrified and carbonised woods were sectioned and studied in detail. Most of them belong to the known genera, viz., *Lagerstroemia, Millettia, Pongamia, Terminalia* and *Sonneratia*. Two new fossil woods namely *Syzygium* and *Parastemon* have been identified which are new to western India. Their occurrence indicates the existence of moist humid conditions during the Late Tertiary in Gujarat and Rajasthan.

J.S. Guleria

Programme 3.4 : Neogene plant megafossils of West Coast

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

Out of a rich collection of carbonised woods from Kerala Coast five woods were identified as *Poeciloneuron* (Clusiaceae), *Adenanthera* and *Koompasia* (Fabaceae), *Parinari* (Chrysobalanaceae) and *Bischofia* (Bischofiaceae). A paper dealing with these woods highlighting their palaeoecological and phytogeographical significance was finalized. Two more woods were tentatively identified, one as *Artocarpus* (Moraceae) and the other having banded parenchyma showing affinities with the family Fabaceae or Meliaceae.

Two carbonised woods from Ratnagiri District, Maharashtra were studied and identified as *Shorea* (Dipterocarpaceae) and *Bouea* (Anacardiaceae).

Rashmi Srivastava

Programme 3.6 : Tertiary megafossils from Neyveli Lignite, Tamil Nadu

Objective : *To study morphotaxonomy of Tertiary megafossils from Neyveli*

lignite and relate them with extant plants

: *To deduce palaeoenvironmental, palaeoecological and phytogeographical information*

Twenty-eight carbonised woods were cut and studied. Preservation of 16 woods was too poor to reveal any anatomical structure. One of them seems to belong to the family Combretaceae and remaining woods identified as duplicates of already known taxa from Neyveli. About 30 blocks of carbonised woods were prepared to study under reflectance microscope. Besides, clearing and photography of the leaves were done and their study is in progress.

Anil Agarwal

Programme 3.9 : Organic petrology of Kutch lignites, Gujarat

Objective : *To evaluate Panandhro lignite for various industrial uses*

: *To understand genesis of lignite and palaeoenvironmental conditions*

Qualitative study and quantitative assessment of lignite microconstituents have been made (under normal incident mode) on particulate pellets from Old Mine section of Panandhro lignitefield. Lignite is dominated by huminite group of macerals with the higher proportions of humotelinite and humodetrinite. Macerals of liptinite group, recorded in subordinate amount, show less morphological variations and lower frequency in comparison to that observed under fluorescence mode, possibly due to their association with dispersed mineral matter. The data generated (both under normal and fluorescence modes) reveal that the lignites of all the lateral sections are more or less similar in respect to maceral composition.

B.K. Misra & Alpana Singh

A paper entitled "Fluorescence microscopic investigations of the main lignite seam from Neyveli Lignitefield, Tamil Nadu, India" was finalized.

Alpana Singh & B.K. Misra

Programme 3.10 : Palynostratigraphy of the Tertiary sediments of Gujarat

Objective : *To correlate Tertiary formations of Kutch with those in Broach and adjacent areas*

: *To decipher the palaeoecological condition of deposition*

: *To compare the fossil pollen with the living ones*

A rich Early Eocene palynoassemblage was recovered from the Waghapadar section. The middle part of the section, dominated by carbonaceous shale, yielded maximum pollen-spores. The assemblage consists of a variety of spores, pollen and fungal remains. Two distinct palynological assemblage zones have been recognised, viz., *Cheilanthoidspora enigmata* Assemblage zone and *Tricolpites crassireticulatus* Assemblage zone in ascending order. Record of *Pilatrisyncolpites* in this basin, which is known only from subsurface younger rocks of Upper Assam, appears to be phytogeographically important. A few tetrad

pollen present in the assemblage seem to be new. Samples collected from Anjar area did not yield any pollen-spore.

J.P. Mandal

The palynoassemblage of Rajpardi lignite, Tarkeshwar Formation (Early Eocene) consists of angiospermous pollen, pteridophytic spores and fungal fruiting bodies. The quantitative and qualitative analyses of the palynoassemblage have been done and illustrated through histograms. It is observed that the angiosperm pollen especially palms are dominant in the assemblage, followed by the pollen of Alangiaceae,Bombacaceae and Linaceae. A majority of taxa are similar with the palynoassemblage of Naredi Formation (Early Eocene) of Kutch, as *Lakiapollis ovatus* Cenozone is recognised in both the assemblages. But Rajpardi palynoflora shows comparatively a large number of fossil *Alangium* grains. Most of angiospermic pollen are similar to modern taxa. The habitat of fossil palynotaxa is interpreted on the basis of comparison with habitat of similar extant plants.

Madhav Kumar

150 samples were collected from Okha, Metapur, Shivarajpur and adjacent areas of South Saurashtra, Jamnagar District, Gujarat for palynological studies.

B.D. Mandaokar

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

Objective : *To build up the palynostratigraphy of different Tertiary formations*

: *To correlate different Tertiary formations of Rajasthan with those in Gujarat*

: *To infer the palaeoecological condition of deposition*

Two bore-holes K14 and K16 drilled by GSI at Kuchaur-Benia area, Bikaner District were palynologically investigated. The assemblage comprises *Piladiporocolpites, Psiladiporocolpites* and *Retidiporocolpites* of *Diporocolpis* apertural type. Besides, *Ocimumpollenites* - fossil pollen resembling the extant pollen of *Ocimum* (Lamiaceae) was also identified. *Pluricolumellatepollis,* another hexacolpate pollen, is also common in the assemblage.

K. Ambwani

A draft manuscript "*Clavadiporopollenites raneriensis* gen. et sp. nov. from the Tertiary sediments of Bikaner District, Rajasthan, India" was prepared.

Krishna Ambwani & R.S. Singh

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

Objective : *To study palynoflora recovered from selected sections and to recognise their ecological importance*

: *To establish biozones, correlation and dating of sediments*

: *To carry out detailed SEM studies for evolutionary lineages*

Samples from mine II bearing lignite section at Neyveli, Tamil Nadu, were collected. The palynotaxa of productive samples were recovered as : *Cyathidites australis, Polypodiaceaesporites major, P. tertiarus, Todisporites major, Dictyophyllidites laevigatus, D. dulcis, Schizaeoisporites ramanujamii, S. ghoshii, S. multistriatus* and *Lycopodiumsporites lakiensis* constitutes the pteridophytic group, whereas monocot taxa are referable to *Arecipites punctatus, A. bellus, Arengapollenites achinatus, Acanthotricolpites brevispinosus, Palmidites maximus, P. plicatus, Palmaepollenites keralensis,* cf. *Sclerosperma manii* and *Spinizonocolpites brevispinosus*. The dicotyledonous pollen appeared to dominate the total population. These were represented by *Dracaenopollis* sp., *Meliapollis ramanujamii, M. navalei, M. quadrangulares, M. meliodes, Tricolpites reticulatus, Ctenolophonidites costatus, C. saadii, C. ramanujamii, Triangulorites bellus, Trilatiporites erdtmanii, Warkallipollenites reticulatus, Ericipites sahnii, Palaeosantalaceaepites minutus, Lakiapollis ovatus, Proteacidites triangulus* and *Anacolosidites luteoides*. Apart from the pteridophytic and angiospermous pollen taxa, a number of fungal spores and fruiting bodies were also present in the assemblage. Based on the assemblage recorded from the lignite section, two cenozones were recognised, viz., *Ctenolophonidites* cenozone referable to 95-110 m depth (top of lignite) and *Trilatiporites erdtmanii* cenozone between 110-120 m depth (bottom of lignite).

SEM studies of fossil *Sclerosperma* cf. *S. manii* (Bande & Ambwani, 1982) was carried out to ascertain the aperture nature and affinities both in fossil and extant pollen of *Sclerosperma* as well as to confirm the existence of African palm-like plants in the ecological complex of Neyveli.

K. Ambwani

Programme 3.13 : Palynostratigraphical investigation of the Tertiary sediments of western coast of India

Objective : *Identification of palynosuits for palynostratigraphical studies*

: *To establish cenozones of the Tertiary sediments and correlate the rock sequence*

: *To trace evolutionary relationship of palynotaxa based on character analysis*

: *To deduce the age and palaeoenvironment of the sediments*

Chemical processing of the samples from Quilon and Warkalli formations of Kerala was done. Several palynofloral assemblages were identified at different stratigraphic levels. The morphotaxonomical study of the palynomorphs was done. In general angiospermic pollen are the most dominant elements followed by pteridophytic spores. The significant palynofossils recovered are : *Lygodiumsporites padappakkarensis, Crassoretitriletes vanraadshooveni, Pteridacidites vermiverrucatus, Lakiapollis ovatus, Tricolporopollis matanamadhensis, Malvacearumpollis bakonyensis, M. grandis, Compositoipollenites alleppeyensis, Chenopodipollis miocenica, Proteacidites triangulus, Ctenolophonidites*

costatus, Quilonipollenites microreticulatus, Tricolpites retipilatus and *Graminidites* sp. On the basis of palynofossils the age of the sediments ranges from Oligocene to Lower Miocene. Ecological and morphotaxonomical evaluation of selected palynofossils were made. On the basis of modern analogues serveral ecological floral communities are identified.

R.S. Singh

PROJECT 4 : PHYTOPLANKTON BIOSTRATIGRAPHY OF MARINE SEDIMENTARIES OF INDIA

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

Objective : *To document lithological succession and facies variations in outcrop areas*

: *To study dinocyst morphology and biostratigraphy and to document phytoplankton rich levels*

: *To integrate dinocyst, calcareous plankton and palaeontological data for stratigraphic precision*

: *To carry out palynofacies and organic petrographic studies*

: *To carry out oxygen isotope and geochemical studies across K/T boundary*

: *To attempt palaeoceanographic interpretations*

Stratigraphic distribution chart containing 47 species of calcareous nannofossils including typical Late Cretaceous, KTB "survivors" and Danian species is completed. Photodocumentation and identification of Early Danian nannofossils belonging to NP1 Zone is partly carried out.

Palaeocene dinoflagellate cyst assemblage obtained from the Langpar Formation and Lakadong sandstone, Khasi Hills have been studied in detail. Photodocumentation and detailed morphological study of Latest Maastrichtian-Danian dinoflagellate cyst genus *Disphaerogena* have been completed resolving its taxonomical intricacies. Study of Late Palaeocene (Thanetian) dinoflagellate cyst assemblage assignable to standard *Apectodinium hyperacanthum* Zone is completed.

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

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

Objective : *To document lithological succession in outcrop areas*

: *To study dinocyst morphology, taxonomy and biostratigraphy*

: *To integrate phytoplankton data with palaeontological and sedimentological data*

: *To carry out palynofacies study, document plankton-rich levels*

: *To carry out stable carbon isotope (C-13) and organic petrographic studies*

: *To attempt palaeoceanography modelling*

Based on the dinoflagellate cyst evidence, lower part of the Trichinopoly Formation is dated to be Middle-Upper Turonian in age. A dinoflagellate cyst biozonation scheme is proposed. Final plates and charts are prepared and a manuscript is finalised.

Dinoflagellate cyst, calcareous plankton (foraminifera, nannofossils) and siliceous plankton (radiolaria) data through Albian-Santonian sequence of Cauvery Basin have been compiled to assess the sequence of bioevents having palaeoceanographic implications. Quantitative analysis of various dinoflagellate cyst groups and palynodebris has revealed significant palaeoenvironmental signatures.

Stratigraphic frequency distribution of Neocomian dinoflagellate cysts recovered from subsurface sequence of Palar Basin is documented.

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

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

Objective : *To compare Neogene calcareous nannoplankton assemblage of Andaman and Nicobar Islands with that known from nearshore and high latitude and to select cosmopolitan markers*

: *To integrate calcareous nannoplankton and planktonic foraminiferal zonations to improve dating resolution*

: *To record palaeoenvironmental events with special reference to Antarctica glaciation event based on plankton assemblage backed by stable isotope and organic data*

Based on data generated during previous years, fresh sampling was done in well measured sections of Car-Nicobar Island, with the aim of demarcating Miocene/Pliocene boundary and selecting a suitable section in Sawai Bay area. Several low-latitude marker species of calcareous nannofossils were found to be either missing or displayed diachronous appearance at Miocene/Pliocene transition beds exposed in Sawai Bay region. In this aspect the vertical distribution of dark and birefringent horse-shoe shaped calcareous nannofossils (ceratoliths) are significant for Indo-Pacific region, demanding more intensive study and photodocumentation of taxa.

A draft manuscript "Nannofossils from mud-volcanoes of Andaman Islands, India : global biostratigraphic applicability" was prepared.

S.A. Jafar

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

Objective : *To study morphology and taxonomy of diatom and silicoflagellate taxa from Late Cenozoic surface and subsurface sections (type*

locality/reference sections) of Andaman and Nicobar Islands

: *To establish biozonation for age determination and correlation with geologically synchronous beds*

: *To interpret palaeoenvironment, palaeogeography and time boundaries*

: *To integrate the diatom biostratigraphy with the established foraminiferal biozones and isotope study*

Rock samples from Meetha Nala and Melville Point sections of the Havelock Island were chemically analysed for diatoms. Melville Point Section is represented by Long and Guitar formations while Inglis Formation is exposed in Meetha Nala Section. Diatoms have been recovered from Long and Inglis formations. Siliceous microfossils are absent in the Guitar Formation. Silicoflagellates, radiolarians and sponge spicules are also present in some samples. A Miocene age is assigned to the diatom assemblage from Havelock. EDAX of selected rock chips from Havelock was carried out. Samples from Little Andaman are barren of diatoms. Preparation of a draft manuscript on the stratigraphy of Car Nicobar Island has been taken up.

Anil Chandra

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

Objective : *To study dinoflagellate cyst morphology and biostratigraphy and to document phytoplankton rich levels*

: *To integrate dinoflagellate cyst, calcareous nannoplankton and palaeontological data for stratigraphic precision*

: *To document palaeoenvironmental events*

Crucial phytoplankton productive levels have been discovered within the pre-nummulitic shale sequence (Naredi-Harudi Formation) overlying the Deccan Traps. Study of dinoflagellate cyst assemblage is in progress.

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

PROJECT 5 : PALAEOFLORISTIC DIVERSIFICATION IN THE HIMALAYA

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

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

More specimens of *Kawaziophyllum* collected from the Dunpathri Member of Mamal Formation were cleaned, photographed and processed for recovery of the cuticle. No cuticle was recovered and as such only morphological characters have been considered for

its taxonomic position.

H.K. Maheshwari, Usha Bajpai & (H.M. Kapoor)

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

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

The manuscript has been revised and corrected on the palynostratigraphic study done in Late Permian, Early Triassic and Late Jurassic sequences in Tethyan sediments of Niti area.

R.S. Tiwari, Vijaya, [V.D. Mamgain & R.S. Misra, GSI]

Manuscript on palynostratigraphic study done in Permian and Early Triassic sequences in Tethyan sediments of Spiti area has been finalized.

R.S. Tiwari, Vijaya, Ram-Awatar & [T. Singh, WIHG]

Chemical processing of 50 rock samples of Spiti Shale, Malla Johar area, has been done for the recovery of palynofossils.

Vijaya & [S. Kumar, Lucknow University]

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

Objective : To correlate the palynoflora with petrography of coal and to compare with the known palynofloras from the peninsular Gondwana

: To reconstruct marine pathways, palaeoecology and palaeoenvironment during the deposition of the Permian sediments in Siang District

The coal and carbonaceous shale collected earlier from Kalijhora River section, north of Siliguri were remacerated. The pollen contents do not release from the matrix as the sediments are highly affected by a dyke in the close proximity.

A manuscript on microfossil contents of faunal coal balls from Arunachal Pradesh was finalised. The mioflora have been compared with Karharbari mioflora of peninsular India and Late Sakmarian of Western Australia. The scolecodont, conodont microforaminifera present in the assemblage suggest deposition in a lagoon.

Suresh C. Srivastava & A.P. Bhattacharyya

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

Objective : To study palynofossils from the Palaeocene- Miocene sediments

: To carry out palynozonation, age determination and correlation of the assemblage

: *To develop information on phytogeography and understanding of the orogeny of Himalaya*

Morphotaxonomic study of the recovered palynofossils from the Tattapani and Metka coal mines were carried out. Photodocumentation of the selected palynotaxa was made. Data interpretation of the recorded palynoflora from Beragua and Kalakot coal mine areas was done. Three distinct palynofloral associations have been recognised in the Subathu succession of Tattapani and its adjoining areas. A comparison of the present dinocyst association with the one recorded earlier from Shimla hills of Himachal Pradesh reveals close similarity. Palynofloral composition dominated by dinocysts confirms a shallow water nearshore marine environment of deposition for the Subathu Formation. A paper entitled "Palynofossils from the Subathu Formation (Eocene) of Jammu and their palaeoenvironmental significance" was finalized.

Palynofossils have been recorded at several stratigraphic levels of Siwalik succession in Mansar and Uttarbani areas of Jammu. Qualitatively as well as quantitatively they are very poorly represented. Detailed morphotaxonomic study is in progress.

Samir Sarkar

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

Objective : *To systematically study spores and pollen*

: *To establish palynozonation*

: *To reconstruct the past vegetation, environment of deposition and palaeogeography*

Maceration of samples collected last year was done but the samples proved unproductive.

R.K. Saxena & Samir Sarkar

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

Objective : *To undertake extensive study of fossil plants from Neogene sediments of different regions of the Himalaya*

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

Leaf-impressions from the Kasauli Formation were sorted, cleared and photographed. Out of the specimens investigated, a frond has been identified as *Acrostichum*, a coastal fern from near Daghota, Kalka-Shimla Road. This fern is of special significance as it indicates persistence of coastal environment in the vicinity of Kasauli-Kumarhatti during Lower Miocene.

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

Morphotaxonomical study of plant remains including woods, leaves, fruits and seeds from Siwalik sediments of Arjunkhola, Suraikhola and Rehr has been carried out.

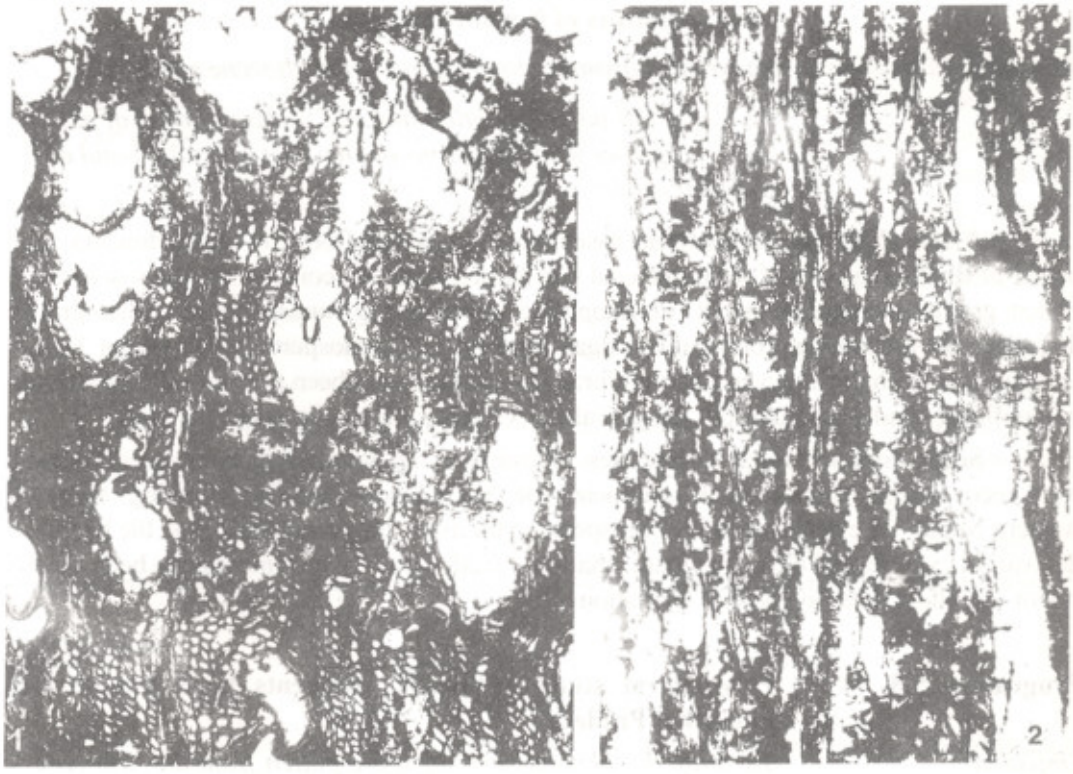
Acrostichum, a coastal fern from the Early Miocene sediments of Kasauli, Himachal Pradesh.

Photodocumentation of already identified leaf-impressions and fruits was completed. A paper entitled "Further contribution to the Siwalik flora from Suraikhola sequence, western Nepal and palaeoecology and phytogeography of the region" was finalized.

A critical examination of carbonised woods collected from Middle Siwaliks of Arjunkhola has been carried out. They show close resemblance with extant taxa, viz., *Dipterocarpus indicus, D. obtusifolia* and *Chrysophyllum roxberghii* of the family Dipterocarpaceae and Sapotaceae respectively.

N. Awasthi & M. Prasad

Investigation on the plant megafossils comprising mainly leaf-impressions collected from Koilabas, Nepal and Kathgodam and Haridwar in Uttar Pradesh has been carried out. A preliminary examination of recently collected material reveals the presence of about 15 new taxa. They have been photographed and their identification is in progress.



Carbonised wood of *Chrysophyllum roxburghii*, an evergreen element, from Nepal Siwaliks; **1**, cross section (X 80); **2**, tangential longitudinal section.

Six fossil woods collected from Siwalik sediments of Tanakpur have been studied and tentatively identified with extant taxa *Cassia* and *Ormosia* of the family Fabaceae, *Terminalia* of Combretaceae and a lauraceous wood. Twenty fossil woods collected from Siwalik sediments of Kalagarh area in Pauri Garhwal District of Uttar Pradesh have been studied. Of these, two fossil woods seem to be new belonging to the genus *Dalbergia* and *Bischofia* of the, families Fabaceae and Euphorbiaceae, respectively.

A number of leaf-impressions recovered from Siwalik sediments of eastern Nepal have been investigated and identified with the extant genus *Bambusa* of Poaceae, *Dipterocarpus* and *Hopea* of Dipterocarpaceae, *Leea* of Ampelidaceae, *Ardisia* of Myrsinaceae and *Diospyros* of Ebenaceae. A draft manuscript "Observations on the plant fossils from the Siwalik sediments of eastern Nepal" was prepared.

The overall study on plant megafossils from the Siwalik sediments suggests the existence of a tropical forest all along the Himalayan foot-hills during deposition. On the basis of habit and habitat of modern equivalents as well as physiognomic characters of the fossils existence of tropical climate during Siwalik period has been suggested.

M. Prasad

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

Objective : *To study palynofossils from the Mio-Pliocene sediments*

: *To carry out palynozonation and age determination of assemblages together with reflections on the past vegetation and environment of deposition*

A Late Miocene palynofloral assemblage recovered from Siwalik sediments exposed at Bhalubong area of western Nepal has been studied. It contains a variety of spores, pollen grains and algal remains. Pteridophytic spores and gymnospermous pollen grains dominate the assemblage followed by algal remains and angiosperm pollen grains. Based on quantitative analysis several palynofloral associations have been recognised. The overall palynofloral evidences point out the prevalence of subtropical climate in the area.

Seven forms of fossil zygospores referable to the family Zygnemataceae (Algae) were recovered from the Siwalik sediments of Surai Khola and its adjoining areas of western Nepal. The occurrence of zygospores in the assemblage indicates that the basin of deposition experienced clean, stagnant, shallow fresh water which must have been fairly warm to allow the zygospore formation.

Samir Sarkar

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

Objective : *To study morphotaxonomy of spore-pollen from the Miocene - Pliocene sediments*

: *To attempt palynozonation, age determination and correlation*

: *To determine the palaeoclimate and environment of deposition prevailing at the time of sedimentation*

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

M.R. Rao

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

Objective : *To determine the Neogene vegetational composition and vegetational history of this area based on palynological studies*

: *To conduct phytogeographic study of recorded palynotaxa*

: *To attempt palynological zonation and correlation of the investigated sediments*

Literature related to Siwalik sediments of the area was consulted to find out the existing gaps.

S.K.M. Tripathi

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

Programme 6.1 : Tertiary floral history of northeast India

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

: *To reconstruct Tertiary floral history, palaeoecology and phytogeography*

A number of fossil leaves, fruits and seeds from Tirap and Baragolai collieries of Makum Coalfield, Assam have been identified with the extant taxa, viz., *Chamaerops, Melocanna, Areca* (monocotyledons); *Garcinia, Sterculia, Holigarna, Bouea, Saraca, Butea, Millettia, Barringtonia, Bassia* and *Cinnamomum* (dicotyledons). The monocotyledonous taxa including *Nipa* provide further evidence of the deposition of coal and associated sediments in the coastal environment.

In order to build up Tertiary flora of the region for reconstruction of the palaeoenvironment a large number of plant fossils, viz., leaves, fruits, seeds and woods were collected from different localities in the Garo Hills. The localities covered were Tura, Damalgiri, Sonmati Kalai, Charpara, Garobadha and Nangwal.

N. Awasthi & R.C. Mehrotra

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

Objective : *To work out palynostratigraphy of different Tertiary formations*

: *To palynologically differentiate Langpar (Early Palaeocene), Langpar-Lakadong (Middle Palaeocene), Lakadong-Umlatodoh-Prang (Early-Middle Eocene), Prang-Kopili (Late Eocene) and Kopili Barail (Early Oligocene) sediments*

: *To correlate the Therria Ghat assemblages with those of Jaintia and Garo Hills*

Description of important palynotaxa recovered from Bapung, Mookhep, Thangskai and Wailynkhot (Meghalaya) was completed. Photography of significant palynotaxa finalized. Quantitative analysis was also completed. The important palynotaxa are *Cyathidites minor, Dandotiaspora dilata, D. telonata, D. plicata, Lycopodiumsporites speciosus, Polypodiisporites repandus, Neocouperipollis kutchensis, N. wodehousei, Matanomadhiasulcites maximus, M. kutchensis, Spinizonocolpites echinatus, Proxapertites microreticulatus, Lakiapollis ovatus, Retitribrevicolporites matanomadhensis, Triangulorites bellus, Trilatisporites kutchensis*, etc.

R.K. Kar & Manisha Nanda

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

Objective : *To study morphotaxonomy and affinity of palynofossils*

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

: *To infer palaeoclimate and environment of deposition of the sediments*

A poor palynoassemblage was recovered from a Disang-Barail transition section near Harangajao. In the absence of stratigraphic marker taxa, dating of lithounits was not possible. However, the occurrence of a good number of *Striatriletes* ascertains that the age of the sediment is younger than Middle Eocene.

J.P. Mandal

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

Objective : *To select stratigraphically and ecologically important palynotaxa of North Cachar Hills*

: *To study ultrastructure of important palynofossils to trace their relation with pollen of extant taxa*

: *To reconstruct the environment of deposition and palaeoclimate during sedimentation*

The rock samples collected for palynological study from Bara Langpher River section and Lumding-Haflong Road sections were macerated and prepared the slides of productive samples and scanned them. The photography of selected spores-pollen taxa was done. The palynoflora recovered from these samples are—*Polypodiaceaesporites* sp., *Parmathyrites indicus, Phragmothyrites* sp., *Frasnacritetrus* sp., *Polypodiisporites repandus, Pteridacidites meghalayensis, Striatriletes* spp., *Dictyophyllidites* sp., *Operculosculptites* sp., *Pinuspollenites crestus, Tricolporopollis rubra,* etc. and some Permian bisaccate grains. Some angiosperm pollen are tagged with similar modern taxa to deduce the habitat of fossil palynotaxa.

Madhav Kumar

Programme 6.7 : Palynostratigraphy of Barail sediments in Upper Assam

Objective : *To study Barail sediments in order to know their lithic characters, nature of contact and palynofossil content*

: *To study morphotaxonomy of the palynofossils*

: *To establish palynological zonation in the entire Barail sedimentary succession*

: *To study the botanical affinity of various spore-pollen taxa*

The spores-pollen from Namchik River section, Changlang District, Arunachal

Pradesh and their distribution patterns in coal-bearing strata were analysed. The palynoassociation rich in angiospermic pollen was assigned to 23 genera and 25 species. Pteridophytes are represented by 16 genera and 25 species. Fungal remains comprise 6 genera and 6 species. Gymnospermic palynofossils are strikingly absent. Quantitatively, palynofossils of the Coal seam I are comparable with that of coal seam II. Based on palynological data the sediments are assigned to Oligocene age. *Retitrescolpites, Polyadopollenites, Bombacacidites, Meyeripollis, Pteridacidites* and *Osmundacidites* indicate the existence of a humid tropical to subtropical climate with high rainfall.

B.D. Mandaokar

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

Objective : To establish palynological zones for correlation and dating

: To deduce palaeoclimate and depositional environment

: To carry out SEM studies of important palynofossils to trace evolutionary trends

Macerated 35 samples of Kopili Formation from Umrangso section, North Cachar Hills, Assam. The productive samples yielded poor palynofossils; only a few sporadic pteridophytic spores *Striatriletes, Cyathidites* and *Monolites* could be encountered.

A manuscript on "Late Eocene palynoflora of Kopili Formation from Jowai-Badarpur Road, Meghalaya : palaeoecologic and palaeogeographic interpretations" was finalized.

G.K. Trivedi

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

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

Twenty five coal and non-coal samples from four coal seams of Changki Valley Coalfield, Nagaland were quantitatively analysed for their maceral contents under normal incident mode. The coals are rich in vitrinite, contain subordinate amount of liptinite, whereas inertinite macerals are low to moderate in proportion. Mineral matter in them is represented mainly by pyrite, clay and calcite. Petrographically, they are similar to those of other Oligocene coals from coalfields of Assam.

A paper entitled "Fluorescence alteration behaviour of vitrinite in some Late Palaeocene bituminous coals from Garo and Jaintia Hiils of Meghalaya, India" was finalized and got it reviewed by Mr. Karl Ottenjann, GLA, Krefeld. Finalized another paper on "Fluorescence alteration behaviour of perhydrous vitrinite and spectral fluorescence analysis of sporinite and alginite macerals in some Late Palaeocene coals from Meghalaya, India".

B.K. Misra

Programme 6.11 : Palynostratigraphy and correlation of Tertiary sediments of Meghalaya

Objective : *To carry out morphotaxonomic study of recorded palynotaxa*

: *To determine stratigraphically significant palynotaxa and their application in zonation, correlation and dating*

: *To infer palaeoclimate and environment of deposition*

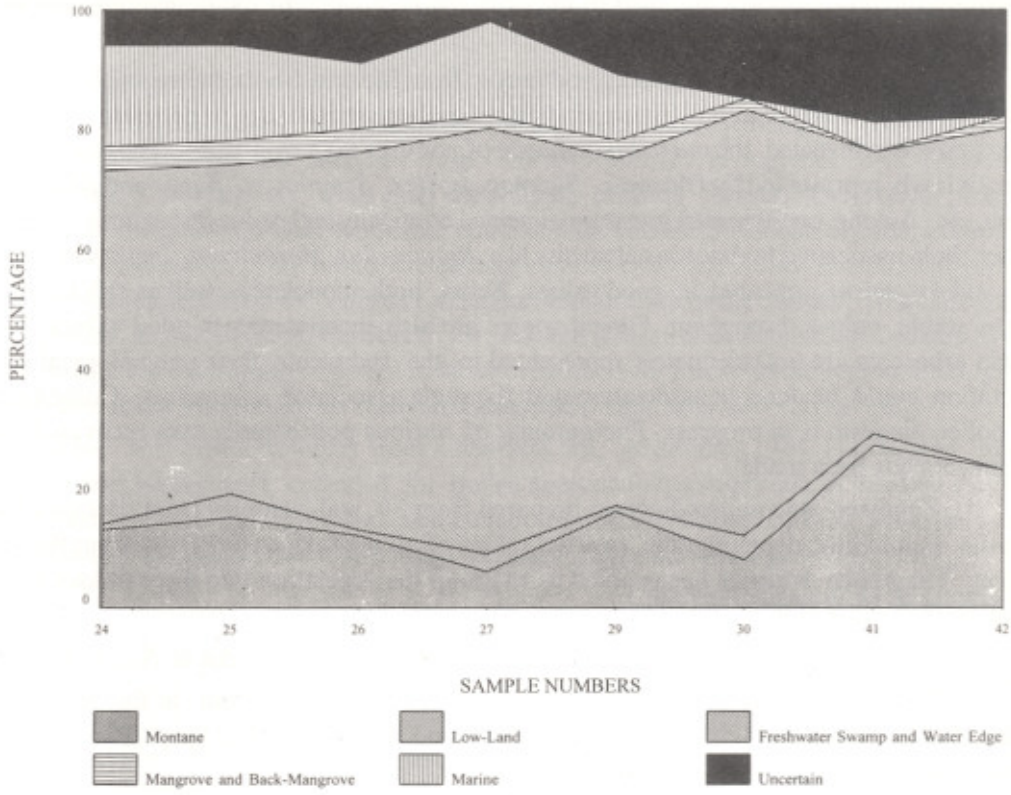
: *To trace botanical affinity and evolutionary lineages of studied palynotaxa*

A palynofloral assemblage, comprising 30 genera and 48 species, has been recorded from the Tura Formation (Palaeocene) exposed in Nongwal Bibra area in East Garo Hills District.Two palynozones have been recognized. The lower is dominated by angiospermous pollen (79 %), viz., *Proxapertites* spp., *Tricolporopollis* spp., *Granustephanocolpites cooksoniae*, *Palmidites* spp., *Tricolpites matanomadhensis*, etc. followed by pteridophytic spores (7.5 %) and fungal remains (13.5 %), whereas the upper palynozone is dominated by pteridophytic spores (76 %), viz., *Lycopodiumsporites* spp., *Dandotiaspora* sp., *Foveosporites triangulus*, *Todisporites* spp., etc. followed by angiospermous pollen (15 %) and fungal remains (9 %). The palynoflora indicates prevalence of tropical-subtropical climate, luxuriant growth of wet-evergreen forest in the vicinity of the area and near-shore, shallow marine environment of deposition. Based on close similarity of the present assemblage with those recorded from parts of the Tura Formation (Garo Hills), Cherra Formation (Khasi Hills), Therria Formation (Jaintia Hills), Mikir Formation (North Cachar Hills), subsurface Palaeocene sediments of Bengal Basin and Matanomadh Formation (Kutch), a Palaeocene age has been assigned to the studied sequence.

Maceration of samples from the Palaeocene-Eocene sediments of Tura-Dalu Road Section (West Garo Hills) has been done and is being continued. Study of palynoflora from the Siju Limestone and Rewak formations of Siju-Baghmara Road Section has been taken up.

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

A rich palynological assemblage has been recorded from the Boldamgiri Formation (Early Miocene) exposed in the type area—Boldamgiri, on Adugiri-Purakhasia Road, in West Garo Hills District. The assemblage is dominated by pteridophytic spores, followed by gymnospermous and angiospermous pollen. Besides, a good number of dinoflagellate cysts and fungal remains have also been recorded. The important palynotaxa of the assemblage are : *Lygodiumsporites*, *Pteridacidites*, *Osmundacidites*, *Intrapunctisporis*, *Striatriletes*, *Foveotriletes*,, *Cheilanthoidspora*, *Polypodiaceaesporites*, *Pinuspollenites*, *Abiespollenites*, *Spinizonocolpites*, *Plumbaginaceaepites*, *Meyeripollis*, *Echistephanocolpites*, *Polyadopollenites*, *Proteacidites*, *Chenopodipollis* and *Malvaceaerumpollis*. Representation of dinoflagellate cysts and pollen of mangrove and back-mangrove and coastal elements suggests a near-shore environment of deposition. Present day distribution of various plant families and abundance of pteridophytic spores and fungal remains indicate tropical-subtropical (warm-humid) climate. The assemblage also contains reworked Permian pollen, e.g., *Parasaccites*, *Plicatipollenites*, etc. which might have been derived from the Lower Gondwana sediments developed in the West Garo Hills, near



Percentage of palynotaxa of various ecological groups in the Boldamgiri Formation, West Garo Hills, Meghalaya.

India-Bangladesh Border.

Maceration of samples from the Baghmara Formation of Baghmara-Rongra Section (South Garo Hills) has been done. Scanning and morphotaxonomic study are in progress. Maceration of samples from Tura-Dalu section (Oligocene-Early Miocene) has been taken up.

R.K. Saxena & M.R. Rao

PROJECT 7 : RECONSTRUCTION OF QUATERNARY VEGETATIONAL PATTERNS

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

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

Pollen analysed 5 modern surface samples collected from Marian Shola, Palni Hills. The vegetation composition of surface samples has enabled us 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 a 1.7 m deep soil profile from Marian Shola dating back to 30,000 years B.P. The evaluation and interpretation of pollen diagram are in progress. Moreover the study has revealed the overall dominance of non-tree taxa over trees. The tree taxa are rare or lowly represented by Oleaceae, Sapotaceae, *Ilex, Symplocos, Eurya* and *Rhododendron*, etc. Among non-tree taxa grasses maintained erratically high value throughout. Whereas, other shola associated herbaceous elements like *Ranunculus, Heracleum, Impatiens, Senecio* and *Artemisia* appeared in good values. Ferns, both monolete as well as trilete spores show stable values throughout. Fungal spores are also encountered in good values. Since shola arboreals are not adequately represented in the sediments, their palynological interpretation could be done in association with the shola associated ephimerals. Construction of pollen diagram is in progress. Photography of various pollen/spore taxa recovered from sediments has been made.

Finalized one pollen diagram prepared from 30 soil samples from Berijam Lake profile, Palni Hills, depicting the relative values of all the taxa encountered from the sediments. The pollen evidence has enabled us to group the vegetation into three phases for the past 20,000 years B.P.

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

Pollen morphology of Indian Nymphaeaceae was worked out in the context of Silent Valley. Finalized pollen morphology of some tree taxa of the area. Also finalized pollen morphology of Apocynaceae.

H.A. Khan

Out of 80 modern plant taxa collected from Palni Hills, Kodaikanal 36 plants have been identified. The following modern pollen taxa, viz., *Ageratum conyzoides, Ardisia* sp., *Cassine glauca, Commelina* spp., *Cytisus* sp., *Ficus* sp., *Grewia* sp., *Hypericum mysorense, Litsea wightiana, Mimosa pudica, Myriactis wallichii, Myrsine africana, Osbeckia leschennaultii, O. stellata, Rhododendron nilgiricum, Rubus ellipticus, Ternstroemia* sp., *Trifolium dubium, Verbena bipinnatifida* and *Vernonia* sp. were studied and photographed under light microscope to get acquainted with various morphotypes of Shola forest.

Anjum Farooqui

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

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

Pollen analysis of 4 samples gathered from deforested region on way from Gangtok to Kupup, eastern Himalaya has revealed the overall dominance of non-arboreals over arboreals as witnessed by high values of grasses, Asteraceae, Apiaceae, Ranunculaceae, etc., whereas among the arboreals *Alnus* is over-represented and other taxa such as *Betula,*

Quercus, Carpinus, etc. are lowly represented, reflecting ± surrounding vegetation.

Chhaya Sharma

Pollen analysis of a 5 m deep lacustrine profile from Sat Tal (ST-II), Garhwal Himalaya has shown that the vegetational sequence commences with mixed conifer-broad-leaved forest. The conifers such as *Pinus, Cedrus, Abies, Picea* together with *Quercus, Alnus, Betula, Carpinus*, etc. were chief constituents of these forests. The overall picture emerged out indicates the cold-temperate climate in the region. Subsequently, the improvement in the frequencies of the broad-leaved taxa such as *Quercus, Alnus Betula, Carpinus* and corresponding decline in conifers reflect the amelioration of the climate. Thereafter, the improvement in the conifers, particularly *Pinus* and *Abies*, and decline in broad-leaved taxa, indicate the restoration of mixed conifer broad-leaved forest in the region. Photography of the fossil palynomorphs recovered from the profile was also carried out.

Five soil profile samples from Chharkha Tal, Murdhung Tal, Hunia and Seni Swamp (Uttar Kashi) were collected for pollen analytical investigations. A detailed survey of forest floristics of the region was also conducted and two dozen surface samples were also collected to analyse the relationship between the present and past vegetation.

Chhaya Sharma & M.S. Chauhan

Pollen analysis of partly investigated sedimentary profile (8 samples) from sub-alpine Kupup Lake from eastern Himalaya has revealed the dominance of non-arboreals over arboreals. *Quercus* is dominant alongwith other associated arboreal taxa, viz., *Alnus, Betula, Carpinus, Juglans, Rhododendron, Corylus, Pinus, Tsuga*, etc. represented in low values. Non-arboreals are represented by elements of Cyperaceae, Poaceae, Cerealia-type, Apiaceae, Cheno/Ams, Ranunculaceae, Asteraceae, etc.

Re-investigated 6 profile samples from Deoria Tal-III, Garhwal Himalaya. Constructed pollen diagram of earlier completed 1.5 m deep profile and prepared draft of the paper entitled "Vegetation and climate of Garhwal Himalaya during Early Holocene". Studies reveal that around 7,000 years B.P., Oak mixed broad-leaved forests existed in the region, reflecting warm temperate and humid climate. Subsequently, around 4,000 yrs B.P. decline in Oak as well as its other broad-leaved associates is registered with a corresponding rise in grasses, sedges, etc. and this leads to infer a change in the climate to cooler conditions. Anthropogenic activities are noticed during this period as evidenced by the first appearance of Cerealia-type pollen besides other encountered culture pollen. Thereafter, around 2,000 years B.P. restoration of Oak forests took place indicating the amelioration in the climatic conditions.

Chhaya Sharma & Asha Gupta

Finalised the joint palaeoclimatic work carried out from Spiti Valley with collaboration of Wadia Institute of Himalayan Geology, Dehradun. The study has revealed that during 2000 to 1500 yrs B.P. this region had alpine-steppe, constituted of grasses, sedges, Cheno/Ams, *Artemisia* together with scrubby elements of *Juniperus, Ephedra*, etc. The vegetational assemblage denotes that this region was under the impact of cold and dry

climate during this period. Between 1500 to 900 yrs B.P. the expansion of broad-leaved elements such as *Betula, Salix, Rhododendron* into these steppes suggests the amelioration in climate. Thereafter, the reversal of cold and dry climate took place as evidenced by the improvement in *Ephedra, Juniperus* and grasses and a corresponding decline in the broad-leaved elements.

M.S. Chauhan

Pollen analysis of 4 surface samples gathered from the vicinity of Chharaka Tal (Sat Tal), Garhwal Himalaya has revealed the exceedingly high values of *Pinus* followed by *Cedrus, Abies, Picea, Quercus, Alnus, Carpinus, Betula*, etc. reflecting more or less the surrounding vegetation. The non-arboreals such as Poaceae, Cyperaceae, *Artemisia*, Cheno/Ams, Asteraceae, Ranunculaceae are also recorded in good frequencies. However, the over representation of Asteraceae in one of the samples denotes the abundance of the members of this family.

M.S. Chauhan & Chhaya Sharma

Constructed pollen spectra of air catches from Chaurangi-Khal and Nachiketa Tal, Garhwal Himalaya. Studies reflect more or less surrounding vegetation except for *Pinus* which deem to be drifted.

Asha Gupta & Chhaya Sharma

Programme 7.3 : History of mangrove vegetation in India

Objective : *To study palynostratigraphy and Dispersed Organic Matter analysis of the sediments from Chilka Lake in Mahanadi-Brahmani-Baitarini deltaic region in Orissa*

Twenty samples of Dangmal profile collected from thickets of mangrove forest at Bhitarkanika, Mahanadi Delta have been palynologically investigated, and exhibited rich occurrence of palynodebris such as pollen, spores, diatoms, dinoflagellate cysts, microforaminifera, pseudoschizea, etc. The core-mangrove taxa encountered are *Rhizophora, Heritiera, Sonneratia, Avicennia, Excoecaria, Aegialitis*, etc. indicating conducive environment for growth and development of mangroves.

Accomplished the pollen analysis of 1.5 m deep profile dated back to 20,000 yrs B.P. from Andaman and Nicobar Islands. Three phases of vegetation development have been recognised : Phase I, between depth of 110.0-80.0 cm, covering a time span between 20,000-18,000 yrs B.P., recorded the existence of brackish water *Heritiera* forest, wherein *Avicennia, Lumnitzera, Acrostichum*, Rhizophoraceae, Palmae had made their presence in moderate values.

Phase II, between depth of 80.0-45.0 cm, covering a time span between 18,000-12,000 yrs B.P., had witnessed a shift in vegetation from brackish water *Heritiera* forest to salt-marsh vegetation wherein halophytes like *Salsola, Suaeda, Porteresia* and sedges colonised. The occurrence of hinterland taxa such as *Holoptelea, Salvadora, Emblica*, Oleaceae, Fabaceae, etc. have also been recorded.

Phase III, between depth of 45.0-0.0 cm covering a time span of 12,000 yrs B.P.,

recorded the reciprocity of Phase I indicating the re-establishment of brackish water *Heritiera* forest albeit in degraded form.

H.P. Gupta & Asha Khandelwal

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

Objective : *To reconstruct climate (temperature and precipitation) from tree rings*

: *To study environmental factors determining the seasonality of cambium activity*

Tree ring samples collected from *Podocarpus* growing in Tirunelveli, Tamil Nadu were studied to understand its growth behaviour. Tree rings of this site is found problematic in dating. Ring boundaries are often not clear and at many places rings get anastomosed each other.

A floating tree ring chronology of teak from one disc sample available in the Wood Museum of Institute of Wood Science and Technology was prepared. This chronology was tentatively dated 1159-1959 AD after cross matching with master chronology (1872-1987 AD) of teak prepared from Korzi, Andhra Pradesh.

R.R. Yadav & A. Bhattacharyya

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

Objective : *To study agricultural practices in context of different cultures in time and space*

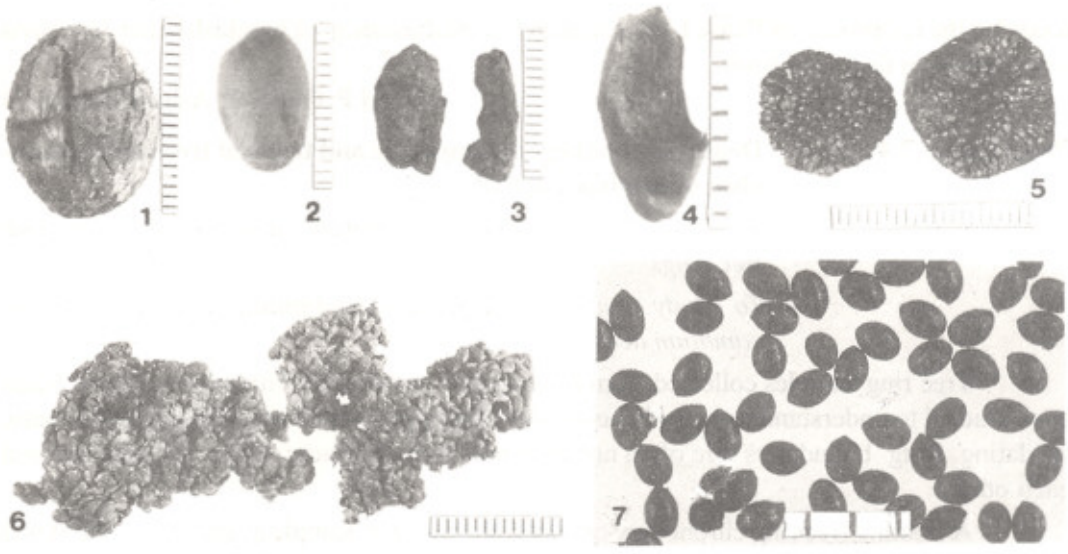
: *To sketch the perspectives of ecological potential of contemporary agro-ecosystem and their contemplated further development*

: *To determine the interaction of pre-historic man with the floral wealth*

: *To reconstruct regional models of ecological conditions around the cultural settlements*

Large quantities of highly deformed and mutilated botanical remains collected at places from the heaps of ash filled inside four altars or hawan-kundas of Kushana Period (100-300 A.D.) at Sanghol, District Ludhiana, Punjab, have been critically examined and studied. The studies for the first time in archaeological context of the subcontinent, bear ample testimony to the confirmation of statements made in Vedic, Puranic and other religious scriptures about the use of varied plant products with healthy constituents and agreeable aroma, in the traditional sacrificial rituals.

The identifiable remains include the mixture of seven types of food-grains, comprising rice (*Oryza sativa*), barley (*Hordeum vulgare*), wheat (*Triticum aestivum*), greengram or mung (*Vigna radiata*), blackgram or urad (*Vigna mungo*), lentil (*Lens culinaris*) and



Carbonised remains of : **1**, Jaiphal (*Myristica fragrans*); **2**, Pistachio (*Pistachia* cf. *vera*) nut-shell; **3**, Chebula (*Terminalia chebula*) fruit pieces; **4**, Chilgoza (*Pinus gerardiana*) seed coat piece; **5**, Gular-fig (*Ficus glomerata*) pieces; **6**, Sesame/Til (*Sesamum indicum*) seeds in lumps; and **7**, Basil/Tulsi (*Ocimum* cf. *sanctum*) seeds recovered from the fire altars of Kushana Period (1000-300 A.D.) at Sanghol, Punjab. These were used for oblations (scale in mm).

sesame or til (*Sesamum indicum*); substantially rich and sweet-smelling fruits of jujube (*Ziziphus nummularia*), date (*Phoenix dactyliferalsylvestris*), grape/raisin (*Vitis vinifera*), almond (*Prunus amygdalus*), walnut (*Juglans regia*), chilgoza (*Pinus gerardiana*), pistachio-nut (*Pistachio* cf. *vera*) and gular-fig (*Ficus glomerata*), and the herbal medicines of congruity, such as emblic-myrobalan/anwala (*Emblica officinalis*), chebulic-myrobalan/ harra (*Terminalia chebula*), tulsi (*Ocimum* cf. *sanctum*), jaiphal (*Myristica fragrans*), black-pepper (*Piper nigrum*) and phok (*Ephedra* sp.). Certain woods specifically prescribed for the purpose of ritual, are represented by the charcoals of pipal (*Ficus religiosa*), gular (*Ficus glomerata*), palash (*Butea monosperma*), Kaitha (*Feronia limonia*), deodar (*Cedrus deodara*) and tamal or camphor (*Cinnamomum tamala* or *C. camphora*) of Himalayas, having agreeable aroma, and the sandalwood (*Santalum album*) of South India, which is one of the oldest perfumery products in India.

Botanical remains from the ancient mound near Balu Village in Kaithal District, Haryana were collected. This time the collection was made at the levels of preceding pre-Harappan culture (ca 2,300 - 2,000 B.C.) and Mature Harappan culture (ca 2,000 - 1,700 B.C.). As the ancient site is situated on the eastern fringe of the Harappan Empire near the Yamuna Canal an impact from the Ganga-Yamuna Doab of Uttar Pradesh is expected on the economy of pre- and Mature Harappans in this region.

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

Botanical remains from ancient mound near Waina Village in Ballia District of Uttar Pradesh were collected to study agricultural practices in context of different chalcolithic

cultures (1300-800 B.C.) in the region of Middle Gangetic Plain. The archaeological excavations have been carried out at this site by the Department of Ancient Indian History, Culture and Archaeology, Benaras Hindu University, Varanasi. Black slipped ware culture (800-600 B.C.) was dominant at Waina Village and a thorough search was made at this level to fill the information gap.

K.S. Saraswat

As only wood charcoal pieces were recovered from Kudan, district Taulihawa, Nepal, a site of Buddhist Period (N.B.P.W.) dating between Ca 600 to 200 B.C., their processing, block-preparation, section cutting and anatomical study were done.

Their anatomical investigations revealed the finds of timbers belonging to Mimosaceae, Fabaceae, Dipterocarpaceae, Combretaceae and Verbenaceae. Mostly the timbers belonged to the *Shorea robusta*, thereby revealing the selective choice of the ancient settlers for this quality timber available locally in the Tarai and Bhabar region. The other timbers exploited by them seem to belong to the species in mixed deciduous Sal forest.

Chanchala Srivastava

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

Objective : *To daily monitor the aerospora of Lucknow and surrounding areas for their seasonal and diurnal periodicity*

: *To identify aeroallergens by biochemical and clinical investigations*

: *To enumerate biota in the aerospora both quantity-wise and quality-wise employing both gravimetric and volumetric techniques in order to achieve precision in seasonal and diurnal periodicity*

Pollen analysed 20 soil, water and moss cushion samples collected from diffrent parts of Lucknow city and around in order to find out the number and frequency of pollen grains preserved in the sediments and their correlation with the aerospora of Lucknow. Collected bulk pollen and fungal spores of many taxa for their clinical/biochemical analyses and recognised their allergenic significance.

Identified 40 types of fungal spores from house dust samples of seven allergic patients of Lucknow. *Aspergillus* dominated the assemblage represented by eight species. The other encountered taxa include *Alternaria alternata, Chaetomium globosum, Cladosporium* sp., *Curvularia lunata, Epicoccum* sp., *Fusarium oxysporum, Helminthosporium* sp., *Memnoniella* sp., *Penicillium citrunum, Rhizoctonia* sp., *Stachybotrys* sp., *Trichoderma* sp., Mycelia sterilia, etc.

Asha Khandelwal

PROJECT 8 : GEOCHRONOMETRY OF INDIAN ROCKS

Programme 8.1 : Radiocarbon dating of Quaternary deposits and materials of

archaeobotanical importance

Objective : *To date Quaternary sediment profiles, ocean sediment cores, coastal deposits and shell deposits and Kankar horizons in the Ganga Plain*

: *To establish the Liquid Scintillation Counting method for C-14 dating*

A total of 81 samples were processed in the Radiocarbon lab, of these 59 samples were dated including 34 samples as a part of consultancy services offered by the institute. Some of the results are as follows :

For reconstruction of the palaeoclimate and environment and their changes during Late Quaternary, 3 clay and 3 kankar samples were dated from 24 Parganas, and Salt Lake area in Calcutta respectively. Lowest horizon dates to >40,000 yrs BP.

Three shell samples from Koparkhairna, district Thana were dated to know the age of the oyster bed and to interpret palaeoclimate and sea level changes. The age of the bottom most oyster bed is 6240±120 yrs BP.

Seven shell samples collected from Kanyakumari, Tamil Nadu by Professor P.K. Banerji, Jadavpur University (School of Oceanography), were dated for Holocene sea level changes and evolution of the lagoon in the East coast. The oldest date 24960±420 yrs BP is obtained for the shell sample from Manaffad point.

Five charcoal samples were dated for the Centre for Earth Science Studies, Trivandrum from recent earthquake site at Latur in Maharashtra. The oldest C-14 age is 2350±100 yrs BP.

Two sediment samples from Marian, Kodaikanal and one sample from Dangmal, at Mahanadi delta, Orissa were dated to reconstruct the palaeofloristics in south India and Orissa. The base date from Marian was 18060±290 yrs BP at 130 cm depth and another date at 100 cm was 10750±160 yrs BP. The sediment sample at 90-135 cm depth at Dangmal gave the age as 1440±200 yrs BP.

Four shell samples from different part of Maharashtra submitted by Dr Shiela Misra, Deccan College, Pune were dated to know the age of microlithic industry and its Early Holocene aggradation. The oldest C-14 age 13130±190 yrs BP is linked to aggradation with increased aridity.

Ten shell samples from Tekkekkad, Kerala, submitted by G.K.Suchindan, Centre for Earth Science Studies, Trivandrum were dated to understand Quaternary coastal evolution and sea level changes along the coast. The interpretation of the data are being carried out.

Two bone samples from Sekta Mound, Sekta, Manipur was dated to establish the chronological relationship with other urn burial sites in Asia. The C-14 age is Modern.

G. Rajagopalan

Interpretations on climatic changes around Didwana Lake, Rajasthan on the basis

of elemental analysis, phosphorus concentrations have been finalised.

G. Rajagopalan & B. Sekar

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

Objective : To date the glauconitic sandstone collected from Vindhyan deposits in U.P. and Rajasthan

: To date the Deccan Trap samples and synthesize the data with fossil studies in collaboration with Cenophytic Department

: To develop data acquisition and reduction system

The high voltage circuit in the MS control unit was checked and by substituting some components, voltage was increased enabling scanning of lower masses. The flame photometer was modified to get digital read out's for various potassium concentration. An UPS system was installed and tested. Glauconite was separated from some Vindhyan sandstone samples. The gettering performance of the extraction, purification system was also checked by recording residual gas spectra.

C.M. Nautiyal

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

Objective : To index and update new data into the existing data banks

: To develop data-base for distribution of stratigraphically important taxa

: To establish data-base for identification and retrieval of palynotaxa

Updating of databank on palynology of Indian Gondwana sediments and related aspects was continued. Editing of already stored data was also done to get the uniformity in the style of data stored for testing the search retrieval programme.

Department of PGGP : Group Effort

The search retrieval programme developed at the Institute was finalized and tested. The programme is named "DCB" after Late Dr D.C. Bharadwaj, Ex-Deputy Director at this Institute who initiated cataloguing of references and planned to have database on computer.

R.S. Tiwari, Archana Tripathi & R. Nandhagopal

For the Index of spore-pollen species, the marker species for Permian palynoflora were photographed and their description were completed. The first draft including description and other details of species was prepared.

R.S. Tiwari, Archana Tripathi, Vijaya & Ram-Awatar

Programme 9.2 : A catalogue of fossil dinoflagellates from India

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

: *To identify latest taxonomic status*

: *To comment on stratigraphic distribution*

Stratigraphic distribution of dinoflagellate cyst taxa reported from the Jurassic sedimentary sequences of India are compiled and compared with the respective global ranges to identify index dinoflagellate cyst taxa for future biostratigraphic researches.

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

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

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

Leaves of *Mesua ferrea* Linn. subsp. *pulchella* Vesque var. *coromandeliana* (Wt.) Maheshwari and *Mesua ferrea* Linn. subsp. *thwaitesii* Vesque were collected and identified. Herbarium sheets of these leaf specimens were prepared. Duplicate specimens of above

A dicot flower from Mahuadanr Valley, Palamu, Bihar.

species were treated with chemicals and prepared slides of cuticle and mounts of leaf venation pattern. Atlas of leaf print was also prepared.

The morphology of leaves and venation patterns were described alongwith their cuticular features. It has been observed that the leaf architectural pattern and cuticular features are constant within a species. It is therefore clear that these features furnish useful taxonomic characters in the family Clusiaceae.

D.C. Saini

Programme 9.9 : Cenozoic plant remains of Palamu, Bihar

Objective : *To study morphotaxonomy of megafossils from the Neogene sediments of Mahuadanr Valley*

: *To reconstruct vegetational history, palaeoecology, phytogeography and depositional environment*

The specimens collected from Mahuadanr, Palamu were sorted out. Photodocumentation was done. Impressions of leaves of *Adina cordifolia, Casearia tomentosa, Cyclostemon assamicus, Ficus microcarpa* and *Hiptage bengalensis* have been identified. Manuscript on the study is under preparation.Besides the fossil plants from Mahuadanr, Palamu, Bihar fossil resins (Amber) were also collected.

G.P. Srivastava

Programme 9.10 : Siwalik flora of West Bengal

Objective : *To study the plant megafossils from the Siwalik sediments exposed in various localities of Darjeeling District*

: *To build up the floristics for interpreting palaeoecology, phytogeography and evolutionary patterns of the Himalayan flora*

The leaf-impressions, collected from Ghish River, Lish River and Sevoke Road cutting sections in the Himalayan foot-hills of Darjeeling District, were studied and identified with the extant taxa—*Polyalthium simiarum* (Anonoceae), *Shorea buchananii* and *Dipterocarpus macrocarpus* (Dipterocarpaceae), *Phyllanthus hirsutum* (Euphorbiaceae) *Swintonia floribunda* (Anacardiaceae), *Pterospermum semi-sagittatum* (Sterculiaceae), *Clinogyne dichotoma* Salisb. (Marantaceae) and *Millettia pachycarpa* (Fabaceae). On the basis of study four papers were finalised. The presence of these elements in the area indicates the prevalence of tropical climate with excessive rainfall during sedimentation as well as exchange of floral elements between India and Malaya Peninsula.

J.S. Antal

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

Objective : *Comparison of pollen of living and fossil palm pollen recovered in Tertiary sediments*

: *Survey of pollen flora of arborescent monocots of Western coast, south India*

SEM studies on the different species of *Phoenix: P. sylvestris, P. reclinata, P. canariensis, P. dactylifera, Livistona australis, L. chinensis, Sabal major, Borassus flabellifer, Hyphaene thebaica* and *Chrysalidocarpus madagascarensis* were carried out and their photography was done. In order to compare the nature of the apertural architecture between fossil *Sclerosperma* (Bande & Ambwani, 1982) with the extant African palm *Sclerosperma manii,* similarities and differences in both the specimens were recorded. The exine pattern of zonisulcate pollen, *Proxapertites crassimurus* was compared with *Areca chainiana.*

An approach to study the fossil plant tissues under SEM was taken up especially for the plants which underwent volcanic activity with particular reference to middle lamella. This study was also applied to the fossils from Deccan Intertrappean beds, lignite, and nonvolcanic fossil woods in the Tertiary sediments occurring over a wide range of geological age. Similar studies were also applied on the modern charcoal for comparison work. It was deduced that the absence of middle lamella in the Deccan Intertrappean woods and openly burn woods, probably points out that volcanic erruption pouring lava causing fire, produced fusain at the cost of middle lamella.

K. Ambwani

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

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

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

: *To infer palaeoclimate and depositional environment*

: *To demarcate K-T boundary on the basis of palynology*

: *To study the limit of paleoprovince during the Late Cretaceous*

: *To study extant pollen and spores for comparison with extinct spores and pollen infering palaeoclimate and depositional environment*

Literature on the Deccan Intertrappean beds was consulted. The samples collected from around Jabalpur, Madhya Pradesh and Nagpur, Maharashtra mainly represent the intratrappean and intertrappean beds. A draft manuscript "Diversity of the genus *Nypa* since Late Cretaceous in the Indian subcontinent" was finalized.

R.S. Singh

PROJECT 10 : APPLICATION OF GEOBOTANICAL ANALYSIS IN

I. MINERAL PROSPECTING

II. RECONSTRUCTING THE HISTORY OF MODERN VEGETATION THROUGH CENOZOIC ERA

Objective : *To assess the extant plant communities for indication of*

minerals in the underlying strata

: *To reconstruct the patterns of migration, extinctions and diversification of Cenozoic floras in conjunction with the lineages of modern floras*

A field excursion was undertaken and a large number of plants, rock and soil samples were collected from the Copper and Manganese rich areas of the Balaghat District, Madhya Pradesh. A few samples were geochemically analysed. Based on the processed data a manuscript entitled "A preliminary study of indicator plants in the copper and manganese rich areas of the Balaghat, M.P., was prepared.

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

PROJECT 11 : PALAEOBIOCHEMISTRY OF PLANT FOSSILS, LIGNITE/ COAL D.O.M. AND RELATED RECENT MATERIAL

Objective : *Extraction and identification of organic compounds from plant fossils, rocks, lignite, coal and related recent material*

: *Evaluation of extracted organic compounds (EOC) for the possible use as biomarkers and in identification of plant groups*

: *Possible structural changes in EOC (by diagenesis, catagenesis and metagenesis) through time for assessment of maturity*

: *Pair-wise comparison of correctly aligned proteins and nucleic acids (DNA & RNA) sequences will be attempted to measure time*

: *Evaluation and assessment of organic compound in lignite and coals*

: *Assessment of palaeoenvironmental and palaeodepositional conditions*

The efforts to establish palaeobiochemical lab are under progress. The samples of Quaternary age have been collected from the moss bags in Sat Tal Lake near Gangotri and sent for extraction of DNA at J.N.U., Delhi. The other samples are being studied for DOM before ultimately subjecting them to extraction of organic matter when the lab is ready.

Manoj Shukla

Sponsored Projects

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

Objective : *To build up data on palynology, sedimentology, C/N ratio and O^{18} isotope from in and around Chilka Lake for palaeoclimatic interpretation*

Palynological analysis of 250 m deep Sadanandpur profile, dating back to 160 ka yrs B.P., has been completed. It is the first attempt to present the palaeorecords of marine palynology of the complete Quaternary sediments from Mahanadi delta in Orissa. Pollen diagrams one each in curve and bar have been prepared. The whole pollen diagram has been classified into 12 pollen zones and 6 barren zones in view to express the finer biostratigraphic units and to demarcate significant epochs and events since the time of deposition of these sediments.The pollen evidence has revealed several cyclic changes in the marine transgressive and regressive facies which are recorded between depth of 236-250 m, 218-223 m and 170-211 m and the sea marginal conditions are recorded at the depth of 53-142 m. The samples between the depths mentioned above have revealed the preponderance of core-mangrove taxa such as *Rhizophora, Ceriops, Bruguiera, Xylocarpus, Aegialitis rotundifolia, Excoecaria agallocha, Avicennia, Sonneratia, Heritiera*, etc. indicating the marine facies with constant depths of sea-water. However, the samples between 48-50 m depth have recorded fresh/brackish water pollen suggesting marine regression resulting into the development of salt marshes. The age for the above events are extrapolated to 160 ka, 140 ka, and 90 ka, respectively. On the basis of litho- and palynostratigraphy, the ancient shore lines have been suggested across the Delang-Jagatsingharpur-Balasore.

The pollen diagrams of Chandrapur and Geokhala profiles (3.0 m each in depth) have been prepared through the TILIA computer software. Four photoplates have been prepared for recovered palynodata from the aforesaid profiles.

H.P. Gupta & Deepak Kohli

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

Objectives : *To document the palynological changes during Palaeogene*

: *To decipher the extinction and evolutionary pattern of the different palynotaxa*

: *To infer the palaeoecological condition of deposition*

A number of bore-hole cores supplied by the MECL and GSI from the various localities of Bikaner District, Rajasthan were chemically processed. A rich palynological assemblage comprising mostly pteridophytic spores and angiospermic pollen was recovered. The dominant species are *Dandotiaspora dilata, Lycopodiumsporites speciosus, Spinizonocolpites echinatus, Piladiporocolpites caratinii, Tricolpites reticulatus, neocouperipollis kutchensis, Retidiporocolpites excellensus, Proxapertites operculatus, Ocimumpollenites indicus*, etc. Besides, 13 bore-hole core samples drilled by the DGM, Gujarat in Surat and Bhavnagar districts were also macerated. Out of 220 samples, 78 samples were productive and the slides of these samples were prepared.

R.K. Kar, Poonam Sharma & Reema Singh

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

Objective : *To understand past climatic changes especially temperature and precipitation during last 500 years based on tree-ring width proxy data*

Tree ring cores were studied through Cross-dating technique and each ring of tree ring series was assigned the calendar year of its formation. Same taxa have been found most promising for constructing climatic sensitive tree ring chronology and further dendroclimatic analysis. Dated tree ring sequences of several conifer taxa were measured by the ring width measuring machine and ring width index chronology were prepared. Statistical analysis between tree ring data and meteorological data of sampling sites or nearest station was done to understand the tree growth and climate relationship.

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

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

Objective : *To identify organic-walled microfossils, their syngenicity and biogenicity from Archaean and Early Proterozoic*

: *Identification of benthic and planktonic biota and their comparison with extant forms*

: *Significance of biota in metallogenesis*

: *Organosedimentary structures-stromatolite morphology, etc.*

: *Study of organic walled microfossils associated with stromatolites*

: *Significance of stromatolites in biostratigraphy, basin analysis, etc.*

The Iron Ore Group exposed in Barbil-Noamundi area has been subdivided into two lithostratigraphical units : Kashia Formation and Barbil Formation. The Kashia Formation is well exposed in Kashia mine about 10 km from Barbil. It is basically an argillo-calcareous lithounit with well developed stromatolite horizons and fossiliferous chert horizon. It has been further subdivided into 7 units. It shows well developed structures and on this basis intertidal to subtidal zone of a lagoon has been suggested as the environment of deposition for the Kashia Formation. Sandstone dykes have been recorded from the uppermost part of the Kashia Formation. This is the first record of sandstone dyke from Archaean of India.

The Kashia Formation has been followed upward possibly with an unconformity by a conglomeratic sandstone of the Barbil Formation. The sandstone is followed upward by a stromatolite unit. A shale unit succeeds stromatolite unit. The shale grades into a thick Haematite-Jasper-Chert Unit. This horizon is being mined for Iron Ore and Manganese deposits. In the carbonate sequence *Conophyton* appears to be the most common columnar stromatolites alongwith *Colonella* type forms. The height of the stromatolite column is up to few centimeters.

Studied thin sections of rocks for organic walled microfossils. The recorded biological forms show two distinct morphotype : spheroidal cells, and filaments with distinct hollow structures. They are either solitary or arranged in groups. Asexual reproductive stages, binary fission and budding are seen. In some slides palmelloid stage is preserved indicating adverse conditions.

P.K. Maithy, Rupendra Babu, Sheenu Sharma

[& S. Kumar, Lucknow University]

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

Objective : Monitoring of extramural and intramural environments of Lucknow, database acquisition of aeroallergens; diagnosis, treatment and control of allergic disorders

Recorded habit, habitat, frequency, distribution, mode of pollination and duration of flowering periods of about 75 plant taxa growing in Lucknow city and around. Prepared a chart of flowering periods of dominant plant taxa. Also prepared both temporary and permanent slides of 115 plant taxa.

Collected and sent the bulk pollen of plant taxa listed to coordinating unit at New Delhi : *Azadirachta indica, Bauhinia variegata , Cannabis sativa, Cassia fistula, C. occidentalis, C. siamea, Cyperus rotundus, Parthenium hysterophorus, Polyalthia longifolia, Terminalia arjuna, Delonix regia, Aegle marmelos, Amaranthus spinosus, Acacia arabica, A. auriculeformis, Zea mays, Sorghum vulgare, Tamarindus indica, Xanthium strumarium, Prosopis juliflora*. Also sent the pure culture of fungal taxa like : *Aspergillus flavus, A. tamarii, A. niger, A. nidulans, A. carneus, A. niveus, Fusarium oxysporum, Penicillium citrunum, Curvularia lunata, Chaetomium globosum, Helminthosporium* sp., *Memnoniella* sp. and *Stachybotrys* sp.

Asha Khandelwal, Rashmi Tewary, Shantanu Chatterjee & Deepak Kohli

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])

Objective : Documentation of palaeobiological remains in Indravati sediments

: Establishment of range of life forms and organo-sedimentary structures

: Integration of these records in biostratigraphic framework

: Interpretation of these data in terms of sequence stratigraphy and palaeoenvironment.

Study of the microtexture and microfabric of the Indravati stromatolites has been completed for three forms.Thin section study of the Kanger Limestone Formation and

Jagdalpur Shale and Limestone Formation (JSLF) is in progress. Some of the limestone samples on maceration yielded few forms which are poorly preserved. A trace fossil zone has been recorded from JSLF. A new microbial carbonate locality has been recorded from Bastar Village in Bastar District. A trace fossil comparable to *Oldhamia* has been noted.

Mukund Sharma

Collaborative Projects/Work

Project I : Precambrian-Cambrian boundary events (IGCP Project - 303)

Studied carbonaceous macrofossils—*Chuaria* and *Tawuia* and their allied morphological forms, viz., *Ramapuraea, Amjhorea, Rohtasea, Sinosabellidites* and *Protoarenicola* from the Halkal Formation, Bhima Group exposed at Kolkur and Gangurti in Karnataka. On the basis of present observation it has been concluded that they represent different stages of a single biological entity, i.e., *Chuaria*. Organic walled microfossils *Leiosphaeridia, Myxococcoides, Eomycetopsis* and vase-shaped forms were also recorded from the same materials. The overall assemblage suppports for the age ranging between 1000-850 Ma.

Recorded cyanophycean algae and acritarch from the brachiopod bearing beds of Lower Tal Formation, Mussoorie Syncline. The assemblage is represented by thalloids, tubular forms cf. *Vendotaenia, Orbruchevella, Micrhystridium, Symplassosphaeridium* and *Leiosphaeridia*. This supports that the Lower Tal represents Precambrian / Cambrian transition of Tal Formation.

Studied chert samples of drill cores belonging to Marwar Supergroup but they were devoid of biological remains.

P.K. Maithy & Rupendra Babu

Project II : Vegetational history, palaeoenvironment and climatic changes during Siwalik in west-central Nepal

Objective : To develop vegetational history of Churia Group (Siwalik) based on systematic study of plant fossils from some selected stratigraphically dated sections in west-central Nepal

: To synthesize the data integrating the geological findings to interpret the palaeoenvironment and climatic changes in the area

Out of a fairly rich collection of leaf-impressions from Tinau Khola, Binai Khola and Arung Khola, 18 more new taxa have been identified, belonging to 16 genera of 12 dicotyledonous families. They are *Gutteria, Orophea, Miliusa* (Annonaceae). *Gynocardia* (Flacourtiaceae), *Shorea, Hopea* (Dipterocarpaceae). *Durio, Grewia* (Tiliaceae), *Chisocheton* (Meliaceae), *Ventilago* (Rhamnaceae), *Swintonia* (Anacardiaceae), *Mitragyna, Mussaendopsis* (Rubiaceae), *Alangium* (Alangiaceae), *Homonoia* (Euphorbiaceae) and *Ficus* (Moraceae). The distribution pattern of the modern equivalent species of the fossil

suggests low land mesophytic tropical evergreen forest in the present foot-hill zone of Nepal during Miocene-Pliocene. Presence of a sizeable number of Malaysian elements, the floral assemblage suggests a phytogeographical link between Indian subcontinent and southeast Asia during the above periods.

N. Awasthi [& M. Konomatsu (Japan)]

An International palaeobotanical Project "Gondwana Alive" under the aegis of the IOP and IUGS has been chalked out by Dr J.M. Anderson, Pretoria, South Africa. This aims at plotting terrestrial plant biodiversity through Gondwana and also includes other allied disciplines. Scope, aims and sub-projects are being finalized for the Indian subcontinent to be presented in a workshop to be held at Santa Barbara, U.S.A.

Shaila Chandra

Plant megafossil specimens (120) from Kashmir Himalaya belonging to Early Carboniferous age were studied, photographed and identified. Description and draft of two papers is being written.

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

A draft manuscript entitled—Organic petrology of Tipam coals, Arunachal Himalaya : their nature, composition, rank and depositional environment has been prepared.

Anand-Prakash, J. Rai [& T. Singh, WIHG, Dehradun]

Palynological study has been done in the productive samples (10) of Talchir sediments exposed along Ajay River, Raniganj Coalfield. Qualitative assessment of spore-pollen taxa reveals a diversified palyno-composition represented by *Plicatipollenites, Potonieisporites, Caheniasaccites, Jayantisporites, Microbaculispora, Crescentipollenites* etc., and few alete forms. It compares with the palynoassemblage of Biohorizon III, Upper Talchir, which supports the absence of lower sedimentary cycle of Talchir Formation in this loop of Ajay River section.

Vijaya [& Sun Kequin, China]

Palynological studies of bore-hole ANH-3 and ANH-1 drilled through Denwa Formation from Anhoni area, Satpura Basin have been processed and found barren of pollen and spores.

Pramod Kumar [& P.K. Raha, GSI, Nagpur]

Cellulose acetate peels of a petrified wood from Arunachal Pradesh were prepared and photographed. The specimen shows a well-preserved parenchymatous pith cells of which at places are filled with dark contents. The primary xylem is endarch. the xylem rays are homogeneous, uni- multi-seriate, and 1-4 cells high. Pits on the radial walls of the tracheids are araucaroid and 2-3 seriate. Cross field pits are large, cupressoid, and mostly 1, rarely 2, in number.

Usha Bajpai [& T. Singh (WIHG, Dehradun)]

Palynological analysis of 35 samples from 13.02 m deep profile dated pre 40,000

yrs B.P. at base from Wadda Lake, Pithoragarh, U.P., shows vegetation and climate changes during major part of Weichselian. During pre 40,000 to 33,000 yrs B.P. climate was probably cold and dry, not conducive for plant covers. However, distinct climatic amelioration has been noticed during 30-28,000 yrs B.P., when local tree taxa *Juniperus, Betula, Larix* are well represented along with high influx of pollen from lower altitude. During 28-26,000 yrs B.P. climate was again reverted towards aridity indicated by the decline of tree elements. During 26,000 B.P. onwards desertic conditions might have prevailed around this site when sediments are found almost devoid of spores and pollen.

A. Bhattacharyya [& B.S. Kotlia (Nainital)]

Under INSA visiting Fellowship at the Earth Science Division, Physical Research Laboratory collaborative research work on quantitative environmental changes in the Himalayan region using multiproxydata was undertaken. During this tenure, 98 samples of five years block from a disc of *Abies pindrow* dated 1496 to 1994 AD collected from Dokriani Bamak glacier, Garhwal Himalaya were processed and cellulose were extrated from these samples for carbon and hydrogen isotope studies.

Stable isotopes of Oxygen (^{18}O) and Carbon (^{13}C) were also analysed from carbonate rich 107 samples from $T5D_1$ bore hole core and 10 samples from TP_6 bore-hole core of Tsokar Lake, Ladakh. Secular variations of these two isotopes in these two bore cores at different depths indicate several dry and wet phases in Tsokar Lake during Weichselian. Stable isotope ratios of carbon was also analysed from a few samples of these two bore cores from organic fraction of these sediments. These values in the present study range from 14.6 to -25.7% indicating dominance of both <- 3 or <- 4 plants at different time of Weichselian. Presence of these two ecologically different plant groups also supports fluctuation of lake levels.

A. Bhattacharyya & [R. Ramesh (PRL)]

Work other than Programmes

A draft of a paper entitled "Imprints of neotectonic activity in Mahuadanr Valley, Palamu, Bihar" has been prepared.

Anand-Prakash, G.P. Srivastava & Ratan Kar

The work on reworked Triassic palynofossils from Cretaceous and Tertiary sediments of Andaman and Nicobar Islands was finalized.

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

A manuscript entitled "Calcareous nannofossils from Eocene of Kutch, western India", was finalised.

S.A. Jafar & J. Rai

A draft manuscript "Fossil coccoliths from Late Miocene of Neill Island, Andaman-Nicobar Islands, India", was prepared.

S.A. Jafar & O.P. Singh

A draft manuscript on the "Palynological findings from the Palaeogene rocks of Baratang Island (Andamans), India" has been prepared.

Anil Chandra & J. Mandal

A manuscript entitled "Pteridophytic spores from Indian Tertiary sediments and their stratigraphical significance" has been prepared and finalized.

Samir Sarkar & J. Mandal

A paper "Spectral fluorescence analysis of sporinites and alginites in some Late Palaeocene (Garo and Jaintia Hills, Meghalaya) and Late Permian Gondwana (Singrauli Coalfield, Madhya Pradesh) bituminous coals from India in relation to vitrinite reflectance" was prepared and sent to co-authors (Profs. Hans W. Hagemann & Monika Wolf, Germany).

After consultation of large number of literature finalized a manuscript entitled "Some major authigenic minerals in Indian coals and lignites: Their significance in interpretation of depositional conditions"

B.K. Misra

A paper on the "Genesis and significance of coal-pockets in the Flysch sediments of Andaman-Nicobar Basin, India" has been prepared and finalised.

B.K. Misra & S.A. Jafar

A manuscript entitled "Alginite in Indian coals and lignites : its influence and significance" was prepared.

B.K. Misra, B.D. Singh & Alpana Singh

Participated and approved the modified draft proposal of ICCP in order to achieve

the reproducibility of fluorescence spectrophotometery result.

Rakesh Saxena

A rich palynofloral assemblage has been recovered from the sub-surface Early Miocene sediments at Turavur in the Alleppey District, Kerala. 39 genera and 45 species belonging to different botanical groups, such as dinoflagellate cysts, fungal remains, pteridophytic spores and angiospermous pollen have been recognized. A manuscript dealing with palynological findings and palaeoenvironment has been finalized.

M.R. Rao

A rich palynofloral assemblage mainly consisting of fungal spores and microthyraceous ascostromata, pteridophytic spores, gymnospermous and angiospermous pollen grains has been recovered from the Dharamsala sediments exposed along Bilaspur-Shimla Highway near the village Karoda in Bilaspur District of Himachal Pradesh. The distributional pattern of palynofossils in the Dharamsala sediments has been analysed and interpreted throwing light on its dating and environment of deposition.

Samir Sarkar

Critical morphotaxonomic evaluation of pteridophytic spores recorded from Indian Tertiary sediments was carried out.

Samir Sarkar & J.P. Mandal

Studied the morphology of various fossil genera showing affinity with modern *Alangium* pollen reported from various Lower Tertiary sediments of India. Their characteristic features have been critically evaluated and compared with extant *Alangium*.

S.K.M. Tripathi & Madhav Kumar

Forty-one samples were macerated from the bore-core 128 drilled by the MEC Ltd. at Mannargudi area, Tamil Nadu. Out of these, 23 samples were productive. The palynological assemblage comprises pteridophytic spores and angiospermic pollen. Among the pteridophytic spores *Cyathidites minor, Lygodiumsporites kutchensis* and *Polypodiisporites repandus* are common. The common species of angiosperms are *Piladiporocolpites caratinii, Meliapollis ramanujamii, Ctenolophonidites costatus, Trilatisporites kutchensis, Triangulorites bellus, Margocolporites tsukadai* and *Verrucolporites verrucus*. The assemblage favours an Early Eocene age for the sediments.

Manisha Nanda

To enhance the reference collections of modern plants in the Institute's herbarium, about 700 plant specimens, wood samples of 10 species and 20 samples of fruits and seeds were collected and identified.

Identification of about 200 plant specimens were done for the sponsored project investigated by Dr Asha Khandelwal of the Institute.

D.C. Saini

Growth ring features of *Podocarpoxylon rajmahalense* (Jain) Bose & Maheshwari

(Holotype N0. 17272, BSIP Museum) described from Amarjola in Amrapara, Rajmahal hills have been studied in dendroclimatological point of view. This study reveals that during the life span of this tree in Mesozoic warm temperate type of climate would have been existed in this region.

R.R. Yadav & A. Bhattacharyya

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Ambwani, K.—Further observations on Trichotomosulcate pollen of *Elaeis*. *Phytomorphology*.

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Antal, J.S. & Prasad, M.—Leaf-impressions of *Polyalthia* Bl. in the Siwalik sediments of Darjeeling District, West Bengal. *Geophytology*.

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Birbal Sahni Institute of Palaeobotany, Lucknow

Sanctioned Budget Estimates and Expenditure during 1995-96

The Revised Budget Estimates for Non-Plan Expenditure of the Institute were approved as Rs. 181.237 Lacs. The Department of Science and Technology released a grant of Rs. 160.000 Lacs during the year and the total actual expenditure under Non-Plan was Rs. 178.254 Lacs.

The Revised Budget Estimates for Plan Expenditure for 1995-96 were approved as Rs. 156.259 Lacs, out of which Rs. 156.000 Lacs was the grant from the Department of Science and Technology. The actual expenditure of Rs. 120.625 Lacs against the balance amount, several commitments were made as per the approved estimates.

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

We have audited the attached Balance Sheet of Birbal Sahni Institute of Palaeobotany, Lucknow, as at 31st March, 1996, and the Income and Expenditure Account and Receipts & Payment Account 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, 1996.

(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 Institute for the year then ended.

Place : Lucknow
Date : August 30, 1996

For : **SINGH AGARWAL & ASSOCIATES**
Chartered Accountants
Sd/-
(Mukesh Kumar Agarwal)

Annexure- 'A'

(Annexed to and forming part of the Audit Report for the year ended 31st March, 1996)

Comments on Accounts of Birbal Sahni Institute of Palaeobotany, Lucknow for the year ended 31st March, 1996.

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.

Publications :

3. On scrutiny of record of the priced publication of the Institute, it has been observed that during the last several years, the Institute had brought our publication on different subject to sell out in the market. Stock position of these priced publication as on 31.03.96 is about Rs. 17.97 lacs apart from which Rs. 2.31 lacs is reserve stock, totalling stock of Rs. 20.28 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 & 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. Backlog in the maintenance of Fixed Assets Register either be updated, at earliest, with the help of some technical personnel, or some ways and means be decided to clear the pendency.

Birbal Sahni Institute of

Balance Sheet as at

Liabilities	Balance upto 94-95 Rs.	Addition During 95-96 Rs.	Total Rs.
Capital	6,14,99,495.41	81,30,000.00	6,96,29,495.41
Excess of Income over expenditure	31,03,509.28	1,40,467.04	32,43,976.32
Excess of Income - Plan	7,15,890.01		
Less Excess of expenditure	5,75,422.97		
Non-Plan			
Net Excess of Income	1,40,467.04		
Cost of Land donated by U.P. Govt.	32,292.00		32,292.00
Founder's Donation	1,52,500.00		1,52,500.00
MGT Scheme (CSIR)	8,100.79		8,100.79
Coal Scheme (CSIR)	7,784.66		7,784.66
Palynological Scheme (CSIR)	5,207.87		5,207.87
UNESCO Aid Fund	19,629.75		19,629.75
Burmah Oil Co., Donation	1,900.00		1,900.00
Rajasthan Scheme	23,009.15		23,009.15
(Sponsored by Univ. of Wisconsin)			
C.D. Pant Memorial Fund	4,494.14	65.00	4,559.14
C.L. Katiyal Memorial Fund	7,901.76	900.00	8,801.76
Other Miscellaneous Donations	28,032.30	2,680.00	30,712.30
P.C. Bhandari Memorial Fund	8,077.95	680.00	8,757.95
A.C. Seward Memorial Fund	24,542.78	2,490.00	27,032.78
P.K. Srivastava Memorial Fund	6,820.81	130.00	6,950.81
Birbal Sahni Research Award	51,105.55	2,670.00	53,775.55
Endowment			
Prof. T.M. Harris Endowment	16,619.49	920.00	17,539.49
Gifts in kind			
Humboldt Foundation	75,000.00		75,000.00
(West Germany)			
General Provident Fund			
Liabilities & Provisions	1,34,70,530.50	15,42,692.69	1,50,13,223.19
Security (Capital)	26,483.90	1,234.00	27,717.90

Palaeobotany, Lucknow

31st March, 1996

Assets	Balance upto 94-95 Rs.	Addition During 95-96 Rs.	Total Rs.
Land & Buildings			
a. Donated by U.P. Government	32,292.00		32,292.00
b. Acquired by the Institute	1,05,65,110.31	61,682.00	1,06,26,792.31
c. Out of Founder's Donation	50,000.00		50,000.00
Research Apparatus & Equipment	2,27,08,556.96	9,42,915.00	2,36,51,471.96
Workshop Equipment	2,06,890.69		2,06,890.69
Office & Miscellaneous Equipments	34,28,412.45	12,91,592.40	47,20,004.85
C-14 Radiometric Dating Equipment	54,54,001.66	1,63,747.33	56,17,748.99
Plant & Machinery	22,69,937.21		22,69,937.21
Apparatus & Equipment Donated			
M.G.T. Scheme (C.S.I.R.)	7,155.79		7,155.79
Burmah Oil Co.	700.00		700.00
Founder's Donation	2,500.00		2,500.00
Coal Scheme (C.S.I.R.)	6,645.29		6,645.29
Palynological Scheme (C.S.I.R.)	5,207.87		5,207.87
Rajasthan Scheme	22,029.45		22,029.45
(Sponsored by Univ. of Wisconsin)			
UNESCO Aid Equipment	19,629.75		19,629.75
Humboldt Foundation	75,000.00		75,000.00
Vehicles	12,87,053.65	6,74,349.28	19,61,402.93
Furniture & Fixtures	27,83,585.98	3,62,053.50	31,45,639.48
Furniture & Fixtures (Donated)			
Burmah Oil Co.	1,200.00		1,200.00
M.G.T. Scheme (C.S.I.R.)	945.00		945.00
Coal Scheme (C.S.I.R.)	1,139.37		1,139.37
Rajasthan Scheme	979.70		979.70
Books & Journals	34,92,284.60	7,11,113.63	42,03,398.23
Founder's Library Donated	50,000.00		50,000.00
Founder's Fossil Collection	50,000.00		50,000.00
Maps & Toposheets	13,142.00		13,142.00
UNESCO's Book Coupons	543.12		543.12

Liabilities	Balance upto 94-95 Rs.	Addition During 95-96 Rs.	Total Rs.
Security (Revenue) Plan	15,000.00	2,000.00	17,000.00
Security (Revenue) Non-Plan	5,000.00		5,000.00
Group Linked Insurance Scheme		26,873.00	26,873.00
TDR Interest- CNR		23,939.00	23,939.00
Grand Total	**7,85,93,038.09**	**98,77,740.73**	**8,84,70,778.82**

For : **Singh Agarwal & Associates**
Chartered Accountants
Sd/-
(Mukesh Kumar Agarwal)
Partner

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

Assets	Balance upto 94-95 Rs.	Addition During 95-96 Rs.	Total Rs.
Investment (Donation)	1,35,600.00		1,35,600.00
Cash in Hand		202.00	202.00
Balance in State Bank of India		84,47,681.25	84,47,681.25
Savings Bank Accounts (S.B.I.)		5,000.00	5,000.00
Unsettled Advances (Capital)		56,47,187.39	56,47,187.39
Security Deposit			
M/s Krishna & Co., Lucknow	3,000.00		3,000.00
M/s Sardar Ji, Lucknow	5,000.00		5,000.00
G.P.O., Lucknow	100.00		100.00
Loans & Advances			
House Building Advance		19,76,414.00	19,76,414.00
Conveyance Advance		4,74,795.00	4,74,795.00
Festival Advance		20,180.00	20,180.00
General Provident Fund			
Special Deposit Scheme (S.B.I.)	1,06,05,000.00	28,00,000.00	1,34,05,000.00
Advances		12,74,575.00	12,74,575.00
With S.B.I. (Savings Bank)		3,33,648.19	3,33,648.19
Grand Total	**6,32,83,642.85**	**2,51,87,135.97**	**8,84,70,778.82**

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
G. Rajagopalan
(Acting Director)

Birbal Sahni Institute of

Income and expenditure account for

Expenditure	Plan	Non-Plan	Total
To Pay & Allounces	7,40,216.00	1,27,67,715.00	1,35,07,931.00
To Field Excursion	3,73,519.61	2,048.60	3,75,568.21
To Honorarium for lecture	0.00	0.00	0.00
Birbal Sahni Memorial Lecture	0.00	2,000.00	2,000.00
To international programmes	0.00	0.00	0.00
Deputation abroad	2,66,713.26	18,000.00	2,84,713.26
To expenses on services ancillary to Research			
Chemicals, Glasswares & Photo Goods	3,17,530.30	3,68,893.54	6,86,423.84
Library Expenses	0.00	17,625.50	17,625.50
Maintenance of app., equipment and workshop machines	0.00	0.00	0.00
Museum Expenses	43,366.00	0.00	43,366.00
Herbarium Expenses	4,817.00	0.00	4,817.00
The Palaeobotanist	0.00	1,20,046.80	1,20,046.80
Annual Report	0.00	81,664.00	81,664.00
Special Publication	2,11,766.35	0.00	2,11,766.35
To Travelling & other Allowances	0.00	0.00	0.00
Governing Body	2,26,601.60	67,549.25	2,94,150.85
R.A.C./Selection Committee	81,200.00	616.00	81,816.00
T.A. to others	74,127.30	26,336.55	1,00,463.85
Attending Meetings & Conf. in India	70,519.00	9,493.60	80,012.60
Training to staff	85,168.48	40,000.00	1,25,168.48
Reimbursement of medical expenses	3,42,935.55	54,128.60	3,97,064.15
Overtime Allowances	48,464.00	15,558.00	64,022.00
Leave Travel Concession	26,533.40	89,032.80	1,15,566.20
Reimbursement of tution fee	3,864.00	19,320.00	23,184.00
Ad-hoc Bonus	28,212.00	2,00,437.00	2,28,649.00
Pensionary Expenses			
Pension/Gratuity	0.00	24,83,664.00	24,83,664.00
Pension Contribution	0.00	0.00	0.00
Leave salary	0.00	0.00	0.00
To Administrative Expenses			
Telephone & trunk call charges	0.00	1,26,353.45	1,26,353.45
To Opening Balance			

Palaeobotany, Lucknow

the period ending 31st March, 1996

Income	Plan	Non-plan	Total
Revenue Account			
By Grant from Govt. of India	74,70,000.00	1,60,00,000.00	2,34,70,000.00
By Grant from U.P. Government	0.00	0.00	0.00
By sale proceeds of priced publ.	0.00	0.00	0.00
The Palaeobotanist	0.00	2,25,852.00	2,25,852.00
Silver Jubilee	0.00	110.20	110.20
Symposium	0.00	889.60	889.60
Gondwana Symposium	0.00	6,749.00	6749.00
Catalogue of Indian Fossil Plants	0.00	9,079.60	9079.60
Seward Memorial Lecture	0.00	723.80	723.80
Birbal Sahni Memorial Lecture	0.00	331.80	331.80
Fourth I.P.C. Proceedings	0.00	0.00	0.00
Picture Post Cards	0.00	182.00	182.00
Aspects and Appraisal of Indian Palaeobotany	0.00	972.00	972.00
By other receipts			
Misc. Receipt	3,243.00	1,10,572.20	1,13,815.20
V.S. Room Charges	0.00	29,500.00	29,500.00
Application Fee	0.00	478.00	478.00
Licence Fee	0.00	4,858.00	4,858.00
Telephone Receipt	0.00	0.00	0.00
Leave Salary	0.00	0.00	0.00
Pension Contribution	0.00	0.00	0.00
Interest in conveyance advance	0.00	23,590.00	23,590.00
Electricity Receipts	0.00	384.75	384.75
Consultancy Receipts	0.00	87,500.00	87,500.00
Interest on H.B.A.	0.00	96,504.00	96,504.00
Interest on Savings Bank Acct./TDR	0.00	5,99,606.00	5,99,606.00
Excess of Expend. over Income	0.00	5,75,422.97	5,75,422.97

Expenditure	Plan	Non-plan	Total
Postage Expenses	0.00	1,14,249.73	1,14,249.73
Advertisement Expenses	32,962.00	90,314.00	1,23,276.00
Assistance to Canteen	0.00	10,436.35	10,436.35
Hot & cold weather charges	3,772.00	4,141.00	7,913.00
To General Expenses			
Petrol & Mobil Oil	48,345.07	19,761.85	68,106.92
Electricity charges	10,30,618.81	47,908.00	10,78,526.81
Electric items	1,17,328.25	63,402.00	1,80,730.25
Municipal Taxes	17,848.50	30,677.40	48,525.90
Security & sanitation	1,99,774.00	58,982.00	2,58,756.00
Insurance of vehicle & Library	48,140.00	4,588.00	52,728.00
Consultancy Charges	0.00	0.00	0.00
Uniform to Staff	48,223.00	27,423.00	75,646.00
Printing & Stationery	2,62,701.10	2,03,573.05	4,66,274.15
Hospitality Expenses	0.00	5,456.70	5,456.70
Miscellaneous expenses	4,30,081.66	1,83,643.15	6,13,724.81
Railway freight & carriage	481.00	583.00	1,064.00
To Maintenance Expenses			
Maintenance of Buildings	0.00	0.00	0.00
Maintenance of Garden	21,507.00	4,805.00	26,312.00
Maintenance of vehicle	83,910.00	50,053.00	1,33,963.00
Maintenance of equipment	4,83,777.01	1,68,014.00	6,51,791.01
Repair & renewals	3,98,115.39	1,60,964.00	5,59,079.39
To Other Expenses			
Visiting Scientist	16,822.00	0.00	16,882.00
Audit Fee	0.00	5,500.00	5,500.00
Legal advice	12,320.00	8,348.00	20,668.00
Prof. Birbal Sahni Res. Scholarship	1,73,189.00	0.00	1,73,189.00
Emeritus Scientist	16,000.00	0.00	16,000.00
Golden Jubilee Expenses	3,65,883.35	0.00	3,65,883.35
Excess of Income over Expenditure	7,15,890.01	0.00	7,15,890.01
Grand Total	**74,73,243.00**	**1,77,73,305.92**	**2,52,46,548.92**

For : **Singh Agarwal & Associates**
Chartered Accountants
Sd/-
(Mukesh Kumar Agarwal)
Partner

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

Income	Plan	Non-plan	Total
Grand Total	**74,73,243.00**	**1,77,73,305.92**	**2,52,46,548.92**

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
G. Rajagopalan
(Acting Director)

Birbal Sahni Institute of

Receipt and Payment Account

Receipts	Plan	Non-Plan	Total
A. Bank Account			
I) Revenue	1,02,091.97	6,38,466.31	7,40,558.28
II) Capital	55,97,237.99	0.00	55,97,237.99
III) Group insurance scheme	0.00	250.00	250.00
IV) Deposit account			
a. Capital	0.00	0.00	
b. Revenue	15,000.00	2,000.00	17,000.00
V) Donation	0.00	11,500.64	11,500.64
VI) CDP account	0.00	494.14	494.14
B. Cash Account			
Non-Plan revenue	0.00	92.00	92.00
C. Savings Bank Account	20,05,000.00	0.00	20,05,000.00
To Govt. of India Grant			
Revenue	74,70,000.00	1,60,00,000.00	2,34,70,000.00
Capital	81,30,000.00	0.00	81,30,000.00
To Government of U.P.	0.00	0.00	0.00
Grant for Revenue			
To Receipt on Capital Account			
To Sale Proceeds of			
Publications			
The Placobotanist	0.00	2,25,852.00	2.25,852.00
Monograph	0.00	0.00	0.00
Symposium	0.00	889.60	889.60
Catalogue	0.00	9,079.60	9,079.60
Aspects & Appraisal of	0.00	972.00	972.00
Indian Plaeobotany			
Seward Memorial Lecture	0.00	723.80	723.80
Birbal Sahni Memorial Lecture	0.00	331.80	331.80
Silver Jubilee Memorial Lecture	0.00	110.20	110.20
Gondwana Symposium	0.00	6,749.00	6,749.00
IV I.P.C. Proceedings	0.00	0.00	0.00
Picture Post Card	0.00	182.00	182.00
To Administrative Receipts / Recoveries			

Palaeobotany, Lucknow

for the year ending 31st March, 1996

Payments	Plan	Non-Plan	Total
By Capital Accounts			
Works and Buildings	8,14,811.00	0.00	8,14,811.00
AC Unit	3,11,592.50		3,11,592.50
Research Apparatus & Equipments	40,56,870.33	0.00	40,56,870.33
Equipments for Services	0.00	0.00	0.00
Ancillary to Research			
Library	7,78,419.03	0.00	7,78,419.03
Museum/Herbarium	3,02,697.00	0.00	3,02,697.00
Photography	1,91,510.00	0.00	1,91,510.00
Workshop Equipments			
C-14 Laboratory	0.00	0.00	0.00
Plants & Machinery			
Furniture & Fixtures	59,356.50	0.00	59,356.50
Vehicles	6,74,349.28	0.00	6,74,349.28
Office/Misc. Equipments	9,50,812.20	0.00	9,50,812.20
Interest on TDR	5,19,682.00	0.00	5,19,682.00
Transferred to Non-Plan			
By Pay & Allowances			
Pay (Officers)	1,81,543.00	36,46,286.00	38,27,829.00
Pay (Establishment)	88,901.00	12,68,591.00	13,57,492.00
D.A.	3,62,643.00	60,48,207.00	64,10,850.00
C.C.A.	12,240.00	1,56,239.00	1,68,479.00
H.R.A.	54,000.00	9,91,048.00	10,45,048.00
I.Relief	40,889.00	6,57,344.00	6,98,233.00
Overtime Allowance	48,464.00	15,558.00	64,022.00
Medical Reimbursement	3,42,935.55	54,128.60	3,97,064.15
Reimbursement of tution fee	3,864.00	19,320.00	23,184.00
Leave Travel Concession	26,533.40	89,032.80	1,15,566.20
Ad-hoc Bonus	28,212.00	2,00,437.00	2,28,649.00
By Travelling Allowance			
TA to Others	74,127.30	26,336.55	1,00463.85
Governing Body	2,26,601.60	67,549.25	2,94,150.85

Receipts	Plan	Non-Plan	Total
Income Tax	27,898.00	4,65,668.00	4,93,566.00
Insurance premium (Salary savings scheme)	8,861.60	2,53,909.30	2,62,770.90
G.P.F. Subscription	1,07,508.00	30,85,662.00	31,93,170.00
Recovery of G.P.F. Advance	17,600.00	6,40,045.00	6,57,645.00
Recovery of BSIP Co-operative Credit Society	27,927.00	3,81,703.00	4,09,630.00
Group Insurance	10,530.00	1,46,825.00	1,57,355.00
Lal Imli	4,465.00	32,488.00	36,953.00
Leave Salary	0.00	0.00	0.00
Application Fee	0.00	478.00	478.00
SEM Facility	0.00	0.00	0.00
Electricity Receipts	0.00	384.75	384.75
Guest House Receipt	0.00	29,500.00	29,500.00
Telephone Receipt			
Licence Fee	0.00	4,858.00	4,858.00
Consultancy charges	0.00	87,500.00	87,500.00
To Misc. Receipt	3,243.00	1,10,572.20	1,13,815.20
Misc. Receipt	0.00	0.00	0.00
Pensionary Charges	0.00	0.00	0.00
Deputation Abroad	0.00		
To Recoveries of Loans & Advances			
Festival Advance	0.00	41,760.00	41,760.00
Conveyance Advance	0.00	1,59,627.00	1,59,627.00
Interest on Conveyance Advance	0.00	23,590.00	23,590.00
House Building Advance	0.00	3,33,214.00	3,33,214.00
Interest on House Building Advance	0.00	96,504.00	96,504.00
To Deposit Account			
Security Deposit			
a. Capital	1,234.00	0.00	1,234.00
b. Revenue	2,000.00	5,000.00	7,000.00

Payments	Plan	Non-Plan	Total
Selection Committtee	81,200.00	616.00	81,816.00
Field Excursion	3,73,519.61	2,048.60	3,75,568.21
Deputation Abroad	2,66,713.26	18,000.00	2,84,713.26
Training of Staff in India	85,168.48	40,000.00	1,25,168.48
Attending Conference & Meeting in India	70,519.00	9,493.60	80,012.60
Golden Jubilee	3,65,883.35	0.00	3,65,883.35
By Maintenance of Property			
Building	0.00	0.00	0.00
Garden	21,507.00	4,805.00	26,312.00
Apparatus & Equipment	4,83,777.01	1,68,014.00	6,51,791.00
Vehicle	83,910.00	50,053.00	1,33,963.00
Repairs & Renewals	3,98,115.39	1,60,964.00	5,59,079.39
By Contingencies			
Telephone & Trunk Call Charges	0.00	1,26,353.45	1,26,353.45
Municipal Taxes	17,848.50	30,677.40	48,525.90
Postage	0.00	1,14,249.73	1,14,249.73
Advertisement	32,962.00	90,314.00	1,23,276.00
Hot & Cold Weather Charges	3,772.00	4,141.00	7,913.00
Petrol & Mobil Oil	48,345.07	19,761.85	68,106.92
Electricity Charges	10,30,618.81	47,908.00	10,78,526.81
Electric items	1,17,328.25	63,402.00	1,80,730.25
Insurance of Vehicle & Library	48,140.00	4,588.00	52,728.00
Liveries to Sub Staff	48,223.00	27,423.00	75,646.00
Printing & Stationery	2,62,701.10	2,03,573.05	4,66,274.15
Hospitality Expenses	0.00	5,456.70	5,456.70
Misc. Expenses	4,30,081.66	1,83,643.15	6,13,724.81
Chemical & Glassware	3,17,530.30	3,68,893.54	6,86,423.84
Assistance to Canteen	0.00	10,436.35	10,436.35
Library Expenses	0.00	17,625.50	17,625.50

Receipts	Plan	Non-Plan	Total
To Donation & Endowments			
Interest on CDP Account	0.00	65.00	65.00
Interest on Donation Account	0.00	10,970.00	10,970.00
To Misc. Receipts on			
Capital Account			
Interest on TDR/	5,43,621.00		5,43,621.00
Interest on TDR		5,19,682.00	51,96,820.00
Transferred from Plan			
Interest on Savings Bank	0.00	79,924.00	79,924.00
To Group Insurance	0.00	39,477.00	39,477.00
received from LIC			
To DST Projects			
(Dr H.P. Gupta)			
Opening Balance	25,700.90	0.00	25,700.90
Grants From DST	20,000.00	0.00	20,000.00
DST Project			
(Dr A. Bhattacharyya)			
Opening Balance	8,777.50	0.00	8,777.50
Grants from DST	65,000.00	0.00	65,000.00
DST Project			
(Dr R.K. Kar)			
Opening Balance	64,282.25	0.00	64,282.25
Grant from DST	1,40,000.00	0.00	1,40,000.00
DST Project			
(Dr P.K. Maithy)			
Opening Balance	16,149.36	0.00	16,149.36
Grant from DST	1,20,000.00	0.00	1,20,000.00
DST Project			
(Dr Mukund Sharma)			
Opening Balance	15,082.18	0.00	15,082.18
Grant from DST	65,000.00	0.00	65,000.00
Sponsored Project			

Payments	Plan	Non-Plan	Total
Museum Expenses	43,366.00	0.00	43,366.00
Legal Advice	12,320.00	8,348.00	20,668.00
Medical Advice	0.00	0.00	0.00
Audit Fee	0.00	5,500.00	5,500.00
Railway Freight	481.00	583.00	1,064.00
Sanitation & Security Services	1,99,774.00	58,982.00	2,58,756.00
Herbarium Expenses	4,817.00	0.00	4,817.00
Visiting Scientist	16,822.00	0.00	16,822.00
Consultancy Charges	0.00	0.00	0.00
Review Committee	0.00	0.00	0.00
By Publication			
The Palaeobotanist	0.00	1,20,046.80	1,20,046.80
Annual Report	0.00	81,664.00	81,664.00
Special Publication	2,11,766.35	0.00	2,11,766.35
By Academic Expenses			
B.S. Memorial Lecture	0.00	2,000.00	2,000.00
B.S. Research Scholarship	1,73,189.00	0.00	1,73,189.00
S.M.L. out of Donation Account	0.00	500.00	500.00
Emeritus Scientist	16,000.00	0.00	16,000.00
By GPF Account			
GPF Subscription	1,075,08.00	30,85,662.00	31,93,170.00
Recovery of GPF Advance	17,600.00	6,40,045.00	6,57,645.00
By Miscellaneous Remittances			
Income Tax Remitted	27,898.00	4,65,668.00	4,93,566.00
GSI	0.00	12,854.00	12,854.00
GSI Payment Recovered from Staff	10,530.00	1,46,825.00	1,57,355.00
S.S. Insurance Premium Remitted	8,861.60	2,53,909.30	2,62,770.90
BSIP Co-operative Society	27,927.00	3,81,703.00	4,09,630.00
Lal Imli	4,465.00	32,488.00	36,953.00

Receipts	Plan	Non-Plan	Total
(Dr (Mrs) Asha Khandewal)			
Opening Balance	35,780.50	0.00	35,780.50
Grant Received	2,22,000.00	0.00	2,22,000.00

Payments	Plan	Non-Plan	Total
By Loans & Advances			
Festival	0.00	37,200.00	37,200.00
Conveyance	1,56,800.00	0.00	1,56,800.00
House Building	4,57,231.00	0.00	4,57,231.00
By Pension & Superannuation			
Pension, Family Pension and Gratuity	0.00	24,83,664.00	24,83,664.00
Leave Salary	0.00	0.00	0.00
Pension Contribution	0.00	0.00	0.00
By Investment			
Donation Account			
CDP Account			
By Deposit Account			
Earnest Money	0.00	0.00	0.00
Refund of Security Money	0.00	2,000.00	2,000.00
DST Project			
Dr H.P. Gupta	38,532.00	0.00	38,532.00
Dr A. Bhattacharyya	53,875.40	0.00	53,875.40
Dr R.K. Kar	1,77,986.20	0.00	1,77,986.20
Dr P.K. Maithy	1,11,005.65	0.00	1,11,005.65
Dr Mukund Sharma	57,771.70	0.00	57,771.70
Dr (Mrs) Asha Khandelwal	1,94,850.30	0.00	1,94,850.30
Closing Balance (Bank)			
Revenue Account	2,03,950.98	5,60,334.34	7,64,285.32
Capital Account	75,84,275.25	0.00	75,84,275.25
Savings Bank Account	5,000.00	0.00	5,000.00
Deposit Account			
a. Capital	27,717.90		27,717.90
b. Revenue	17,000.00	5,000.00	22,000.00
BSIP Group Insurance	0.00	26,873.00	26,873.00
CDP Account	0.00	559.14	559.14
Donation Account	0.00	21,970.64	21,970.64

Receipts	Plan	Non-Plan	Total
Grand Total	**2,48,71,990.25**	**2,34,47,099.34**	**4,83,19,089.59**

For : **Singh Agarwal & Associates**
Chartered Accountants
Sd/-
(Mukesh Kumar Agarwal)
Partner

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

Payments	Plan	Non-Plan	Total
DST Projects			
Dr H.P. Gupta	7,168.90	0.00	7,168.90
Dr A. Bhattacharyya	19,902.10	0.00	19,902.10
Dr R.K. Kar	26,296.05	0.00	26,296.05
Dr P.K. Maithy	25,143.71	0.00	25,143.71
Dr Mukund Sharma	22,310.48	0.00	22,310.48
Dr (Mrs) Asha Khandelwal	62,930.20	0.00	62,930.20
Cash in hand	0.00	202.00	202.00
Grand Total	**2,48,71,990.25**	**2,34,47,099.34**	**4,83,19,089.59**

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
G. Rajagopalan
(Acting Director)

Birbal Sahni Institute of

Statement of Account of Capital Expenditure

Grants	Receipt		
	Upto last month	During the month	Total
Carried Forward	1,47,532.46		1,47,532.46
Grant 86-87			
Carried Forward	74,28,221.63		74,28,221.63
Grant 94-95			
Current Year	47,00,000.00	34,30,000.00	81,30,000.00
Grant, 1995-96			
	1,22,75,754.09	34,30,000.00	1,57,05,754.09
Plus Deposit A/C	26,483.90	1,234.00	27,717.90
	1,23,02,237.99	34,31,234.00	1,57,33,471.99
Interest Earned	3,62,127.00	1,81,674.00	5,43,801.00
& Transferred		36,12,908.00	
Less Investment	35,05,000.00		
Less Matured	35,00,000.00		
	5,000.00		5,000.00

For : **Singh Agarwal & Associates**
Chartered Accountants
Sd/-
(Mukesh Kumar Agarwal)
Partner

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

Palaeobotany, Lucknow

during the Month of 31st March, 1996

Expenditure				
Upto Last month	During the month	Refund	Total	Balance
				1,47,532.46
22,97,753.76	24,06,484.47		47,04,238.23	27,23,983.40
22,77,643.58	11,58,536.03		34,36,179.61	46,93,820.39
45,75,397.34	35,65,020.50		81,40,417.84	75,65,336.25
-	-		-	27,717.90
45,75,397.34	35,65,020.50		81,40,417.84	75,93,054.15
	5,19,862.00		5,19,862.00	23,939.00
	40,84,882.50			76,16,993.15

	(-) 5,000.00
Balance as per Cash Book	76,11,993.15

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
G. Rajagopalan
(Acting Director)

Birbal Sahni Institute of

Statement of account of various projects tenable at Birbal Sahni Institute

Particulars	Opening Balance as on 1-4-95 Rs.	Receipt Rs.	Total Rs.
Dr H.P. Gupta (DST Project)	25,700.90	20,000.00	45,700.90
Dr A. Bhattacharyya (DST Project)	8,777.50	65,000.00	73,777.50
Dr R.K. Kar (DST Project)	64,282.25	1,40,000.00	2,04,282.25
Dr P.K. Maithy (DST Project)	16,149.36	1,20,000.00	1,36,149.36
Dr Mukund Sharma (DST Project)	15,082.18	65,000.00	80,082.18
Dr (Mrs) Asha Khandelwal (E&F)	35,780.50	2,22,000.00	2,57,780.50
Total	**1,65,772.69**	**6,32,000.00**	**7,97,772.69**

For : **Singh Agarwal & Associates**
Chartered Accountants
Sd/-
(Mukesh Kumar Agarwal)
Partner

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

Palaeobotany, Lucknow

of Palaeobotany, Lucknow for the year ending 31st March, 1996

Recurring Expenditure/Refunds Rs.	Capital Expenditure Rs.	Total Rs.	Closing Balance as on 31-3-96 Rs.
38,532.00	-	38,532.00	7,168.90
41,611.40	12,264.00	53,875.40	19,902.10
1,77,986.20	-	1,77,986.20	26,296.05
1,11,005.65	-	1,11,005.65	25,143.71
57,771.70	-	57,771.70	22,310.48
1,94,850.30	-	1,94,850.30	62,930.20
6,21,757.25	**12,264.00**	**6,34,021.25**	**1,63,751.44**

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
G. Rajagopalan
(Acting Director)