

Annual Report 1988-89



BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY
LUCKNOW



Annual Report
1988-89

Cover photo : A view of the main building of the Institute.

Back Cover photo : *Impardecispora* Venkatachala & Kar, a pteridophytic spore from the Lower Cretaceous of Kutch, Gujarat.

Title page photo : A restoration model of *Williamsonia seawardiana*.

Published by : Birbal Sahni Institute of Palaeobotany, Lucknow and printed at : Kapoor Art Press, New Delhi.

Produced by : Jaswant S. Antal

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

	<i>Page</i>
Foreword	i
Research	1
International Geological Correlation Programmes	41
Doctorate Degree Awarded	42
Doctorate Theses Submitted	43
Papers Submitted	44
Papers Published	50
Field Work	54
Papers presented at Symposia/Conferences/Meetings	57
Lectures delivered	62
Technical Assistance rendered to other Agencies	63
Deputation/Training/Study Abroad	64
Courses/Lectures in the Institute by outside Scientists	66
Workshop/Conference sponsored	66
Deputation to Conference/Symposium/Seminar/Workshop/Expedition	67
Representation in Committees/Boards	68
Honours and Awards	71
Publication	72
Library	73
Herbarium	75
Museum	76
Republic Day	78
Founder's Day	78
Symposium on Vistas in Indian Palaeobotany	79
Scientists	80
Technical and Administrative Personnel	83
Appointments and Promotions	86
Retirements	87
Organisation Structure	88
Governing Body	88
Finance and Building Committee	89
Research Advisory Council	90
Departments	91
Internal Committees	92
Accounts for the year 1988-89	94

Foreword

The Birbal Sahni Institute of Palaeobotany is devoted to promotion of higher study and research in fossil botany encompassing both fundamental and applied aspects. Though Professor Birbal Sahni, FRS conceived the idea to place palaeobotanical research in India on an organized basis as early as 1929, yet he succeeded in seeding the embryo of an Institute of Palaeobotany only in 1946.

The Foundation Stone for a new building for the Institute was laid by the then Prime Minister, Pandit Jawaharlal Nehru, on April 3, 1949 at 53 University Road, Lucknow. The Institute now enjoys an autonomous status under the Department of Science and Technology, Government of India. The Founder's dream of "an ever brighter and more useful future in which men of all nations will co-operate in the spirit of science and of service" has come true as the scientists at the Institute have committed themselves to put the Birbal Sahni Institute of Palaeobotany and the expertise generated here to the service of the Nation.

Search for palaeobiological evidences for origin, evolution and development of diverse life forms from fossil bacteria through fungi, algae into higher plants and their significance in age determination, correlation of sediments and fossil fuel evaluation has been made during this year by the Scientists at the Birbal Sahni Institute of Palaeobotany. Substantial data has been generated and interpreted through integrated and multidisciplinary approach. A synopsis of the achievements made during 1988-89 academic year follows.

Precambrian—Cambrian

Discovery of stromatolites in Kumsi manganese has established its lateral extension in Shimoga Schist Belt of Dharwar Craton. Presence of methanotrophic and methanogenic bacteria and the ^{13}C ratio (-23% to -35%) vs PDB in graphites from Kolar, Ganacharpur and Nagvand areas supports biogenic origin. A critical study of *Krishnania*, *Longfengsabnia*, *Vindhyavasnia*, and other similar looking forms from Indian Proterozoic revealed a morphological similarity. Hence, all these forms are included under *Krishnania* which has nomenclatural priority.

A septate filamentous fossil with a one cell thick margin recovered from Deoban cherts (950 Ma) of Chakrata area may represent one of the earliest metazoans. The Suket Shale Formation of Vindhyan Supergroup shows presence of vendotaenid algae and medusoid and echinoidal holdfast like bodies. Either they indicate a younger age for these beds or represent an early advent of metazoan/metaphyte in India. Fission-Track age obtained for glauconite sand samples is 625 ± 95 Ma and for Beach granite, the base rock deposits in Chittorgarh is 1470 ± 100 Ma.

Late Palaeozoic

A critical re-examination of all the relevant information restricts the term Gondwana to the group of terrestrial sediments in the Indian craton that began with a basal Permian glacial event and terminated with a large hiatus at the top of Triassic. A reassessment of plant megafossils collected from the sedimentaries

exposed in Gopad River, Sidhi District, Madhya Pradesh indicates a strong Late Permian affinity though palynofossils reflect an Early Triassic age. Vertically preserved *Vertebraria* axes have been found in Kamthi Formation of Ib River Coalfield. Ginkgopsid leaves have been recorded for the first time in the Permian of Rajmahal Basin. In Mailaram area of Godavari Graben, five distinct palynoassemblages (Upper Permian and Lower Triassic) have been recorded while in Budharam area, palynoflora comparable to Panchet Formation was identified. The spontaneous combustion of certain coal seams in Raniganj and Jharia coalfields has been attributed primarily to frequent occurrence of resins, spores and perhydrous vitrinite reactive material amenable to auto-oxidation. By a new method of analysis—tissue preservation and gelification indices—several coal facies have been identified in East Bokaro Coalfield. In the Lower Bomte Formation of West Siang District, Arunachal Pradesh palynofloras correlating both the Lower and Upper Barakar Formation have been identified.

Mesozoic

Fossil seeds from Nidhpuri have been detailed. Palynoflora at various depths between 1st and 6th traps in the northern part of Rajmahal Basin has shown dominance of *Araucariacites*, *Podocarpidites*, *Cooksonites* and other similar forms indicating Early Cretaceous age. Fossil floras from the Athgarh, Bansa, Gangapur, Dhrangadhra, Gardeshwar and Himmatnagar localities seem to be contemporaneous and flourished during Early Cretaceous in warm-humid climate. The Cretaceous sequence of Cauvery and Palar basins includes five dinocyst assemblage zones (dated Turonian to Santonian) in Trichinopoly Formation, Cauvery Basin and two interval zones with seven interval sub-zones (assigned to Early to Late Barremian) in Palar Basin. The nannoplankton taxa of Pariwar Formation favour a Late Aptian—Early Albian age assignment for the deposit. Dinocyst assemblage of upper Mahadek and Langpar formations of Assam-Arakan Basin indicates Late Maestrichtian to Danian age. Unusual combination of pollen characters of *Circumpollis* has been critically evaluated. Studies on *Classopollis* group of pollen show that even as far back as the Triassic (208 Ma) this group of pollen had developed an exine comparable to that of some modern angiosperms.

Cenozoic

Presence of fossil woods of *Hopea*, *Carallia* and *Phyllanthus* in Varkala Basin and *Barringtonia*, *Euphorbia*, *Koompassia*, *Madhuca* and other allied forms in Namsang beds, Assam-Arakan Basin indicates high humid conditions. Palaeocene vegetational scenarios of Nagpur-Chhindwara and Mandla regions have been portrayed based on the evidence of the Deccan intertrappean plant fossils. Fossil woods from Nagpur-Chhindwara region have been dated by F-T method to 51 ± 6 and 45 ± 5 Ma. Fossil woods of *Bombax* and *Ficus* from Upper Tertiary sediments in Jaisalmer and *Lagerstroemia*, *Sterculia* and *Tamarindus* from Tertiary sediments, Gujarat have been identified. Tertiary spore-pollen assemblages from the Kerala Basin have revealed associations of tropical upland, lowland, fresh water, sandy beach and mangrove vegetation and high precipitation. Dinoflagellate cysts and pollen of *Rbizophora*, *Nypa* and *Barringtonia* suggest brackish water swamps. Two new exposures of Ratnagiri Lignite have been discovered on the West Coast. Extinction pattern of fossil pollen flora during terminal Eocene in India has been attributed to plate movements and resulting in major climatic variations causing

extinction. In north-east India, Lower Tertiary sediments are characterized by *Lycopodium*—*Dandotiaspora* associations. Comparative analysis of palynofloras of Neyveli Formation has suggested deposition during Palaeocene-Eocene age. Marker species of coccoliths and discoasters in Andaman assemblage indicate an Early Campanian to Late Eocene age.

Optical properties of Tertiary and associated sediments in Assam have shown hydrocarbon-rich organic material. Through a critical evaluation of palaeobotanical data development and diversity of vegetational pattern and climatic changes through Palaeocene to Pliocene in the Himalayan belt have been identified. A rich variety of palynofossils and presence of desmids in the Siwalik sediments in Solan have indicated fresh-water deposition. The marine influence suggested by other parameters has not been confirmed.

Dispersed organic matter studies of Chilka Lake have shown different types of variably degraded organic material. C-14 measurements of the Ganga alluvium indicate clear correlation with known global climatic phases.

Wood charcoal remains (ca 2300-1700 B.C.) from archaeological samples from Rohira in Punjab belonging to *Acacia*, *Cedrela*, *Mimusops*, *Cedrus*, *Vitis* and *Lawsonia* have suggested timber exploitation and horticultural and gardening activities in the Harappan period.



(B. S. VENKATACHALA)
Director

Research

Project I.D.1 : **Palaeobiology of Precambrian-Cambrian sediments of India**

Objective : Search for Precambrian biota and tie-up with radiometric dates based on glauconite; establishment of evolutionary chronology

Subproject I.D.1.1 : **Palaeobiology and stratigraphy of Vindhyan sediments in Son Valley and Rajasthan**

Objective : Search for the evidence of Vindhyan life and its role in mineralisation

A new form of *Newlandia* was studied from the Chutiya Limestone Formation of Dabua and was found to have been deposited in a barrier coast line lagoonal environment.

Sekwia excentrica revealed similarity under SEM with encystment structures comparable to *Nucellosphaeridium* Timofeev. Critical restudy of *Krisbmania*, *Longfengsabnia*, *Vindbyavansia* and other similar looking forms from the Indian Proterozoic suggests that all the forms are morphologically identical; the name *Krisbmania* has priority. This group of photosynthesising organisms belonging to ?Chlorophyceae inhabited shorelines.

A branched tubular ?codiaceous form was recorded from the Nagod Limestone Formation exposed around Khemri-Kotar, M.P.

Taxonomic identification of acritarchs in Sirbu Shale Formation (*Protosphaeridium* and *Orygmatosphaeridium*) and in Bhandar Limestone Formation (tubular sheaths) has been completed.

Organic-walled microfossils recorded from the Vindhyan succession of Satna and Maihar consist of eight genera of algae and five genera of acritarchs which support a Late Proterozoic age for the Bhandar Group.

A new, columnar form of *Tungussia paliensis* from the calcareous bands of Sirbu Shale Formation exposed at Pali Ghat in Chambal River Section indicates turbulent and upward shallowing condition of the sea.

Seven samples of stromatolites from the Ganurgarh Shale and Sirbu Shale formations yielded highly deformed microbiota. The forms are circular cells *Huronispora psilata*, colony of solitary cells *Aphanocapsiopsis sitboleyi*, *Palaeoanacystis vulgaris*, *Myxococcoides globosa*, oval-shaped cells linear arranged forms *Gunflintia minuta*, *Anabaenidium johnsonii*, *Kildinosphaera*, *Orygmatosphaeridium*, *Baltisphaeridium* and *Michrysphaeridium*. Frequent occurrence of acritarchs, which is significant, indicates a lagoonal deposit.

The stromatolites in Kajrahat Limestone Formation are *Cryptozoon proliferum*, *Stratifera* sp., *Irregularia* sp., *Conophyton gargaricum*, *Conophyton vindhyaensis* and in Bargawan Limestone Formation *Conophyton vindhyaensis*. Their

identification is based on three facet diagrams. Microbiota preserved in between the laminations belong to *Huronispora* and *Oscillatoriopsis*. Observations support that *Conophyton* may be used as a marker for Semri Group.

Authentic microfossils in the Palri Shale Formation, Chittorgarh have been distinguished, in thin sections, from pseudomicrofossils formed by apatite grains.

P. K. Maithy, Rupendra Babu and K. L. Meena

Subproject I.D.1.2 : Biological remains from Precambrian sequence of Kumaon and Garhwal Himalaya

Objective : To decipher evolution and diversification of life forms during the Precambrian

Stromatolites from the Deoban-Gangolihat belt have been referred to *Rabaella* sp., *Kussiella kussiensis*, *Conophyton garganicus*, *C. cylindricus*, *Stratifera undata*, *S. bearnica*, *Gongylina differentiata*, *G. mixata*, *Plicatina antiqua*, *Baicalia* sp., *B. chandakia* f. nov., *B. nova*, *Minjaria uralia*, *Boxonia* sp. and *Jurussia* sp. The microbiota comprises *Granularida* in *Kussiella*, *Lenticularida* in *Conophyton garganicus*, *Angustana* in *Stratifera undata* and *Grumulosida* in *Baicalia* sp. and *B. chandakia*.

A specimen with septate nature (metamerism) and single layer (cellular?) margin observed in Deoban cherts (950 Ma) of Chakrata area may represent one of the earliest metazoans. Multicelled linear bodies with single to multilayered (cellular?) margin and hollow central area have also been observed in the Infra Krol (Riphean) succession of Nainital area. The Suket Shale Formation of Vindhyan Supergroup (Ca 1000 Ma) shows the presence of Vendotaenid algae, very small medusoid and echinoid holdfast-like bodies (2 μ m). These records may indicate a younger age for these beds or may represent an early advent of metazoan/metaphyte in India.

Manoj Shukla (and V. C. Tewari, W.I.H.G., Dehradun)

Subproject I.D.1.4 : Fission-Track dating of glauconite from the Vindhyan sediments

Objective : Dating and correlation of Vindhyan sediments in Son Valley and Rajasthan

Glauconitic grains were separated from four glauconitic sandstone samples collected from a 5m thick profile near Astal Village, Karauli area, Rajasthan using Frantz Isodynamic magnetic separator with the following settings: front slope—25 degree, side slope—10 degree, current—0.4 Amp. The F-T ages for these samples obtained are as 650 ± 105 Ma, 640 ± 115 Ma, 610 ± 95 Ma and 600 ± 110 Ma. The average F-T age of this glauconitic sandstone bed can be given as 625 ± 95 Ma.

The F-T age of Bearch granite, the base-rock of Vindhyan deposits in Chittorgarh, Rajasthan sampled at Det Village, about 10 km from Chittorgarh on Ajmer road has been measured as 1470 ± 100 Ma using separated apatite mineral grains.

G. Rajagopalan and A. P. Srivastava

Project I.D.2 : **Flora and palynostratigraphy of coal and associated sediments of Gondwana grabens and their genesis**

Objective : *Floristics, phytogeography, palaeoecology, palynostratigraphy, correlation of coal seams and tracing of evolutionary trends*

Subproject I.D.2.1 : **Morphotaxonomy, floristics and biostratigraphy of Lower Gondwana plants in Son Valley**

Objective : *Comparative morphology and floristics*

Talchir and Karharbari plant fossils from Anuppur and Chirimiri areas were investigated. Lycopod stems and presence of *Euryphyllum* leaves are significant finds from Chirimiri area.

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



A bryophytic remain recovered from Talchir Formation of Umaria Coalfield.

Fossils of bryophytes and algae have been identified from the Talchir sediments of Umaria area.

Shaila Chandra

The sedimentaries exposed by the Gopad River in Sidhi District, M.P., initially mapped as Permian, were in the early sixties dated as Triassic on the basis of occurrence of a pinnate type of leaf assumed to be a *Dicroidium*. On the basis of occurrence of palynomorphs recovered from the "*Dicroidium*"-bearing shale, the age assignment was refined and placed equivalent to the Parsora "Stage". A reassessment of available data reveals that the plant megafossil assemblage from these sedimentaries has a strong Late Permian affinity, as is indicated by the presence of a number of *Glossopteris* species, typical glossopterid fructifications *Satsangia* and *Eretmonia*, *Rhabdotaenia* and "*Tbinnfeldia*" *callipteroides* leaves. The presence of the leaf genus *Dicroidium* is not confirmed as none out of hundreds of leaves collected so far during the last two decades shows a forked rachis and a stomatal apparatus with four subsidiary cells. Palynologically too, the assemblage has a typical Late Permian aspect in the presence of the genera *Densipollenites*, *Weylandites* and *Falcisporites*. The presence of a large number of disaccate striate pollen is also characteristic. The stratigraphic setting of these beds also suggests a Late Permian age.

Shaila Chandra and Hari K. Maheshwari

Subproject I.D.2.2 : Palynostratigraphy of the Gondwana sediments in Son Valley

Objective : *Morphotaxonomy, correlation and age determination*

Repeated search of palynofossils in the *Dicroidium*-bearing bed of Nidpur Section in Gopad River near Marhwas, M.P., suggests an Early Triassic affinity for these deposits. The trough-fault model with minor displacements has been suggested on the basis of field observations. The prominence of taeniate disaccates, cavate triletes and several other simple disaccate with prominent sulcus may have greater relationship with Triassic palynofloras rather than the Permian. Bore-core SPB-17 has been taken up for palynological analysis in order to determine the sequence of strata in the Sohagpur area.

R. S. Tiwari and Ram Awatar

Subproject I.D.2.3 : Classification of coal types, rank determination and investigation of sedimentary organic matter in Son Valley

Objective : *Genesis and characterization of coal types*

Although, the Umaria and Korar coalfields lie within 5 km of each other, the quality of the coals is significantly different. Umaria coal has variable reactive vitrinite (5.4% to 74.2%) and nonreactive inertinite (7.4% to 62.0%) constituents. The vitrinite reflectance ranges between 0.40 per cent to 0.57 per cent which suggests high volatile bituminous rank. Korar coals are medium volatile bituminous in rank (Ro Max. 1.18%-1.22%) and have rich reactive constituents (46% to 61.0%).

The higher rank for the Korar coals is attributed to the influence of post depositional thermal effects.

G. K. B. Navale and B. D. Singh

Fluorescence light microscopic study of Turra coal seam from 6 lateral sections (from east to west) of Singrauli Coalfield records appreciably high amount of liptinite macerals (14.5% to 57.4% on mineral matter free basis) constituted chiefly by sporinite (9.6% to 38.3%) and liptodetrinite (1.2% to 12.0%). Other macerals of liptinite group-cutinite, resinite, suberinite, exsudatinite, fluorinite and alginite together are only in subordinate amount. Normal reflected light study, on the other hand, recorded total liptinite content up to 19.0 per cent (on m.m.f. basis). The coal seam is characterised by the persistent presence of alginite (*Botryococcus*, up to 0.8%) from east to west that indicates lacustrine genesis of the Turra Seam. High amount of liptinite macerals in the Turra coal seam makes it better suited for liquifaction rather than for thermal power generation.

B. D. Singh and B. K. Misra

Subproject I.D.2.4 : Floral succession in the Triassic sediments of Son Valley

Objective : *Morphotaxonomy, palaeoecology and biostratigraphy*

The report on fossil seed genera from Nidpur plant bed has been finalized. Based on cuticular similarities three alliances of various plant organs are established.

1. Seed *Sabnispermum indicum*, pollen-organ *Bosea indica* (*Weylandites indicus* pollen) and leaf *Lepidopteris indica* are assigned to the plant *Lepidopteris indica*.
2. Seed *Delevoryaspermum nidpurensis*, pollen-organ *Pteruchus nidpurensis* and leaf *Dicroidium nidpurensis* are ascribed to the plant *Dicroidium nidpurensis*.
3. Detached seed *Savitrismum crateriformis* belongs to the seed-bearing organ *Umkomasia*.

The seed *Savitrismum* is abundant in Nidpur sediments and is frequent throughout Gondwanic countries. *Rostrumaspermum venkatachala*, an archegoniate seed of coniferous affinity has also been studied. The significance of seed cuticle in taxonomy; evolution and as an indicator of palaeoecology and climate has also been interpreted. Four types of sporangia have been recognised, viz., having cingulate spores, showing alete spores, possessing non-striate bisaccate pollen and having an unusual type of spores.

Shyam C. Srivastava and S. R. Manik

Subproject I.D.2.5 : Comparative morphology and floristics of Lower Gondwana plants in Damodar and Rajmahal grabens and their significance in evolution and stratigraphy

Objective : *Floristics, compilation of fossil floras, stratigraphy and evolution*

Investigation of Upper Barakar flora from shales associated with seams VI and VII from Junkundar, Shampur, Amdih and West Victoria collieries of Raniganj Coalfield has been completed. The flora is predominantly composed of species of the genus *Glossopteris*. *Lelstotheca robusta* and *Neomariopteris hugbesii* are the only other elements. As compared to the Lower Barakar flora, this flora is less diversified indicating a stable dry and warm-temperate climate.

A. K. Srivastava

Ginkgoites eximia and *Ginkgoites feruglioi*, two species of ginkgophyte leaves, earlier reported from Lower Permian beds of Argentina, have been recorded for the first time from Permian beds of Rajmahal Hills, Bihar. So far, this genus was not known to occur in beds older than Late Triassic.

Usha Bajpai

There are three major coalseams in the Raniganj Formation of Jharia Coalfield, viz., Mahuda, Bhurungia and Lohpiti, in ascending order. The main constituents of the plant fossil assemblage from the roof shale of Lohpiti seam, that lies below the Mahuda Sandstone Member, are the leaf *Glossopteris sbailae*, the stem *Araucarioxylon kumarpurensis* and the megaspore *Noniasporites harrisii*. A similar fossil assemblage has earlier been reported from the shale underlying Kumarpur Sandstone Member of Raniganj Coalfield.

Usha Bajpai and Rajni Tewari

A detailed overview of the glossopterid fructifications was prepared and presented as Key Note paper to the 3rd Conference of International Organization for



Ginkgoites, a ginkgoid leaf from the Lower Permian of Rajmahal Basin.



Nontiasporites barrisi, a marker megaspore genus from the latest Permian in Damodar Graben.

Palaeobotany held at Melbourne, Australia. It has been conclusively shown that the glossopterid fructification is a dorsiventral foliose structure that is borne in the axil of a regular or modified vegetative leaf. On the basis of organisation of the fructifications, two families of the glossopterids, viz., Dictyopteridumaceae and Eretmoniaceae, have been recognized.

Hari K. Maheshwari

The question of the lower and upper limits of the Indian Gondwana was re-examined. Taking into account all the relevant information, it has been proposed to restrict the term Gondwana to the group of terrestrial sediments in the Indian Craton that began with a basal Permian glaciogene epoch and terminated with a large hiatus at the top of Triassic. The Gondwana Supergroup as recircumscribed will thus comprise Talchir, Damuda, Panchet and Mahadeva groups.

B. S. Venkatachala and Hari K. Maheshwari

Climatic reflections in the Permian vegetation of Indian Peninsula were identified. The vegetation of the early Early Permian comprised plants with leaves that were undifferentiated into lamina and petiole. As no petrified wood is recorded, the plants probably were small and stunted indicating an arid cold climate. The late Early Permian leaves with thick cuticles indicate restricted water availability. During early Middle Permian, the precipitation probably was very high as the leaves were mostly hypostomatic. Definite growth rings in the wood indicate a temperate climate. The Late Permian had a warm temperate climate with high wind velocities as is indicated by large woods with growth rings, deciduous, petiolate, mostly hypostomatic leaves and thick undergrowth of articulates and ferns.

Hari K. Maheshwari, Usha Bajpai and Rajni Tewari

Ginkgophyte leaves have been recorded from the Permian of Rajmahal Basin. These leaves have provisionally been referred to the genera *Rhipidopsis*, *Psymophyllum* and *Saportaea*. Seed-bearing and pollen-sac bearing branched

organs have also been found in association. The fructifications are believed to belong to one of these leaf types.

Hari K. Maheshwari and Usha Bajpai

Subproject I.D.2.6 : Comparative morphology, floristic and biostratigraphy of Lower Gondwana plants in Mahanadi and Pranhita-Godavari grabens

Objective : Floristics and compilation of fossil floras, phytogeography and evolution

Plant megafossils from Karharbari/Barakar and Kamthi formations of Ib River Coalfield were studied. The occurrence of vertically preserved *Vertebraria* axes in Kamthi Formation is taken as indicative of *in-situ* preservation. The Kamthi flora comprises *Schizoneura*, *Trizygia*, *Benlightfootia*, *Surangephyllum*, *Neomariopteris*, *Dichotomopteris* and *Glossopteris* (18 species). The Karharbari/Barakar flora comprises *Lelstotheca*, *Gangamopteris* (3 species), *Glossopteris* (16 species), *Vertebraria*, *Noeggeratbiopsis* and *Euryphyllum*.

K. J. Singh and Shaila Chandra

Subproject I.D.2.7 : Comparative morphology of Lower Gondwana megaspores

Objective : Morphotaxonomy, affinity based on comparative studies with modern taxa, biostratigraphical significance

Samples from Barren Measures and Raniganj formations of Jharia Coalfield were processed. The megaspore *Noniasporites barrisii* recovered from the Lohpiti Sandstone Member was investigated in detail and has now been shown to possess a mesosporium.

Usha Bajpai and Rajni Tewari

Subproject I.D.2.8 : Mesozoic flora from Satpura Graben

Objective : Morphotaxonomy, relationship and evolutionary linkages

Study of Early Cretaceous Jabalpur megafloora has been partly finalized. This assemblage is dominated by conifers and has fair representation of cycadophytes, meagre representation of pteridophytes and rare occurrence of ginkgophytes. *Pachypteris indica*, *Taeniopteris spatulata*, *Anomozamites* sp., *Elatocladus* sp., *Pagiophyllum* sp., *Brachyphyllum jabalpurensis* sp., nov., *Araucarites minutus* and *Satpuria seboraeensis* are described from Jabalpur. *Cycadolepis* sp. and two new species of *Elatocladus* were discovered from Sehora.

Sukh-Dev and Neeru Pandya

Subproject I.D.2.9 : Mesozoic flora from the Mahanadi and Pranhita-Godavari grabens

Objective : Systematic study of floral succession and biostratigraphical implications

Study of plant megafossils from Athgarh Formation was completed. It is dominated by pteridophytes and conifers. *Equisetites* sp., *Todites indicus*, *Cladophlebis medlicottiana*, *C. acutipennis*, *Elatocladus tenerrimus*, *Brachyphyllum regularis*, *Araucarites minutus* and *Conifero-caulon rajmahalense* are reported for the first time. The Athgarh flora appears contemporaneous with Early Cretaceous floras of Bansa, Gangapur (assemblage-2), Dhrangadhra, Gardeshwar and Himmatnagar which flourished in tropical to sub-tropical climate.

Sukh-Dev and Neeru Pandya

Gollapalle flora, augmented with new finds, shows closer resemblance with that of Gangapur (Butarmal Nala) and Jabalpur formations (Sehora). The Raghavapuram flora constituted of conifers and cycadophytes with rare ferns and ginkgos is characterized mostly by small and thick-leaved forms which indicate rather a dry environment.

Neeru Pandya and Sukh-Dev

Subproject I.D.2.10 : Fossil flora of Rajmahal Formation

Objective : *Morphotaxonomy, floral succession and age determination*

Pteridophytic plant fossils from Rajmahal Formation (Chunakhal) include the genera *Lycopodites*, *Selaginellites*, *Equisetites*, *Marattiopsis*, *Gleichenites*, *Todites*, *Eboracea*, *Cladophlebis* and *Sphenopteris*. *Gleichenites* and *Todites* are abundant. *Eboracea* recorded for the first time is commonly distributed in other tropical to sub-tropical floras.

Jayasri Banerji

Subproject I.D.2.11 : Reconstruction of the *Pentoxylon* plant

Objective : *Anatomical investigation of *Pentoxylon* stem, *Nipaniophyllum* leaf, *Sabnia* pollen organ and *Carnoconites* seed-cone for establishing organic relationship*

One dozen seed specimens have been recovered from the chert-slices of *Nipania*. Wood-sections of *Araucarioxylon* are being studied. Reconstruction of the *Pentoxylon* plant is attempted.

Shyam C. Srivastava

Subproject I.D.2.12 : Palynostratigraphy of Gondwana Sequence in Rajmahal Basin

Objective : *Palynostratigraphy, biozonation and correlation of coal-bearing horizons*

Palynoflora in Intertrappean beds at various depths between 1st and 6th trap in bore-hole RJNE-32, northern part of Rajmahal Basin reveals the dominance of *Araucariacites* and *Podocarpidites*. Pteridophytic spores are inconsistently represented. *Cooksonites*, *Aequitriradites* and *Triporetetes* are also recorded. The composition of the palynoflora indicates an Early Cretaceous age.

R. S. Tiwari and Archana Tripathi

Subproject I.D.2.13 : Palynostratigraphy of Gondwana Sequence in Damodar Graben

Objective : Palynological dating, palynostratigraphy and biozonation

Triassic samples from Dhardharia Nala (Lugu Hill, Bihar) and Panchet Hill (West Bengal) proved palynologically barren. Palynological assemblage from Barren Measures, Raniganj sequence in bore-hole RPA-2 shows a continuum in generic composition.

R. S. Tiwari and K. L. Meena

Subproject I.D.2.14 : Palynostratigraphy of Gondwana Sequence in Godavari Graben

Objective : Palynostratigraphy, biozonation and correlation of coal-bearing horizons

In bore-core GAM-7 from Mailaram area presence of five distinct palynoassemblages related to Upper Permian and Lower Triassic age has been established. *Taeniaepollenites*, *Columinisporites*, *Triquitrites* and *Iraquispora* are reported for the first time from the Indian sediments. Four bore-cores (GBR 4, 5, 6 & 7) from Budharam area have been studied and a palynoflora comparable to that of the Panchet Formation was recorded in bore-core GBR-7. Palynofossils from younger Talchir sequence in bore-core GAG-1 indicate marine influence in Ainapalli area. A Barakar palynoflora from Koyagudem area in bore hole KYG-19, 20 has been studied.

Suresh C. Srivastava and Neerja Jha

Lower Barakar and Lower Kamthi palynofloras have been demarcated in bore-core GM-5 from Manuguru area.

Neerja Jha

Subproject I.D.2.15 : Palynostratigraphy of Palaeozoic and Mesozoic sediments in Mahanadi Basin

Objective : Palynostratigraphy and biozonation

Palynological investigation of phosphorite-bearing beds in Kelo River Section, Raigarh District, M.P. revealed the presence of an assemblage comparable to that of Upper Raniganj Formation (Upper Riphean). Presence of *Leiosphaeridia* indicates a marine influence during the deposition, which observation corroborates with the formation of phosphorite-rich sediments and suspected bioturbidite remains.

R. S. Tiwari

In the beds exposed on the left bank of Brahmini River, downstream of Sarang Village, occurrence of *Playfordiaspora*, *Cyathidites*, *Klausipollenites*, *Satsangisaccites*, *Lunatisporites*, *Striatopodocarpites* and *Araucariacites* indicates Triassic relationship for sediments of one suite, while taxa like *Todisporites*, *Leptolepidites*, *Santhbalisporites*, *Klukisporites*, *Cicatricosisporites* and *Murospora* characterise another suite comparable with Late Jurassic/Early Cretaceous assemblages. Few samples from Nandira Jhor Nala have yielded *Plicatipollenites*

indicating that the sediments to the west of Brahmini River are of Early Permian age. Obviously, all the sediments earlier classified under Talchir Formation are not Talchir but some are of much younger age.

R. S. Tiwari and Archana Tripathi

In the palynoassemblage of Birla Fire-Clay Mine in Talbasta region, the common occurrence of *Murospora* and *Araucariacites* complex was noticed. The palynoassemblage from bore-core samples from Talbasta is dominated by *Araucariacites* complex. Wide morphological variations were noticed in the genus *Murospora*. Other genera present in these assemblages are *Cyatbidites*, *Concavissimisporites*, *Impardecispora*, *Contignisporites*, *Callialasporites*, *Alisporites*, *Podocarpidites* and *Cycadopites*. This data is significant for building the Upper Mesozoic sequence in the basin.

B. N. Jana

Subproject I.D.2.16 : Palynology of Gondwana Sequence in Satpura Basin

Objective : *Palynostratigraphy, biozonation and correlation of coal-bearing horizons*

Palynoassemblage analysed from Napupura section (Jatamao), Madhya Pradesh, contains characteristic pollen and spores of Early Cretaceous age. They are: *Coptospora*, *Concavissimisporites*, *Contignisporites*, *Murospora*, *Callispora*, *Triporoletes*, *Cicatricosisporites*, *Boseisporites*, etc. The assemblage has the dominance of *Callialasporites* in association with disaccate pollen *Podocarpidites* and *Alisporites*.

The palynoflora recovered from Mesozoic sediments of Khatama caves, Madhya Pradesh is poor. The elements so far identified are *Callialasporites*, *Araucariacites*, *Podocarpidites* and *Alisporites* along with plenty of bordered pitted tracheids.

Pramod Kumar

Subproject I.D.2.17 : Critical assessment of coals from Damodar and Rajmahal grabens

Objective : *Classification of coals and assessment of their quality*

Organic petrological studies of Raniganj coals susceptible to spontaneous combustion have revealed high amount of resinite and its characteristic distribution in time and space showing conformity in trends with peroxy complex pattern, crossing point temperature values, moisture and volatile contents. The resinites (yellow and green under uv excitation, blue filter) probably correspond to terpene and lipid fraction. The resinites along with perhydrous vitrinites provide an active site for oxygen absorption causing exothermic reaction which probably leads to spontaneous combustion.

Aspects on coal petrographic facies and depositional condition of East Bokaro coals have been worked out based on geology, tectonics and coal microconstituent

characteristics. Also, coal forming environments have been attempted on the basis of tissue preservation and gelification indices.

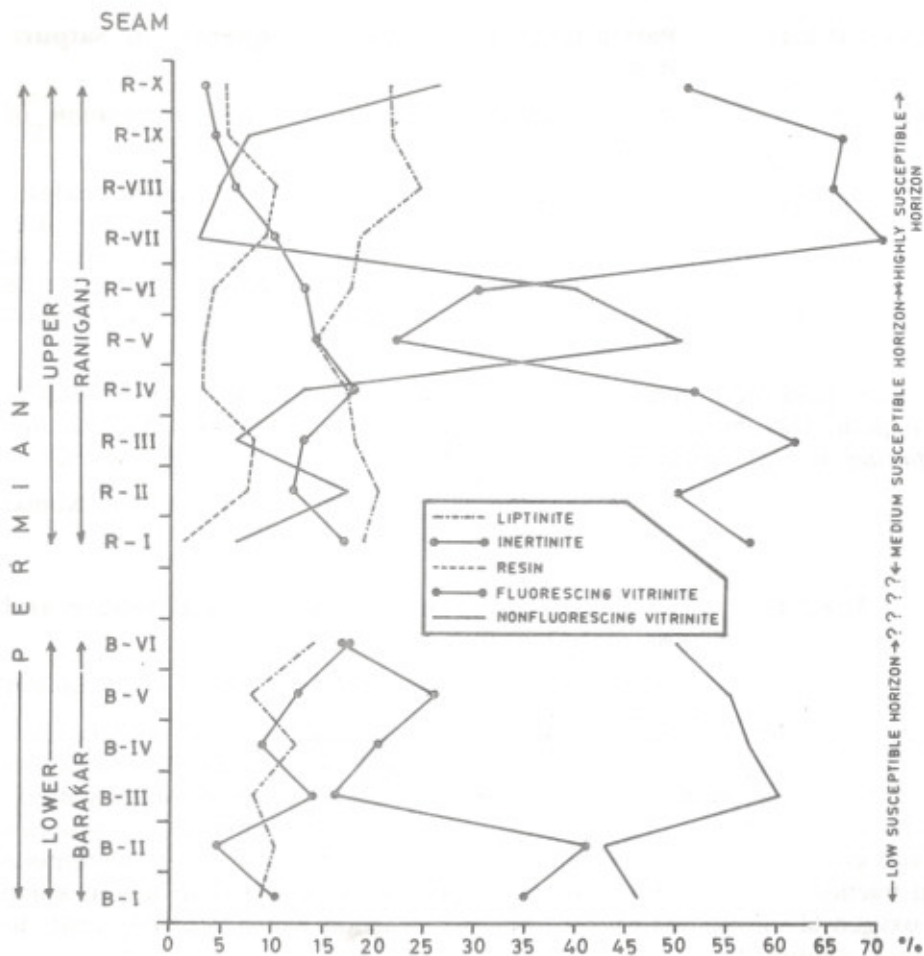
G. K. B. Navale and R. Saxena

Various compositional models on tri- and two axis graphs, utilizing petrographic and rank data of Hura and Chuperbhita coalfields of Rajmahal Graben have been developed to ascertain the nature and composition of different coal types besides possible correlation of the seams.

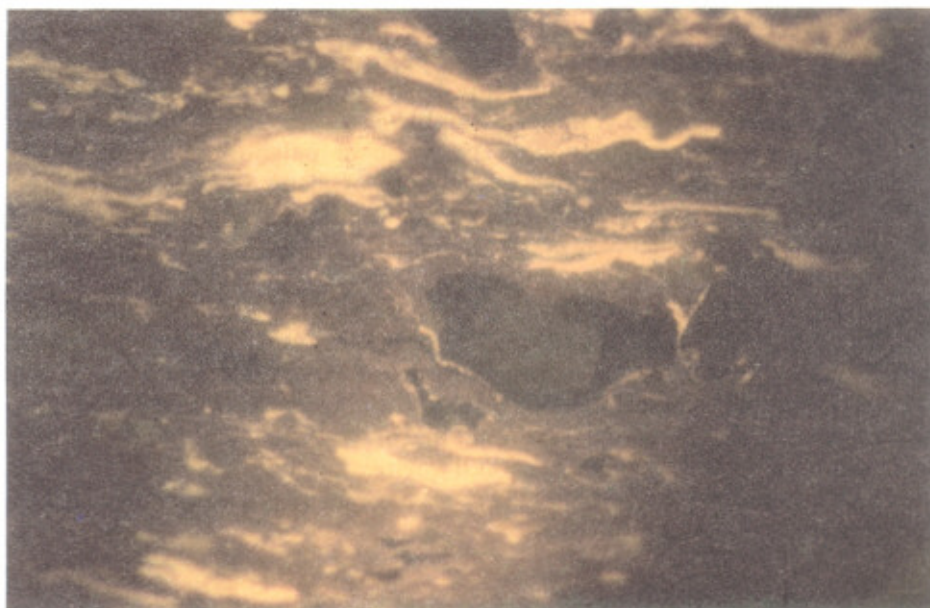
G. K. B. Navale and B. D. Singh

Group study was made on the fluorescence optical properties of resins in Gondwana and Tertiary coal for laboratory standardization.

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



Behavioural pattern of various microconstituents under ultra-violet light in Permian coals susceptible to spontaneous combustion.



Spore rich coal matrix associated with green active resinous material in Indian coals.

Subproject I.D.2.18 : Evaluation and rank assessment of coal seams of Pathakhera Coalfield, Satpura Graben

Objective : *Coal seam characterization*

The lower, middle and upper workable coal seams of Pathakhera Coalfield are characterized by the presence of bright, semibright and dull bands of variable thickness. Vitrinite, inertinite and exinite maceral groups form the major fraction of coal microconstituents. These macerals generally occur as part of durite, clarodurite and duroclarite microlithotypes. Inorganic mineral matter is invariably associated with all the microconstituents.

On the basis of quantitative representation of microconstituents, the Pathakhera coals have been divided into three types (i) vitrinite rich type, (ii) intermediate type, and (iii) inertinite rich type. The rank of the coals based on maximum reflectance of vitrinite in oil, ranges between 0.6 to 0.9 per cent. These coals can be grouped with the high volatile bituminous-C coals of the I.C.C.P. classification. The coal in PK-2 incline shows sudden rise in reflectance, probably due to the presence of igneous intrusion.

Anand Prakash and O. S. Sarate

Subproject I.D.2.20 : Palynostratigraphic studies, rank and properties of coal and associated sediments in Eastern Himalaya

Objective : *Palynological study of coal and associated sediments and petrographic evaluation of coal*

In the Lower Permian Bomte Formation in West Siang District two palynozones have been recorded. The assemblages correspond to Upper Karharbari and Lower Barakar palynofloras, respectively. The percentage of *Indotriradites* shows an increase from east to west within Siang District. Presence of *Rimospora* along with *Scheuringipollenites* in the younger assemblage indicates that the Bomte Formation includes more than one biozone. The Permian palynoflora from the Subansiri District corresponds to the older assemblage of Siang District. Coal balls largely consist of Permian pollen similar to those found in sediments entombing these concretions.

Suresh C. Srivastava and A. P. Bhattacharyya

The petrographic analysis of the Upper Tertiary coals (Tipam Group) from five road sections of Arunachal Pradesh indicates an overall dominance of structured vitrinite (telinite) macerals followed by the macerals of inertinite group and argillaceous mineral matter. Liptinitic macerals have also been noticed under fluorescent light. At few places the cell cavities appear to be filled with resinous matter. In general, it seems that these coals have formed in cutoff channels of fluvial environment.

Anand Prakash

Project I.D.3 : Floristics, palynostratigraphy and organic petrology of Indian lignites and associated sediments

Objective : Comparative morphology of mega- and microfossils and microstructure of lignites, correlation, genesis and depositional environment

Subproject I.D.3.1 : Tertiary plant megafossils from Kerala Basin

Objective : Morphology, palaeoecology, phytogeography and evolution of modern trees of Western Ghats

Anatomical study of carbonised woods from the Neogene sediments of Varkala, Payangadi and Padappakara has revealed the presence of *Hopea*, *Carallia*, *Careya* and *Phyllanthus*. These genera are also known from other Neogene deposits of India.

N. Awasthi and Rashmi Srivastava

Subproject I.D.3.2 : Biogenic investigation of Panandhro Lignite (Kutch) and dispersed organic matter in associated sediments

Objective : Characterization of lignites and quality assessment

Fluorescence spectral analysis of sporinite, alginite and resinite macerals in Panandhro lignite helped in characterizing these macerals on the basis of their spectral parameters—maximum fluorescence intensity and red/green (650/500 nm) quotient. On the basis of its fluorescence properties, the maceral resinite has been classified into five types. The spectral quotients of macerals sporinite and alginite correspond very well with the rank of the lignite suggesting its use for rank determination as well. Quantitative assessment of fluorescing macerals recorded quite high proportion of liptodetrinite and resinite macerals (up to 45%).



MPV-3 system for biopetrological research installed recently at the Institute.

Liptodetrinite is recognised for the first time in Indian lignites. Presence of high amount of liptinite macerals suggests high prospects for hydrogenation.

B. K. Misra

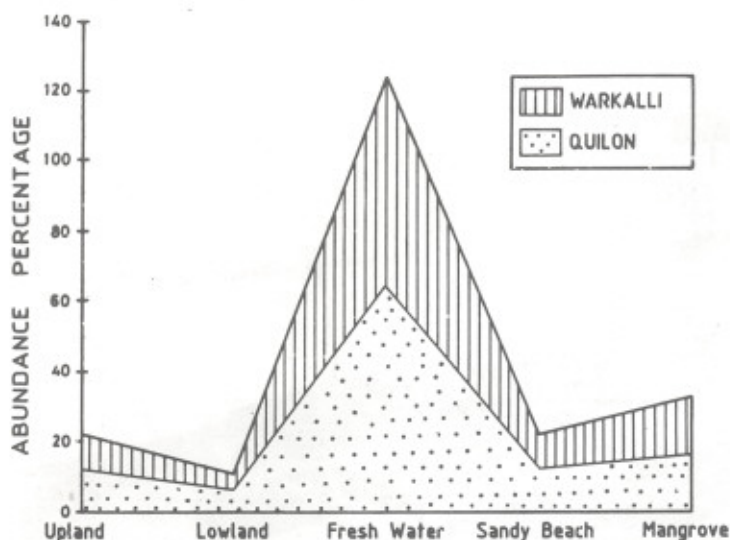
Fluorescence spectral properties of three resinite types from Eocene lignites of Panandhro and Matanomadh areas of Kutch and Permian coals of Raniganj Coalfield revealed that with the increase in age of the fuel deposits, maximum fluorescence intensity of each resinite type correspondingly shifts towards higher wave length accompanied by increase in red/green quotient.

Anand Prakash, Rakesh Saxena and B. K. Misra

Subproject I.D.3.3 : Palynological study of the West Coast lignites

Objective : *Morphotaxonomy of spore/pollen biostratigraphy and correlation with other southern basins*

Forty genera and 55 species of pteridophytic spores and angiospermous pollen have been identified in the bore-cores of Kalarkod and Nirkunnam, Cannanore District, Kerala. Important genera are *Striatriletes*, *Crassorettriletes*, *Polypodiisporites*, *Cheilanthoidspora*, *Quilonipollenites*, *Lakiapollis*, *Tricolpites*, *Margocolporites*, *Tricolporopollis*, *Myricipites*, *Ctenolophonidites* and *Malvacearumpollis*. Tropical humid climate with plenty of rain fall has been inferred. The brackish water environment of deposition is indicated by mangrove elements and dinocysts. Preliminary survey of the assemblage from Payangadi and



Distribution of different ecological group of plants in Quilon and Warkalli formations.

other localities reveals the presence of some stratigraphically and ecologically important palynofossils.

M. R. Rao

Spore-pollen assemblages of the Quilon and Warkalli formations, Kerala Coast have been critically reviewed. Associations of upland, lowland, fresh water, sandy beach and mangrove vegetations have been figured out. Composition of the palynological assemblages indicates the existence of tropical rain forests with a high degree of rain fall. Dinoflagellate cysts and pollen of *Barringtonia*, *Rbizophora*, *Nypa* and *Calamus* suggest the presence of brackish water mangrove swamps. The sandy beach conditions are indicated by *Palmidites*, *Palmaepollenites* and *Quilonipollenites*. Divergent views on the age of Quilon and Warkalli formations have been reconsidered on the basis of new palynological evidences.

H. P. Singh and M. R. Rao

Subproject I.D.3.4 : Studies of dispersed organic matter from the Karewa sediments

Objective : *Characterisation of organic matter study of depositional environment*

Qualitative and spectral fluorimetric studies of promising peat/lignite samples from Nichahom, Varnar, Botapathri, Budsungi, Ningal and Pakharpura sections indicate the presence of a sizeable fraction of liptinitic material. The sporinites show maximum fluorescence intensity in the wave length range of 440-480 nm, which suggests that the organic matter is still at early stages of diagenesis. A number of samples rich in semiamorphous grey organic matter show the presence of well-preserved bacterial remains. A reducing lacustrine environment of deposition in the Karewa intermontane basin has been envisaged for peat formation.

Anand Prakash, Rakesh Saxena and O. S. Sarate

Project I.D.4 : Floristics, palynostratigraphy and biodiagenesis of sedimentary sequence of petroliferous Assam-Arakan Basin

Objective : Comparative morphology, biostratigraphy, palaeoecology and biodiagenesis

Subproject I.D.4.1 : Tertiary vegetational history of Assam Shelf

Objective : Morphotaxonomy of fossil woods and leaves, palaeo-environment and evolution of flora

Fossil woods of *Barringtonia*, *Euphorbia*, *Koompassia* and *Madbuca* found in the Namsang beds near Deomali and of several other taxa reported earlier from Tipam sandstone and Namsang beds indicate that the flora grew under tropical climate with excessive humid conditions that remained nearly unchanged throughout the Neogene Period.

Preliminary examination of leaf-impressions and fruits collected from the Makum Coalfield, Assam has revealed the presence of 25-30 types of leaves representing several families of dicotyledons and monocotyledons.

N. Awasthi and R. C. Mehrotra

Subproject I.D.4.2 : Palynostratigraphy (spore-pollen) of the Upper Cretaceous-Palaeocene sequence in Assam Shelf

Objective : To establish palynostratigraphic zones in Upper Cretaceous-Palaeocene sequence in Assam Shelf

Pteridophytic spores recovered from Tertiary sediments of north-east India were studied. The genera *Lycopodiumsporites* and *Dandotiaspora* exhibit maximum development in Palaeocene. *Polypodiaceasporites*, *Polypodiisporites* and *Seniasporites* are also found in good numbers in Palaeocene but are more common in Middle Eocene to Miocene. *Ceratopteris* spores known in fossil condition as *Striatriletes* also show the same pattern of distribution. *Osmundacidites* (dispersed spores of *Osmunda*) is found in considerable amount during Middle-Upper Eocene. Thus on the basis of spores, the pteridophytic population during Tertiary in north-east India is divided into two associations (i) the lower *Lycopodium-Dandotiaspora*, and (ii) the upper *Polypodiaceae-Ceratopteris* associations.

R. K. Kar

Palynological studies of Tura Formation exposed in Nangwal Bibra area of Garo Hills were completed. The assemblage is dominated by *Proxapertites* and *Matanomadbiasulcites*.

K. Ambwani

Striatriletes was studied under SEM in order to find out its affinity with other related fossils and living spores, viz., *Malayaeaspora*, *Anemia* and *Mobria*. Exine and ornamented patterns in *Neocouperipollis*, a spinose monocolpate, and *Spinozonocolpites*—a spinose zonocolpate pollen have been studied.

R. K. Kar, K. Ambwani and Madhav Kumar

Significant palynotaxa in the assemblage of the Palaeocene sediments around Thanjinath, Meghalaya are *Lycopodiumsporites*, *Dandotiaspora*, *Neocouperipollis*, *Spinizonocolpites*, *Proxapertites*, *Lakiapollis* and *Kielmeyerapollenites*. Few trichotomosulcate, spinose pollen were also recorded. In the Barail sediments exposed on Moriani-Mokokchung Road, Nagaland the genera *Striatriletes*, *Neocouperipollis*, *Tricolporopillites*, *Pellicieropollis*, *Marginipollis* and *Lakiapollis* were provisionally identified.

J. Mandal

Palynological investigation of Langrin Coalfield, Meghalaya was completed. The following species, viz., *Gemmamonocolpites dimorphus*, *Clavamonocolpites indicus*, *Spinizonocolpites bulbospinosus*, *S. indicus* and *S. reticulatus* were newly proposed. Pteridophytic spores are dominant in the basal two coal seams but they gradually decrease in the upper seam where the angiosperm pollen take the lead. The gymnospermous pollen are absent in the assemblage. It seems that the sediments were deposited in warm and humid condition. A Palaeocene age is ascribed for the sediments.

R. S. Singh

Eighty samples collected from Jarain and Laitrymbai collieries, Jaintia Hills, Meghalaya were chemically processed. The assemblage is dominated by *Lycopodiumsporites*, *Dandotiaspora*, *Neocouperipollis*, *Lakiapollis*, *Retitribrevicolporites* and *Kielmeyerapollenites*.

Madhav Kumar

A rich palynological assemblage was obtained from Tikak Parbat Formation, Ledo Hills, Assam. The assemblage is dominated by pteridophytic spores followed by angiospermous pollen. The dominant genera are *Lygodiumsporites*, *Alsophyllidites*, *Dictyophyllidites*, *Striatriletes*, *Eximispora*, *Lycopodiumsporites*, *Polypodiaceasporites*, *Polypodiisporites*, *Pellicieropollis*, *Dermatobrevicolporites* and *Meliapollis*.

B. D. Mandaokar

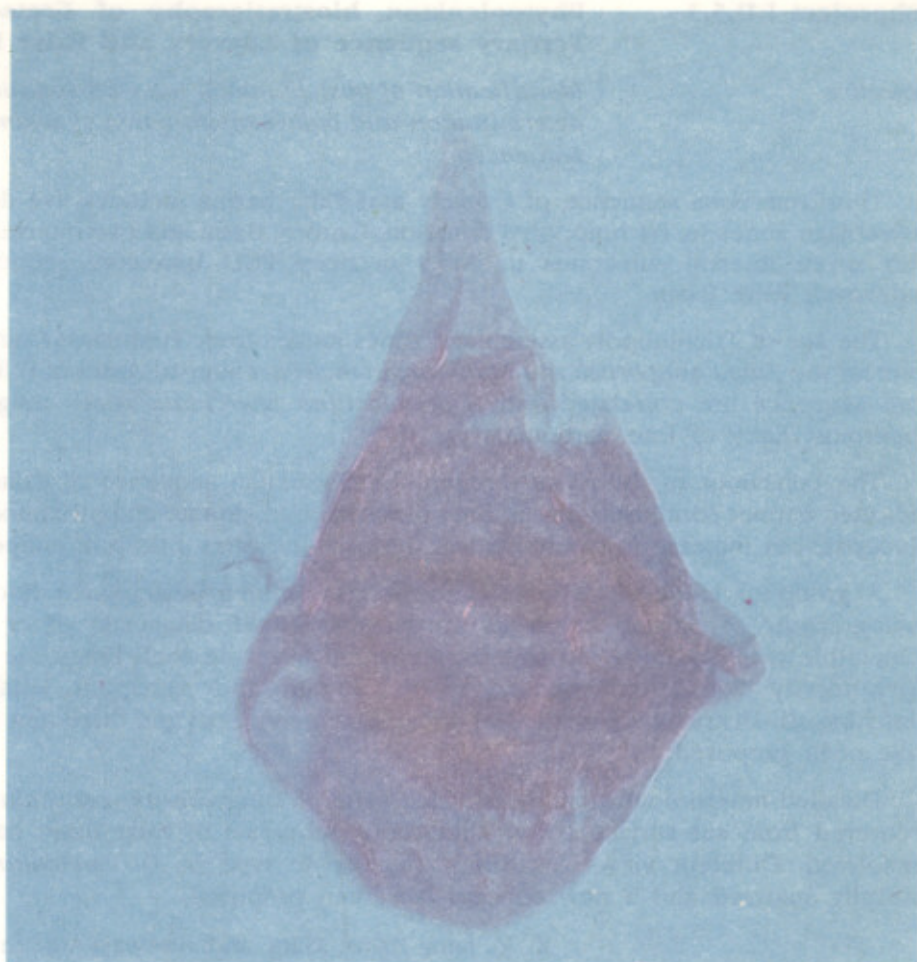
One hundred and twenty one samples collected from Kopili Formation at Garampani and Therriaghat areas of Assam and Meghalaya were macerated. About 385 generic and specific cards were made for the Tertiary spore catalogue.

G. K. Trivedi

Subproject I.D.4.4 : Biodiagenesis of Tertiary coals in Assam

Objective : *Organic matter classification and maturation level*

Biopetrographic, rank and fluorescence microscopic studies of Palaeocene and Oligocene coals from Meghalaya and Upper Assam and Nagaland, respectively revealed appreciably high amount of hydrogen rich macerals (46.5-83.5%) constituted chiefly by perhydrous vitrinite, liptodetrinite and resinite besides, subordinate amount of other liptinite macerals. Theoretically deduced hydrocarbon potential or hydrogen index of the Tertiary coals varies between 200-350 mg CH/g org. and 300-470 mg CH/g org. for Oligocene (Upper Assam and Nagaland) and



Dingodinium cerviculum Cookson & Eisenack emend. Khowaja-Ateequzzaman *et al.*, an Early Cretaceous index dinoflagellate cyst, from the subsurface of Palar Basin.

Palaeocene (Meghalaya) coals respectively. It has been presumed that the Oligocene oil-source in Upper Assam and Nagaland have generated oil mainly from Kerogen types IIB and IIA association, whereas, in Meghalaya the coals with high hydrogen-index (300-470 mg CH/g org.) and dominance of Kerogen types IIA and IIB suggest a good prospect of Palaeocene oil.

B. K. Misra

Project I.D.5 : **Fossil flora, palaeogeography, palaeoecology and palynostratigraphy of Cauvery, Palar, Krishna-Godavari, Bengal and Andaman basins**

Objective : *Morphotaxonomy, biozonation, correlation, biostratigraphy, palaeoecology and phytogeography*

Subproject I.D.5.3 : Phytoplankton biostratigraphy of Cretaceous-Tertiary sequence of Cauvery and Palar basins

Objective : Identification of phytoplankton taxa, biozonation, age determination and palaeoenvironment of sedimentary sequences

The Cretaceous sequence of Cauvery and Palar basins includes five dinocyst assemblage zones in Trichinopoly Formation, Cauvery Basin and two interval zones with seven interval sub-zones in 745.9 m deep PUD bore-core sequence at Puduvoyal, Palar Basin.

The age of Trichinopoly assemblage zones ranges from Turonian to Santonian whereas the *Aptea anapbrissa* and *Muderongia mcwbaei* interval zones of PUD bore-core sequence are correlated with *Odontochitina operculata* zone, assigned to uppermost Early to Late Barremian age.

The behaviour of dinocysts through the Barremian sequence of Palar Basin indicates warmer conditions due to high percentage of chorate and proximochorate dinocysts, but increase in cavate cysts at the base indicates a drop in temperature.

A group of lenticular type of dinocyst taxa lacking postcingular horns and having traces of paratabulation as are present either diagnostic of or atleast compatible with gonyaulacoid pattern, recovered from the shell limestone unit of Trichinopoly Formation exposed near Kunnam and Annapadi villages in Tiruchirapalli District were studied in detail. One new genus and three new species have been proposed.

Detailed morphological study of a rich suite of *Dingodinium cerviculum* cysts recovered from sub-surface Lower Cretaceous sequence of Palar Basin has been completed. Different views regarding archaeopyle type in *D. cerviculum* were critically analysed and a new concept has been proposed.

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

Subproject I.D.5.4 : Tertiary megafossils of Cauvery Basin and their comparison with extant plants

Objective : Comparative morphology of petrified and carbonised woods and leaves and palaeoecology

Carbonised woods of *Baubinia* (Fabaceae) and *Altingia* (Hamamelidaceae) have been identified from the Neyveli lignite mine. Occurrence of *Altingia* is indicative of swampy environment of the lignite deposition.

Anil Agarwal

Subproject I.D.5.6 : Fossil calcareous algae from Cauvery Basin

Objective : Morphotaxonomy of calcareous algae and their significance as rock builders

Morphotaxonomic studies have been carried out on *Cayeuxia*, *Halimeda*, *Neomeris*, *Permocalculus*, *Litbothamnium* and *Archaeolithothamnium* from thin

sections of Kallakudi Limestone. Different forms have been documented and described.

A. Rajanikanth

Subproject I.D.5.7 : Floristics of Neogene sediments in Bihar and Bengal

Objective : *Vegetational history of the Neogene period*

Report on leaf-impressions, flowers, fruits and petrified woods representing 31 genera belonging to 22 families of dicotyledons from the Cenozoic of Bihar and Bengal was finalized.

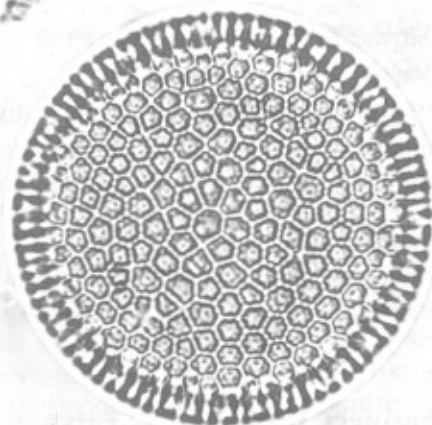
M. B. Bande and G. P. Srivastava

Subproject I.D.5.8 : Cenozoic diatom biostratigraphy, palaeogeography and palaeoecology of the Cenozoic diatoms

Objective : *Morphotaxonomy, biostratigraphy, palaeogeography and palaeoecology of the Cenozoic diatoms*

A rich assemblage of diatoms and silicoflagellates has been recovered from Miocene sequence of Nancowry and Kamorta Islands (Nicobar Group). Morphotaxonomical studies of this assemblage is carried out. The diatom assemblage is represented by various species of *Actinocyclus*, *Actinoptycbus*, *Arachnoidiscus*, *Asterolampra*, *Asteromphalus*, *Aulocodiscus*, *Auliscus*, *Azpeitia*, *Campylodiscus*, *Diploneis*, *Campyloneis*, *Cocconeis*, *Craspedodiscus*, *Coscinodiscus*, *Denticulopsis*, *Hemidiscus*, *Gephyria*, *Navicula*, *Nitzschia*, *Paralia*, *Podocystis*, *Rhabboneis*, *Surirella*, *Thalassiosira*, *Triceratium*. Stratigraphically important taxa are comparable to the low latitude diatom zones of Middle Miocene. Silicoflagellates include *Dictyocha*, *Mesocena* and *Distephanus*.

Anil Chandra



Coscinodiscus marginatus Ehrenberg from the Miocene sediments of Nancowry, Nicobar Islands.

Project I.D.6 : **Palynostratigraphy and fossil floras of sedimentary basins in Gujarat, Rajasthan and Narmada Valley**

Objective : *Morphology, palynostratigraphy, biozonation and palaeoenvironments*

Subproject I.D.6.1 : **Studies of Tertiary plants from Jaisalmer and Cambay Basin**

Objective : *To build up vegetational history*

Fossil woods of *Bombax* and *Ficus* from Upper Tertiary sediments near Jaisalmer have been identified. Fossil woods of *Lagerstroemia*, *Sterculia* and *Tamarindus* are recorded from the Tertiary sediments of Gujarat. The genus *Barringtonia* has also been found in the Miocene sediments of Kutch.

J. S. Guleria

Subproject I.D.6.3 : **Nannoplankton morphology and biostratigraphy of Mesozoic and Tertiary sediments of Kutch and Jaisalmer basins**

Objective : *To study various lithounits for nannoplankton biostratigraphy and for deducing palaeoenvironment*

One hundred and seventeen calcareous nannoplankton taxa have been identified from the Eocene of Kutch. These include 16 new species, 12 new combinations and 5 lectotype designations. This study highlights: (i) Recognition of post-Trappean Bartonian event and rejection of Palaeocene, Early Eocene and Lutetian marine sediments in Kutch Basin, (ii) Integration of planktonic foraminiferal zones with nannoplankton zones, (iii) Near-shore tropical mode of deposition for Bartonian sediments.

Sparse but valuable nannoplankton taxa *Watznaueria barnesae*, *Watznaueria brittanica*, *Eprolithus floralis*, *Rucinolithus irregularis*, *Rbagodiscus angustus*, *Stradneria crenulata*, *Chiastozygus* sp. and *Zeugorbabdotus* sp., favour assignment to CC7 *Chiastozygus litterarius* zone of Late Aptian-Early Albian age for a black shale of Pariwar Formation found in a bore-well at 300 m depth at Habur Village, Jaisalmer District.

Early Oxfordian nanoflora is documented under LM and SEM. Incorporating sedimentologic data, five palaeoceanographic events are recognised in Kuldhra Member of Jaisalmer Formation at Kuldhra Village. Hard ground/omission surfaces are recognised and several nannoplankton taxa reported for the first time from non-European area. Eight new species and one new combination are proposed. Correlations are suggested with nannoplankton zones of adjoining Kutch Basin and the geotectonic evolution of Kutch-Jaisalmer Basin is discussed.

S. A. Jafar and Jyotsana Rai

Subproject I.D.6.4 : **Palynology of Mesozoic deposits in Narmada and Saurashtra basins**

Objective : *Palynostratigraphy, biozonation and correlation*

A 0.70 m thick carbonaceous band from inliers of Ellichpur area, Maharashtra has been found to contain *Callispora potonieii*, *Matonisporites dubius*, *Contignisporites glebulentus*, *Triporoletes reticulatus*, *Coptospora kutchensis*, *Cooksonites* sp., etc. The prominence of *Callialasporites*, *Podocarpidites* and *Alisporites* has been recorded. This palynoassemblage correlates well with the *Triporoletes reticulatus* zone of Cauvery Basin and other Early Cretaceous assemblages.

Pramod Kumar

Subproject I.D.6.5 : Floristics, phytogeography and biostratigraphy of Lameta Group

Objective : *Morphotaxonomy, floristics, phytogeography and biostratigraphy*

The plant remains of *Azolla* from Dongargaon comprise branched slender stems bearing small, crowded alternately arranged leaves. The microsporocarps are large in size and contain sporangia. The megaspores are marked with massulae. These organs are attributed to a single species due to their close association. It appears that the genus *Azolla* was established in India during the Maastrichtian time.

Sukh-Dev

Subproject I.D.6.6 : Palaeocene palynology of Rajasthan—a reconnaissance

Objective : *Morphotaxonomy, biozonation, correlation and palaeoecology*

Morphotaxonomic studies of 46 samples from Barmer Sandstone, Rajasthan revealed *Dandotiaspora*, *Todisporites*, *Lygodiumsporites*, *Palmaepollenites*, *Liliacidites*, *Proxapertites* and *Neocouperipollis*.

S. K. M. Tripathi

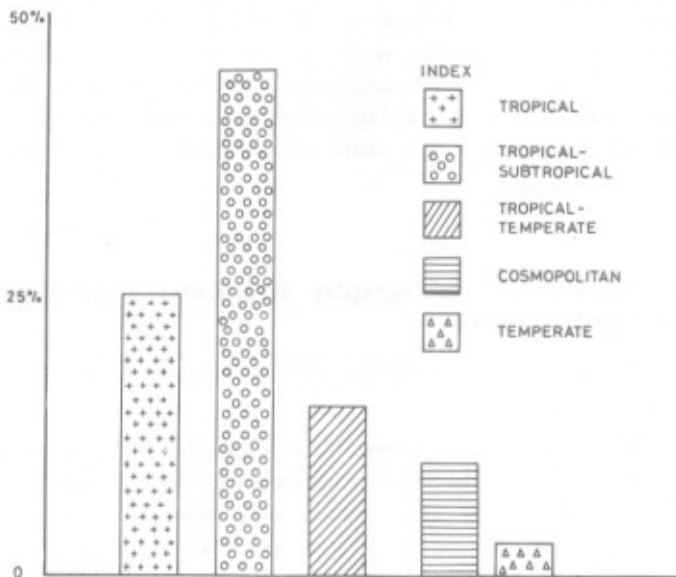
Project I.D.7 : Palynostratigraphy and organic petrology of the Tertiary sediments of Himalaya

Objective : *Biozonation, age determination and palaeoecological interpretation*

Subproject I.D.7.1 : Palynostratigraphy of the Lower Tertiary sediments of Simla Hills and adjoining areas

Objective : *Biozonation, age determination and palaeoecological interpretation*

Morphotaxonomic study of the Subathu palynofossils from Garkhal area was carried out. *Hystriobkolpoma* and *Diphyes* are the most dominant taxa. The other significant dinocyst taxa are *Fromea*, *Spiniferites*, *Acobomosphaera*, *Cordosphaeridium*, *Lingulodinium* and *Thalassiphora*. The overall composition of the present assemblage is closely comparable to that published from the *Homotryblium* Cenozone of Kalka-Simla and Banethi-Bagthan area of Himachal Pradesh. The assemblage seems to have been deposited in a flat tidal condition.



Distribution of fossil plants as related to climatic complexes in the Tertiary of Himalaya.

Chemical processing of the Subathu samples from Bonog-Bohol area has been completed. A diversified palynoflora assemblage has been recorded. Some important taxa in this assemblage are: *Homotryblium*, *Hystrichosphaeridium*, *Adnatosphaeridium*, *Glaphyrocysta* and *Podocarpidites*. Additionally, several new palynologically productive horizons have been located near Dhundhon.

Pinus pollen grains have been identified in the Kasauli palynofloral assemblage (Early Miocene) from its type locality. This is possibly the oldest record of *Pinus* pollen grains known from the Lesser Himalaya so far. Pollen grains of modern *Podocarpus*, *Pinus*, *Picea*, *Cedrus* and *Abies* have been studied and thoroughly compared with their fossil counterparts recorded from the Tertiary sediments of Himachal Pradesh to understand the range of variation as exhibited by their morphological characters.

Available palaeobotanical and palynological data from the Tertiary period of Himalaya have been critically analysed and vegetational models developed in response to varying altitudinal, latitudinal and palaeogeographical factors have been reconstructed. Development and diversification of vegetational patterns have been identified. Climatological changes through Palaeocene to Pliocene times in the Himalayan belt have been brought to light as exhibited by the vegetational complexes.

H. P. Singh and Samir Sarkar

Subproject I.D.7.2 : Palynostratigraphy of Tertiary sediments of Arunachal Pradesh

Objective : Morphotaxonomy, biozonation, correlation and palaeoecology

Palynological assemblages recovered from different Tertiary sections exposed in Kameng, Subansiri and Siang districts, Arunachal Pradesh are impoverished both in quality and quantity and are constituted by angiospermic and gymnospermic pollen, pteridophytic spores, dinoflagellate cysts, acritarchs and fungal remains. Reworked Permian palynofossils have also been recorded. Angiospermic pollen register dominance over other groups. The assemblage is comparable to the Miocene assemblages recorded from Assam-Arakan Basin and Quilon beds, Kerala. The area lying in the vicinity of depositional site seems to have supported tropical to subtropical vegetation. High altitude gymnospermic elements of the assemblage indicate an elevated topography surrounding the basin. Deposition of the sediments took place in a coastal environment. Miocene lithological units of Arunachal Pradesh have been correlated with Bokabil Formation, Assam.

S. K. M. Tripathi

Project I.D.8 : Palaeobotany and palynology of Tethyan Himalaya

Objective : *Morphotaxonomy, biostratigraphy and age determination*

Subproject I.D.8.1 : Palaeophytic and vegetational history of the Peritethyan realm

Objective : *Morphotaxonomy, floristics, biostratigraphy and age determination*

A collaborative programme on Palaeozoic plant fossils from Jammu and Kashmir has been formulated to be jointly worked out with the Geological Survey of India. Final approval is awaited.

Hari K. Maheshwari and Usha Bajpai

Subproject I.D.8.2 : Palynostratigraphic studies of Palaeozoic and Mesozoic sediments in Western Himalaya

Objective : *Morphotaxonomy, correlation and dating of sediments*

With reference to known lateral variability of spore-pollen complexes and provincialism among the palynoassemblages Indian Gondwana and Tethys Himalayan sediment, palynological assemblage are under study representing the Permian and Triassic morphotaxonomy of characteristic palynotaxa has also been discussed.

R. S. Tiwari and Vijaya

Subproject I.D.9 : Reconstruction of Quaternary vegetation and climatic pattern

Objective : *Palynostratigraphy, palaeoenvironment and palaeoclimate*

Subproject I.D.9.1 : History of vegetation and climate in the subtropical, temperate and alpine belts of Himachal Pradesh and Uttar Pradesh

Objective : *Palaeofloristics and palaeoenvironments of Quaternary Period through palynological studies*

Pollen analysis of a 3.5 m deep profile from Shatrughan Tal, Kumaon Himalaya, reveals the dominance of mixed Chirpine-Oak forest during last 1000 years depicting a warm temperate climate in the region. Non-arboreal vegetation was poorly represented by grasses, sedges, cheno/Ams, Asteraceae, etc. A more or less uniform vegetational pattern has been observed throughout the profile, except for a slight decline in the forest composition with a simultaneous increase of grasses, sedges together with culture pollen around 500 yrs. B.P. owing to anthropogenic activities.

The study of a part of 6 m deep lake bottom profile from Naukuchia Tal reveals the presence of a mixed Oak-Chirpine forest suggesting a warm temperate and moist climatic condition during last 6000 years. The non-arboreal vegetation comprising grasses, Asteraceae, Cheno/Ams. was meagrely represented.

Pollen spectra of 32 surface samples collected from Kumaon Himalaya provided an overview of the vegetation growing in the area vis-a-vis its representation in the pollen spectra.

The modern pollen and spore depositional models prepared from Sat Tal area in Kumaon Himalaya depict the major constituents of pollen/spore rain such as *Quercus*, *Pinus*, *Viburnum*, *Mallotus*, *Baubinia*, Rosaceae, Oleaceae, Poaceae and a number of fungal spores, viz., *Helminthosporium*, *Alternaria*, *Tetraploa*, *Xylaria*, *Nigrospora*, etc.

Pollen morphological studies were carried out of about a dozen plant species distributed in Kumaon Himalaya.

Chhaya Sharma and M. S. Chauhan

Subproject I.D.9.2 : **History of vegetation and climates in tropical montane forest in Kerala**

Objective : *Palynological investigation to build up a complete floral succession in forests of Anamalai Hills and Silent Valley*

Pollen analysis of 28 soil samples from the Silent Valley reveals the predominance of non-arboreal taxa over arboreals. Among the non-arboreals, Poaceae is the most dominant element. The arboreals are represented by *Elaeocarpus*, *Euonymus*, *Symplocos*, *Ilex*, *Palaquium*, etc. Fern and fungal spores are represented in good frequencies.

Pollen diagrams of 5 soil profiles from Anamalai and Silent Valley were prepared.

H. P. Gupta and S. K. Bera

Studied pollen morphology of 150 species of the Silent Valley plants to prepare an atlas. Pollen slides of seven species of Silent Valley plants of the families Berberidaceae, Caprifoliaceae, Celastraceae, Sabiaceae, Rubiaceae and Ternstroemiaceae were prepared.

H. A. Khan

Subproject I.D.9.3 : Dendrochronology of Indian tropical trees

Objective : Tree ring analysis and decoding climatic data with emphasis on monsoon records

Cross dating of 16 cores of Deodar collected from near Joshimath and Harsil in U.P. Himalaya have been completed and a master tree ring chronology has been prepared. Growth and climatic relationship of Deodar, growing near Joshimath using "Response Function" a type of multivariate statistical analysis has been carried out.

Cross dating of 5 cores of *Toona ciliata* collected from moist evergreen forest of south India have been completed.

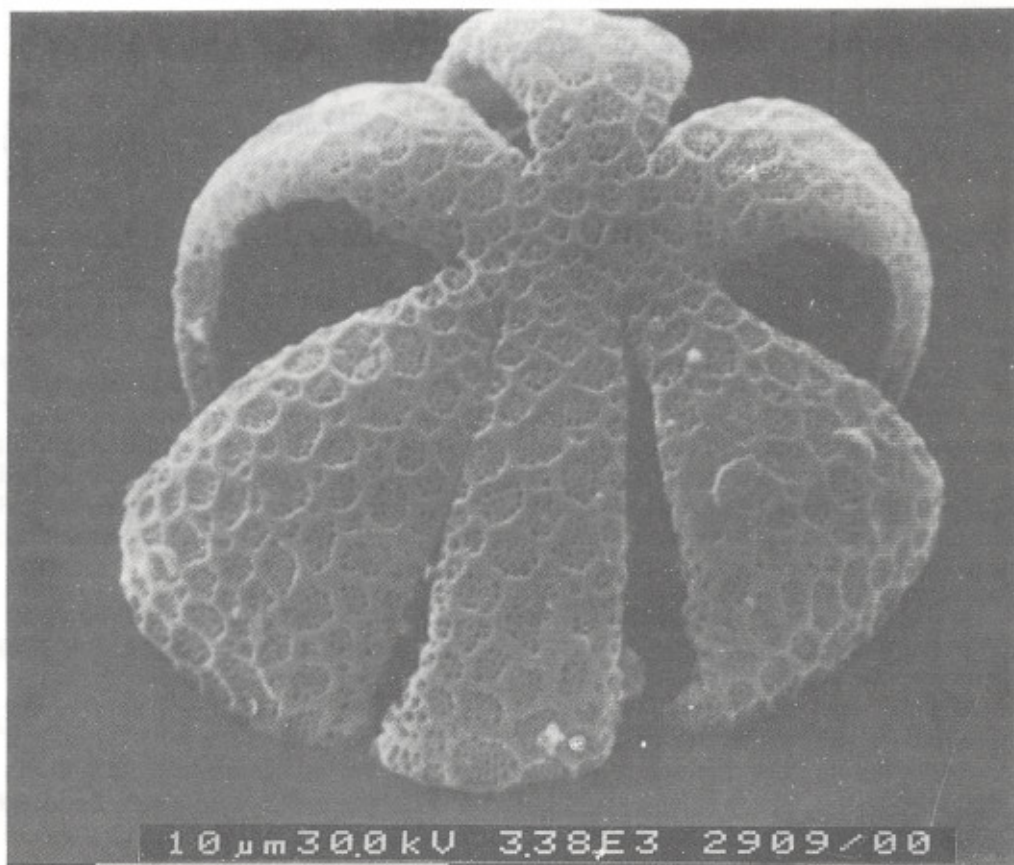
R. R. Yadav and A. Bhattacharyya

Subproject I.D.9.4 : Pollen flora of Sikkim Himalaya

Objective : To prepare modern pollen atlas of Sikkim plants to serve as a model for the study of Quaternary sediments

Studied pollen of 15 taxa belonging to Lamiaceae, Polygonaceae, Urticaceae, Salicaceae, Nyctaginaceae and Asteraceae. Carried out detailed pollen morphological studies on *Salvia leucantha* and *Polygonum*.

Chhaya Sharma and Asha Gupta



Double sculptural pattern in pollen of *Salvia leucantha* Cav.

Project I.D.10 : History of mangrove vegetation in India

Objective : *Reconstruction of Holocene vegetation and to understand the ecosystem, causes of deterioration of mangroves in time and space and its impact on environment*

Pollen analysed a 5.5 m deep profile from Balugaon, Chilka Lake, Orissa and constructed the pollen diagram (dated about 3200 yrs. B.P.). It depicts the gradual deterioration of mangrove vegetation in and around Chilka Lake. On completion of D.O.M. studies a diagram showing different types of organic matter in different values has been prepared.

Pollen analysed 14 samples of lake water, lake bottom mud and surface soil collected in and around Chilka Lake and prepared a pollen diagram and a pollen depositional model for south-western flank of Chilka Lake. Pollen/spore calendar of air catches at the bank of Chilka Lake represents upland and hinterland vegetation rather than mangrove vegetation.

H. P. Gupta and Asha Khandelwal

Project I.D.11 : Geochronology of Indian rocks

Objective : *Radiometric dating*

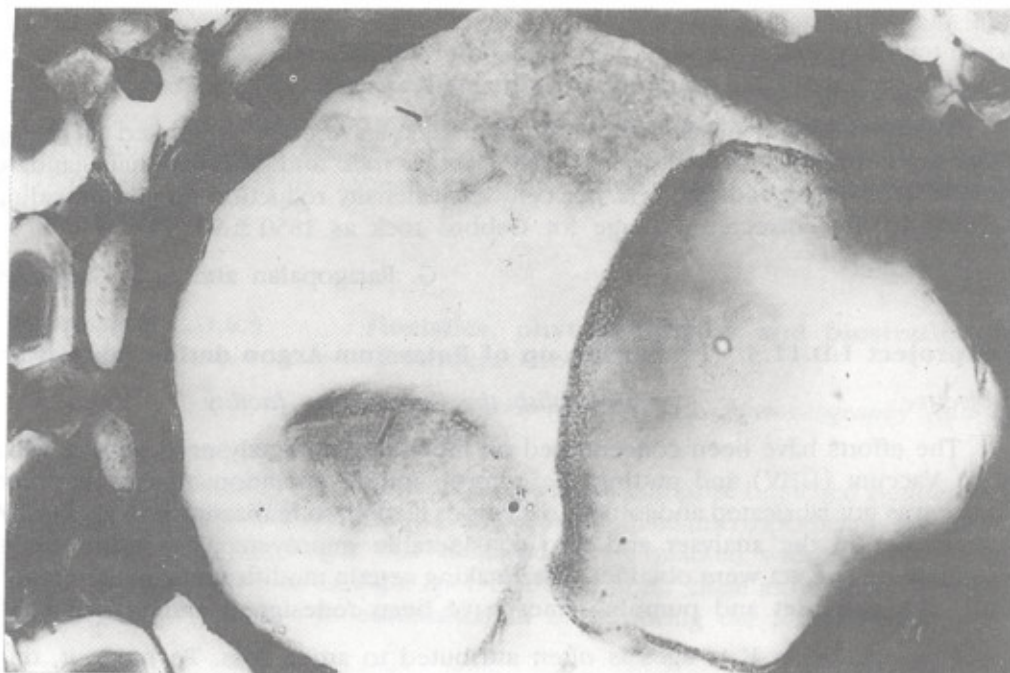
Subproject I.D.11.1 : Radiocarbon dating of carbonaceous material from Quaternary deposits and of cultural importance

Objective : *To investigate rate of subsidence of Ganga Plain, rate of sedimentation in Indian Ocean and chronology of vegetational changes in the Himalayan region*

Seventy two samples including anthracite background and NBS Oxalic acid (contemporary radiocarbon standard) were processed. C-14 ages for 50 samples have been calculated. Eleven samples could not be dated due to very low carbon content.

Six more samples from Arabian sea core (SK-185) have been dated to correlate with $\delta^{18}\text{O}$ measurements carried out at PRL, Ahmedabad. The most important feature of these measurements on this core is a negative excursion of $\delta^{18}\text{O}$ during last glacial maximum (18 ± 1.5 Kyr) which lasted for nearly 4 Kyr. This has been interpreted as due to increased run off from South Indian rivers during north-east monsoon leading to low salinity waters reaching the core site by oceanic currents. These data show stronger north-east monsoon during last glaciation.

Further C-14 age measurements on calcrete and marl deposits of Gangetic alluvium indicate a clear correlation with the known global climatic phases. Aridity conditions during glacial periods lead to formation of calcrete deposits in the plains which have ages corresponding to global glaciations. The marl deposit in the abandoned channel has been dated to 8500 yrs B.P. at base (2.6 m). The rate of sedimentation in the channel is only 0.7 cm/100 yrs as against 2.7 cm/100 yrs obtained for the alluvial deposit. This low rate of deposition indicates flooding during sea level rise in Early Holocene and abandonment later on due to changes in river course.



Fossil fission-tracks on apatite grains deposited in the vessel of a petrified wood—*Palmoxyton*, from the Deccan Intertrappean beds, Mandla District (F-T age 54 ± 6 Ma).

Benzene synthesis on a number of CO_2 samples have been made. The maximum yield obtained was only 65 per cent. The chemical procedure needs some modifications for which the glass system is being redesigned.

G. Rajagopalan

Subproject I.D.11.2 : Fission-Track dating of the rock samples

Objective : To date minerals and rocks by Fission-Track method

Fifteen transverse thin sections for each of the two petrified wood samples (collected under Project ID 14) from Keria and Mohgaonkalan in Nagpur-Chhindwara region were processed for F-T dating. The F-T ages of the two samples have been obtained as 51 ± 6 and 45 ± 5 Ma.

On the two glauconitic sandstone check samples from Kutch, Gujarat, one sample (Gh-5) was slightly weathered. Only after a large number of trials in the settings of magnetic separator a good separation of glauconitic grains could be obtained from this sample. The respective F-T ages obtained are 138 ± 22 Ma, which agree well with the ages indicated by ammonite studies.

Our laboratory has been chosen as one among the sixteen laboratories all over world, for the calibration work on International F-T age Standard samples of Apatite and Zircon. Track densities for fossil and preinduced grains in Apatite standard sample (88/5/29) have been obtained as 1.51×10^6 and 1.08×10^6 t/cm², respectively. The fossil track densities for the other two standard samples (88-2 and 88-4) have been obtained as 3.64×10^5 and 5.28×10^5 t/cm²). For Zircon sample

(88/4) a track etching assembly was designed for proper revelation of tracks. The fossil tracks in Zircon standard were etched in KOH pellets at 220 degree Celsius for 5 hours and the fossil track density obtained was 6.53×10^5 t/cm².

The track length measurements on 300 tracks have been completed including fossil and induced Apatite grains from Gabbro rock and International Standard sample. This study indicated 32 per cent track density reduction due to annealing leading to the corrected F-T age for Gabbro rock as 1850 ± 90 Ma.

G. Rajagopalan and A. P. Srivastava

Subproject I.D.11.3 : Setting up of Potassium-Argon dating laboratory

Objective : To establish the K-Ar dating facility

The efforts have been concentrated on modifying the analyser to achieve Ultra High Vacuum (UHV) and putting the control unit in operation. A new modified flange was got fabricated and joined to analyser leading to realization of UHV (in 10^8 torr range) in the analyser and also considerable improvement in static mode. Residual gas spectra were obtained after making certain modifications in the control unit. The gas inlet and pumping lines have been redesigned and reassembled.

Discrepancy in K-Ar ages is often attributed to argon loss. To judge it, thin section studies on Deccan Trap samples have been initiated and slides of 5 trap samples have been prepared. Glaucony separates from sandstone samples collected from Newari (Vindhyana) have also been prepared.

C. M. Nautiyal and G. Rajagopalan

Project I.D.12 : Environmental and depositional studies in modern sediments

Objective : Depositional environments

Subproject I.D.12.1 : Study of Kerala mud banks and estuaries to develop a suitable analogue to understand ancient sediments

Objective : To understand the depositional environment of mud-bank and to develop a profile of palynological studies in marginal areas

Palynological charts and histograms were prepared to show the distributional pattern of spores, pollen grains, phytoplankton, cuticle and tracheids in Vembanad Lake, Alleppy and Quilandy mud-banks. It was observed that terrigenous entities are more prevalent towards the shore while phytoplanktons abound from the shore.

R. K. Kar and Madhav Kumar (in collaboration with CESS)

Project I.D.13 : Atlases of stratigraphically and ecologically significant Indian fossil taxa and fossil floras

Objective : Preparation of atlases of stratigraphically and ecologically significant taxa

Subproject I.D.13.1 : Catalogue of stratigraphically significant palynofossils in the Indian Gondwana sediments

Objective : Cataloguing of stratigraphically significant palynofossils

The first volume of catalogue elaborating on four pollen genera, viz., *Callumispora*, *Parasaccites*, *Crucisaccites* and *Faunipollenites* has been completed. This contains observations made after examination of type specimens and related material under light and scanning electron microscopes. Their circumscription and key for various taxa and stratigraphic distribution are detailed.

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

Subproject I.D.13.2 : Software development for morphotaxonomy and palynostratigraphy

Objective : To update data bank on palynology of Gondwana related sediments and to develop software for morphology of taxa and palynostratigraphy

Updating of the data bank was continued. The information is being transferred to 18 BIT machine. Various morphographic characters have been identified and coded for developing the software for morphotaxonomic studies. Various characteristic assemblages and their combinations have been identified for the software for palynostratigraphy.

R. S. Tiwari, Suresh C. Srivastava, Archana Tripathi, Vijaya, B. N. Jana, Neerja Jha, Ram Awatar, K. L. Meena and A. P. Bhattacharyya

Subproject I.D.13.3 : An atlas of Tertiary palynofossils

Objective : To catalogue stratigraphically significant palynofossils

Twenty-three samples of Walalane bore-core, Senegal were chemically processed. Nine samples yielded spores, pollen and phytoplankton. The assemblage is dominated by angiospermic pollen followed by pteridophytic spores. *Dandotiaspora dilata* and *Matanomadbiasulcites* recorded from the Palaeocene of India are also present in the assemblage. *Proxapertites*, *Spinizonocolpites*, *Longapertites* and *Ariadnaesporites* have been provisionally identified. A Palaeocene age is assigned to the assemblage on the basis of known pantropical markers.

This is the first documented record of Palaeocene assemblage in Senegal.

B. S. Venkatachala and R. K. Kar (in collaboration with C. Caratini and C. Tissot of French Institute, Pondicherry)

Project I.D.14 : Deccan Intertrappean flora

Objective : Critical investigation of the flora to trace the phylogeny and evolution of angiosperms, phytogeography and ecology of Tertiary Deccan flora

Based on the evidence of the Deccan Intertrappean fossil plants, reconstructions of the vegetation around Nagpur-Chhindwara and Sahpura (Mandla



Early Tertiary vegetational reconstruction around Shahpura, Mandla District, Madhya Pradesh.



A leaf-impression of *Terminalia chebula*, an element of moist deciduous forests, from the Siwalik sediments, Nepal.

District, M.P.) during the Early Tertiary was taken up. Dummies of the reconstructions were prepared and draft of the manuscript finalised.

M. B. Bande

Project I.D.15 : Siwalik flora and its stratigraphical implications

Objective : *Floral composition of the Siwalik Group, palaeoecology and phytogeography of the Himalayan foot-hills during the period*

Subproject I.D.15.1 : Siwalik plant megafossils

Objective : *Comparative morphology, floristics, palaeoecology and phytogeography*

A large number of leaf-impressions and a few fruits further collected from the Siwalik sediments exposed along Mahendra Raj Marg, Suraikhola area, Nepal were investigated. Most of the leaves and fruits were studied and photographed. They are assignable to over hundred new types, of which about 52 have been identified by comparing them with herbarium sheets at the Central National Herbarium, Howrah.

N. Awasthi and Mahesh Prasad

Subproject I.D.15.3 : Palynological study of the Siwalik sediments from Suraikhola area, Nepal

Objective : *Systematic palynology, biozonation and palaeoecology*

Significant elements of the Siwalik palynoflora from Surai Khola are *Zygnema*, *Mougeotia*, *Botryococcus*, *Striatriletes*, *Lycopodiumsporites*, *Monoporopollenites* and *Polyadopollenites*. Periodic changes in the composition of the palynological spectra show that the vegetational succession reflects changing palaeogeographical conditions. A fresh-water swampy condition is interpreted for older horizons. Palyno-associations from various stratigraphic levels indicate an interplay of different compositions of semievergreen vegetational pattern.

Palynological investigation of the Siwalik sediments exposed along Nalagarh-Ramshahr Road section in Solan District, Himachal Pradesh, reveals a total of 24 genera and 30 species of gymnospermous and angiospermous pollen grains, pteridophytic spores, fungal spores and conidia. The presence of desmids indicates fresh water environment of deposition. The marine influence as indicated by other workers has not been confirmed.

Samir Sarkar

Project I.D.16 : Plant remains from pre- and proto-historic sites in India

Objective : *Plant economy of ancient India*

Subproject I.D.16.1 : History of economic crops and other plants from pre- and proto-historic sites

Objective : *To trace history of crops and other plants*

The study of wood charcoal remains from an ancient mound in a village Rohira, District Sangrur in Punjab (Ca 2300-1700 B.C.) revealed the mode of timber exploitation by Harappans. From pre-Harappan levels (2300-2000 B.C.) the woods have been identified as belonging to *Acacia* sp., *Capparis aphylla*, *Cedrela toona*, *Mimusops* cf. *hexandra*, *Tectona grandis*, *Tamarix* sp., *Cedrus deodara*, *Vitis vinifera* and *Lawsonia inermis*. In the succeeding mature Harappan deposits (2000-1700 B.C.) the wood charcoals belong to *Acacia* sp., *Tamarix* sp., *Dalbergia sissoo*, *Nyctanthes arbortristis* and *Vitis vinifera*.

The presence of *Acacia*, *Tamarix* and *Capparis* charcoals suggests the arid conditions during the period of Harappan settlement. *Vitis vinifera*, *Lawsonia inermis* and *Nyctanthes arbortristis* have brought to light the first substantial evidence that the Harappans in India maintained the horticultural and gardening traditions, which demand a different set of skills and techniques. *Lawsonia* and *Nyctanthes* are of Mediterranean origin and their occurrence in Punjab is suggestive of their introduction from West Asia.

K. S. Saraswat

Subproject I.D.16.2 : History of early domestication of plants

Objective : *To work out usefulness of wild plants in ancient times and the origin of cultivars*

Wood charcoals have been studied from different cultural horizons at Hulaskhera, District Lucknow, U.P. dating back from 800 B.C.-500 A.D. *Acacia* sp., *Cedrela* sp., *Madhuca indica*, *Lagerstroemia* sp., *Sborea robusta* and *Ziziphus* sp. are known from the Black Slipped Ware phase (800-600 B.C.). Timbers from the subsequent Sunga, Kushana and Gupta periods (200 B.C.-500 A.D.), have tentatively been identified as those of families Anacardiaceae, Combretaceae, Leguminosae, Lythraceae, Meliaceae and Rubiaceae.

A large number of weeds and other wild species have been identified from this site (800 B.C.-500 A.D.), to sketch the perspectives of ecological potential of contemporary agro-ecosystem. The species identified include *Commelina benghalensis*, *Fimbristylis* sp., *Portulaca* sp., *Dactyloctenium aegyptium*, *Eleusine indica*, *Echinochloa crusgalli*, *Panicum* sp., *Cyperus* sp., *Elaeocharis* sp., *Chenopodium* sp., *Trianthema portulacastrum*, *Scleria elata*, *Solanum* sp., *Scripus* sp., *Lathyrus apbaca*, *Vicia* sp., *Polygonum barbatum*, *Trigonella occulta*, *Sida spinosa*, *Indigofera* sp., *Poa* sp., *Carex* sp., *Datura stramonium* and *Desmodium gangeticum*.

Chanchala

Project Sp. 1 : **Geology, palaeobiology, geochemistry and isotopic composition of Archaean sediments of India**
(DST no. 22 (IP-6)/84-STP II)

Objective : To search stromatolitic structures and organic remains in the Archaean sediments and their evaluation

Lateral extension of stromatolites from Kumsi manganese mines has been established in Shimoga Schist Belt of Dharwar Craton. Detailed study of the first locality and preliminary examinations at two more localities have established cyclicity in the development of stromatolites. Continued search for microbiota in the associated cherts has so far not yielded positive results. Detailed study reveals presence of two types of filamentous remains, viz., *Phormidella tenue* and *Phormidella sandurensis* which are comparable to extant *Phormidium*. Microspherules having carbon in traces have been observed in rock thin section from another locality of Sandur Schist Belt, Dharwar Craton.

Methanotrophic and methanogenic bacteria have been observed under S.E.M. in graphites from Kular, Ganacharpur and Nagvand area. ^{13}C ratio for these graphites range between -23 to -35 per cent vs PDB which supports biogenic origin and role of methanogenic and methanotrophic bacteria in these formations.

The studies carried out so far, therefore have brought forth convincing evidence for extensive palaeobiological activity in the Archaean Dharwar Craton. The Archaean record, in the Dharwar Craton spanning 3.4 to 2.6 Ga provides evidence for:

- a. Highly evolved sedimentary environments and well-defined shelf zones.
- b. Development of highly evolved stromatolites.
- c. Presence of photosynthetic cyanobacteria in stromatolite and cherts of iron formations.

- d. Activity of iron reducing bacteria.
- e. Existence of methanogenic and methanotrophic bacteria.

B. S. Venkatachala, Manoj Shukla, V. K. Yadav, Mukund Sharma and Rajendra Bansal (jointly with NGRI, Hyderabad and BARC, Bombay)

Project Sp. 2 : Nannoplankton biostratigraphy and palaeoenvironmental framework of Cretaceous-Palaeocene sedimentaries of Andaman Islands, India (DST no. ES/23/003/86)

Objective : To study various lithounits for nannoplankton productivity and to deduce age and palaeoenvironment

Critical marker species of coccoliths and discoasters suggesting Early Campanian to Late Eocene time slice have been recorded and documented from Nayagarh Mud Volcano samples of Baratang Island. Nannofloral assemblage *Discoaster* sp., *D. barbadiensis*, *D. kuepperi*, *D. saipanensis*, *D. lodoensis*, *D. salisburgensis*, *D. binodosus*, *D. elegans*, *D. nonradiatus*, *D. billi*, *D. megastypus* and *Rhamboaster cusps* suggest definite presence of Early Eocene and Lutetian-Priabonian Flysch sediments in subsurface of Baratang Island.

S. A. Jafar, U. C. Mainali and O. P. Singh

Sixtytwo samples available from Cretaceous-Tertiary sediments of Andaman Islands were processed chemically for the recovery of palynofossils with a view to determine the age and palaeoenvironment of these sediments. Palynological studies indicate the occurrence of Late Cretaceous and post Upper Eocene sediments in this area.

S. K. M. Tripathi

Project Sp. 3 : Palynostratigraphy of the Ratnagiri and Neyveli lignites and associated sediments (CSIR no. 24(171)/86-EMR II)

Objective : Morphotaxonomy of spore/pollen, biostratigraphic zonation, dating and correlation of sediments with other lignite bearing sediments of South India and palaeoecological interpretations

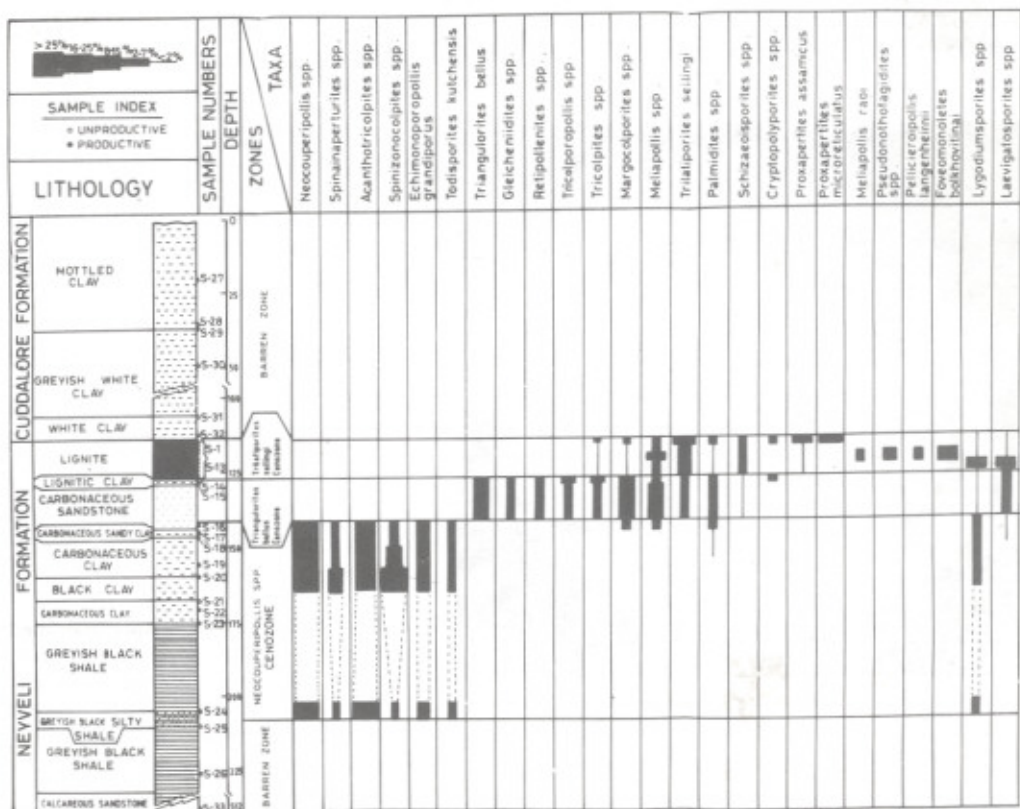
The palynofloral assemblage of Amberiwadi consists of 61 genera and 98 species of fungal remains, pteridophytic spores and angiospermous pollen grains. The fungal remains and pteridophytic spores are dominant in the assemblage, whereas angiosperm pollen are poorly represented. The palynofossils which are significantly represented in the assemblage have been referred to *Phragmothyrites*, *Ratnagiriathyrites*, *Lirasporis*, *Heliospermopsis*, *Trichothyrites*, *Inapertisporites*, *Cyathidites*, *Todisporites*, *Lygodiumsporites*, *Assamiasporites*, *Laevigatosporites*, *Monolites*, *Polypodiaceasporites*, *Polypodiisporites*, *Lakiapollis*, *Dermatobrevicolporites*, *Verrutripores*, etc. The palynoflora suggests a warm, humid (tropical) climate with good rainfall during the deposition of the Ratnagiri beds. The

environment of deposition has been interpreted as near shore with sufficient fresh water supply and fresh water swamps nearby.

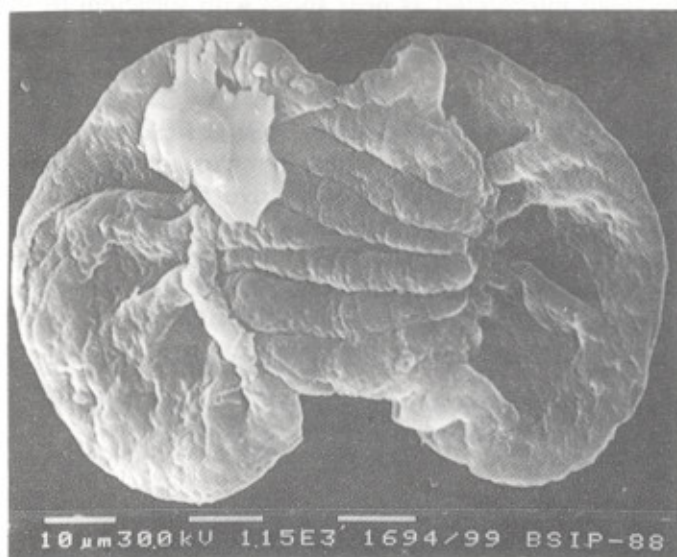
R. K. Saxena and N. K. Misra

The Neyveli Formation of Jayamkondacholapuram well-12 (South Arcot District) consists of 48 genera and 95 species of fungal remains, pteridophytic spores and angiospermous pollen. On the basis of qualitative and quantitative analyses, this unit is divided into three biostratigraphic zones, viz., *Neocouperipollis* spp. Cenozoone, *Triangularites bellus* Cenozoone and *Trilatiporites sellongi* Cenozoone. The comparison of the present assemblage with the known Indian Tertiary palynofloras suggests a Palaeocene-Eocene age.

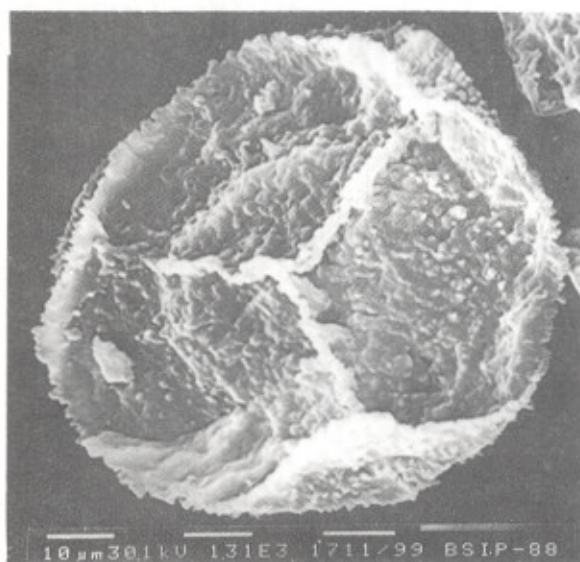
R. K. Saxena and Sanjay Khare



Palynostratigraphic zonation of the Neyveli Formation in Jayamkondacholapuram well-12, Tamil Nadu.



A



B

A, *Striatites* and **B**, *Gondisporites* from the newly identified Upper Permian coal-bearing horizons in Dewanganj-Birbhum area.

Project Sp. 4

: Palynological dating and correlation of newly identified coal-bearing strata in Birbhum, Diwanganj Area, West Bengal (CSIR no. 24(172)/86 EMR-II)

Objective

: To build palynostratigraphy through coal-bearing subsurface strata in these areas and to determine their age

All aspects of palynological study of bore DNJ-11 have been completed. Fifteen samples ranging from 354 to 68 m depth have been studied quantitatively for different palynotaxa. Initially a *Scheuringipollenites* dominated Barakar assemblage is documented. Subsequent productive samples show a "condensed sequence", starting with a somewhat Barren Measure aspect, characterised by *Densipollenites*, a Raniganj flora with characteristics *Indospora* and *Gondisporites* and ultimately the youngest two samples yielded a Triassic assemblage, attested by the presence of pollen genera *Falcisporites*, *Satsangisaccites* and *Weylandites*.

R. S. Tiwari and D. Chowdhury

Project Sp. 5 : Phytoplankton biostratigraphy with emphasis on an integrated model for dating, biozonation and correlation of marine Cretaceous-Tertiary sequence of Assam Shelf (CSIR no. 24(170)/86-EMR-II)

Objective : *Dinocysts morphology, taxonomy and identification of index phytoplankton taxa; biozonation, age determination and correlation of sedimentary sequences; precise demarcation of time boundaries and palaeoenvironmental and palaeobiogeographic interpretations*

Dinocyst assemblages from Upper Mahadek and Langpar formations have been studied in detail. Photodocumentation under phase/differential interference contrast of dinocyst assemblage from part of the section containing the reported iridium peak is completed. Thirty dinocyst taxa are identified. The assemblage includes *Dinogymnium acuminatum*, *Fibrocysta licia*, *Lejeunecysta hyalina*, *Pbelodinium magnificum*, *Ceratiopsis striata*, *C. diebelli*, *Andalusiella polymorpha*, *Hystrichokolpoma* cf. *rigaudae*, *H. bulbosa*, *Senegalinium bicavatum*, *Exochosphaeridium bifidum*, *Fibrocysta bipolaris*, *Areoligera senonensis*, *A. coronata*, *Palaeocystodinium* spp., *Cordosphaeridium exilimurum*, *C. inodes*, *Hafniasphaera* sp., *Danea californica* and *Chiropteridium inornatum*. Late Maestrichtian-Danian age is suggested for Langpar Formation exposed in Therriaghat area.

A rich dinocyst assemblage strikingly dominated by marginate cysts is recovered from top of the Mahadek Formation exposed along Cherra-Shella Road in Cherrapunji area.

Data file of dinocyst related bibliography of northeast India is updated.

K. P. Jain, Rahul Garg, N. C. Pant and A. S. Chopra

Project Sp. 6 : Studies of palaeoclimate through the application of palaeobotanical methods (D.S.T. no. E.S./63/028/86)

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

Prepared a list of 1000 plant species found in Sikkim Himalaya with information pertaining to their altitude, frequency and association with other elements. Description of pollen of extant taxa of plants from Sikkim Himalaya is in progress.

Chhaya Sharma

Collaborative Project : Study of the Plio-Pleistocene woods from Sahabi, Hadar, OMO and Semliki (Africa)

Objective : Plio-Pleistocene vegetational history of north and eastern Africa, reconstruction of palaeoenvironments and phytogeography

About 200 samples of fossil wood specimens from Semliki (Africa) were polished in transverse and tangential planes and sent to Belgium for further studies. Thin sections of 10 fossil woods from Hadar were prepared.

Photodocumentation of woods of about 90 modern species from Africa was done. Information regarding their habit-habitat and distribution in Africa was compiled.

M. B. Bande

International Geological Correlation Programmes

- I.G.C.P. Project 216** : **Global biological events in earth history**
K. P. Jain, Member, National Working Group
- I.G.C.P. Project 237** : **Gondwana floras**
H. K. Maheshwari, Co-convener, National Working Group
R. S. Tiwari, Member, National Working Group
- I.G.C.P. Project 245** : **Non-marine Cretaceous Correlation**
K. P. Jain, Member, National Working Group
Suresh C. Srivastava, Member, National Working Group
- I.G.C.P. Project 261** : **Stromatolites and their biostratigraphic significance**
Manoj Shukla, Member, National Working Group

Global Sedimentary Geology Programme

Cretaceous Resources/Events and Rhythms

K. P. Jain, Member, National Working Group

Doctorate Degree Awarded

K. L. Meena

- . Ph.D., Kanpur University,
Title of Thesis : "*Palynostratigraphic studies of-
Permo-Triassic sediments in Raniganj Coalfield,
India*"

Rajni Tewari

- . Ph.D., Kanpur University,
Title of Thesis: "*Contribution to palaeobotany of
Permian Gondwana of India*"

Doctorate Theses Submitted

- Khowaja-Ateequzzaman** — "Study of Cretaceous dinoflagellate cysts and acritarchs from East Coast of India: their application in biostratigraphy, palaeogeography and palaeoecology"
- Surendra R. Manik** — "Contributions to the Triassic flora of India"
- Neeru Pandya** — "Contributions to the Mesozoic flora of India"
- Jyotsana Rai** — "Calcareous Nannoplankton from Eocene of Kutch, western India"
- Gajendra P. Srivastava** — "Studies on the Cenozoic plants of West Bengal and Bihar"

Papers Submitted

- Acharyya, S. K., Raha, P. K., Das, D. P., Moitra, A. K., Shukla, Manoj & Bansal, Rajendra**—Late Proterozoic microbiota from the Infra-Krol rocks from Nainital Synform, U.P. Himalaya, India. *Indian J. Geol.*
- Awasthi, N.**—Siwalik Flora. *Encyclopedia India.*
- Awasthi, N. & Mehrotra, R. C.**—Additions to the flora of the Tipam Sandstone, northeast India. *Palaeobotanist.*
- Awasthi, N. & Prasad, Mahesh**—Studies on plant megafossils from the Siwalik sediment of Suraikhola, western Nepal and their palaeoecological implications—a preliminary report. *Palaeobotanist.*
- Bajpai, Usha**—The genus *Ginkgoites* from the Lower Permian of Rajmahal Hills, Bihar, India. *Ameghiniana.*
- Bajpai, Usha & Tewari, Rajni**—Plant fossils from youngest Raniganj beds in Jharia Coalfield. *Palaeobotanist.*
- Bande, M. B.**—Deccan Intertrappean Flora. *Encyclopedia India.*
- Bande, M. B., Srivastava, G. P. & Misra, V. P.**—Fossil leaves and flowers from the Upper Tertiary beds of Mahuadanr, Palamau District, Bihar. *Rec. geol. Surv. India.*
- Bande, M. B. & Srivastava, G. P.**—Fossil woods of Guttiferae (*Kayea*) and Lauraceae from the Tertiary of West Bengal, India. *Geophytology.*
- Bande, M. B. & Srivastava, G. P.**—Cenozoic plant fossils from Mahuadanr Valley, Palamau District, Bihar, India. *Palaeobotanist.*
- Banerji, Jayasri**—Plant fossils from Dubrajpur Formation at Khatangi Hill, Rajmahal Basin, Bihar and their implication in stratigraphy. *Palaeobotanist.*
- Bera, S. K. & Gupta, H. P.**—Correlation between pollen spectra and vegetation of Chhota Sigiri Glacier in Himachal Pradesh, India. *Palaeobotanist.*
- Bhaskaran, M., Rajagopalan, G. & Somayajulu, B. L. K.**—Th/ U and C dating of Quaternary carbonate deposits of Saurashtra, India. *Isotope Geosci.*
- Bhattacharyya, A.**—Palaeovegetation and climate during post-glacial period in the vicinity of Rohtang Pass, Himachal Pradesh. *Pollen Spores.*
- Bhattacharyya, A.**—Modern pollen spectra from Bara Sigiri Glacier. *Sci. Cult.*
- Bhattacharyya, A. & Yadav, R. R.**—Analysis of tree growth and climate relationship in Deodar (*Cedrus deodara*) from Joshimath, U.P. Himalaya. *Palaeobotanist.*
- Caratini, C., Delibrias, G. & Rajagopalan, G.**—Palaeomangroves of Kanara Coast (Karnataka, India) and their implications on Late Pleistocene sea level changes. *Palaeobotanist.*

- Chandra, A., Yadav, R. R., Saxena, R. K. & Setty, M. G. A. P.**—Palynological investigation of the sediment cores from the Arabian sea. *Pollen Spores*.
- Gupta, A.**—Fossil report of bilette bryophytic spores. *Curr. Sci*.
- Gupta, H. P.**—The Shola in South Indian montane : present, past and future. *Palaeobotanist*.
- Gupta, H. P. & Khandelwal, Asha**—Mangroves of India : history and palynostratigraphy of Chilka Lake, Orissa, India. *Palaeobotanist*.
- Gupta, H. P. & Yadav, R. R.**—History of mangrove vegetation in Paradeep and Jambu, Orissa, India for the past 500 yr B.P. : a palynological assessment. *Palaeobotanist*.
- Jafar, S. A. & Rai, Jyotsana**—Discovery of Albian nannoflora from type Dalmiapuram Formation, Cauvery Basin, India—palaeoceanographic remarks. *Curr. Sci*.
- Kar, R. K.**—Palynological studies of Miocene and Mio-Pliocene of north-east India. *Palaeontographica*.
- Kar, R. K.**—Palynological studies of the Barail sequence (Oligocene) in the type area, Assam, north-east India. *Palaeobotanist*.
- Kar, R. K.**—Palynology of Prang Formation (Middle-Upper Eocene) exposed on Jowai-Badarapur Road, Meghalaya, India. *Rev. Palaeobot. Palynol.*
- Khandelwal, A.**—Aeromycological survey at Lucknow. *Indian J. Plant Pathol.*
- Khandelwal, A.**—Vertical variation of aerospora concentration at Lucknow. *Geophytology*.
- Khowaja-Ateequzaman, Garg, Rahul & Jain, K. P.**—Observation on a archaeopyle type in fossil dinocyst species *Dingodinium cerviculum* Cookson & Eisenack 1958. *Palaeobotanist*.
- Khowaja-Ateequzaman & Jain, K. P.**—*Cauveridinium* gen. nov. and related GV type dinocyst taxa : a discussion. *Palaeobotanist*.
- Kumar, P.**—Status of Chaugan beds, Narsinghpur District, Madhya Pradesh : a palynological approach. *Palaeobotanist*.
- Maheshwari, H. K.**—The glossopterid fructifications—an overview. *Proc. 3rd I.O.P. Conference*, Melbourne.
- Maheshwari, H. K.**—Formation of coal. *Encyclopedia India*.
- Maheshwari, H. K., Bajpai, Usha & Tewari, Rajni**—Climatic reflections in the Permian vegetation of Indian peninsula. *Proc. VII int. Gondw. Symp.*, Sao Paulo.
- Maithy, P. K.**—First report of tiny pustular doughnut-shaped stromatolite from the middle Proterozoic of Vindhyan Supergroup exposed around Rohtas. *Proc. Indo-Soviet Symposium on Stromatolites and Stromatolitic deposits*, Dehradun.
- Maithy, P. K. & Babu, Rupendra**—Stromatolite morphology and microbiota from the Semri Group (Lower Vindhyan), Chopan, Uttar Pradesh. *Indian J. Earth Sci.*
- Maithy, P. K. & Babu, Rupendra**—Pseudomicrofossils and altered microfossils

from Palri Shale Formation, Lower Vindhyan, Chittorgarh, Rajasthan. *N.Jb. Geol. Palaeont. Stuttgart*.

Maithy, P. K. & Meena, K. L.—Organic-walled microfossils from the Proterozoic succession of Vindhyan Supergroup exposed around Satna and Maihar, Madhya Pradesh. *Indian J. Earth Sci.*

Maithy, P. K. & Meena, K. L.—*Tungussia paliensis* f. nov: a new stromatolite from the Bhandar Group, Upper Vindhyan of Sawai Madhopur, Rajasthan. *J. geol. Soc. India*.

Maithy, P. K., Rajagopalan, G., Narain, K., Sarkar, A. & Srivastava, A. P.—Geology, biology and Fission Track dating of the Vindhyan succession exposed around Rohtas, Rohtas District, Bihar. *Earth Sci. Rev.*

Mandal, J.—Palynological investigation of Palaeocene sediments from Thanjinath, Meghalaya. *Palaeobotanist*.

Manoharachari, C., Shukla, Manoj & Sharma, Mukund—Problem of fungal contamination in Precambrian palaeobiology—a cautionary note. *Palaeobotanist*.

Misra, B. K., Saxena, R. & Anand-Prakash—Spectrofluorimetric study of some resinites from Indian coals and lignites. *Palaeobotanist*.

Misra, B. K. & Singh, B. D.—The Lower Permian coal seams from Singrauli Coal-field (M.P.), India : petrochemical nature, rank, age and sedimentation. *Int. J. Coal Geol.*

Navale, G. K. B.—Methods for petrographic analysis of coal (part 1): definition of terms relating to petrographic analysis. *Indian standards*.

Pandya, Neeru & Sukh-Dev—Resolution of Gollapalle flora and its dating potential. *Palaeobotanist*.

Rajanikanth, A.—A fossil marine brown alga from the Gangapur Formation, Pranhita-Godavari Graben. *Curr. Sci.*

Rao, M. R.—Palynological investigation of Arthungal bore-hole, Alleppey District, Kerala. *Palaeobotanist*.

Ray, S. B., Rajagopalan, G. & Somayajulu, B. L. K.—Radiometric studies of sediment cores from Gulf of Mannar. *Marine Geology*.

Rigby, J. F. & Chandra, S.—A review of the Permian flora of Bacchus Marsh, Victoria. *Proc. 3rd I.O.P. Conference, Melbourne*.

Rigby, J. F. & Chandra, S.—Review of microsporangiate organs, possibly of *Glossopteris* in the Permian Gondwana flora. *Proc. 7th I.P.C., Brisbane*.

Sarkar, A., Ramesh, R., Bhattacharya, S. K. & Rajagopalan, G.—O evidences for a stronger North-East monsoon current during the last glaciation. *Nature*.

Sarkar, Samir—Siwalik pollen succession in Surai Khola of western Nepal and its palaeoecological implications. *Palaeobotanist*.

Sarkar, Samir—The Kakara palynofossils and their bearing on age. *Rev. Palaeobot. Palynol.*

- Sarkar, Samir, Bhattacharyya, A. P. & Singh, H. P.**—Palynology of Middle Siwalik sediments (Upper Miocene) from Bagh Rao, Uttar Pradesh, India. *Pollen Spores*.
- Saxena, R. & Bharadwaj, D. C.**—Biostratigraphy and palaeoecology of Lower Gondwana sediments of West Bokaro Coalfield, Bihar, India. *Rev. Palaeobot. Palynol.*
- Saxena, R., Bharadwaj, D. C. & Savanur, R. V.**—Geological and biostratigraphical studies of Barakar (Permian) sediments of West Bokaro Basin, India. *Int. J. Coal Geol.*
- Saxena, R., Navale, G. K. B., Chandra, D. & Prasad, Y. V.S.**—Organic petrology of the Permian coal seams susceptible to spontaneous combustion. *Palaeobotanist*.
- Saxena, R. K. & Bhattacharyya, A. P.**—Palynological investigation of the Dharmsala sediments in Dharmsala area, Kangra District, Himachal Pradesh. *Geophytology*.
- Saxena, R. K. & Khare, S.**—Biostratigraphic zonation and age of the Neyveli Formation of Jayamkondacholapuram well-12, South Arcot District, Tamil Nadu. *Indian J. Earth Sci.*
- Saxena, R. K., Khare, S. & Misra, N. K.**—*Ecbimonoporollis*, a new pollen genus from the Neyveli Formation of Jayamkondacholapuram well-12, South Arcot District, Tamil Nadu, India. *Pollen Spores*.
- Saxena, R. K. & Misra, N. K.**—Palynological investigation of the Ratnagiri beds of Sindhu Durg District, Maharashtra. *Palaeobotanist*.
- Shukla, M., Venkatachala, B. S. & Sharma, M.**—Interaction of lithosphere and biosphere : some evidences from early metazoans and metaphytes from India: *Lunar planet. Sci.*, Houston.
- Singh, K. J. & Chandra, S.**—Occurrence of an African plant *Benlightfootia* Lacey & Huard-Moine from the Ib-River Coalfield, Orissa, India. *Palaeobotanist*.
- Singh, A. & Misra, B. K.**—New colporate pollen grains from Neyveli lignite, South India. *Rev. Palaeobot. Palynol.*
- Singh, B. D. & Navale, G. K. B.**—Petrographic evaluation of a coal seam exposed in the Korar Coalfield, Madhya Pradesh. *Indian Minerals*.
- Singh, B. D. & Navale, G. K. B.**—The nature and composition of Umaria coals, Son Valley, Gondwana Basin, Madhya Pradesh. *Mines Metals Fuels*.
- Singh, B. D. & Singh, A.**—Coking characteristic coal seam in the Korar Coalfield, Madhya Pradesh—a petrographic evaluation. *Geosci. J.*
- Singh, H. P. & Rao, M. R.**—Tertiary palynology of Kerala Basin—an overview. *Palaeobotanist*.
- Singh, H. P. & Sarkar, Samir**—Vegetational dynamics of Tertiary Himalaya. *Palaeobotanist*.
- Singh, R. S.**—Palynology of Langrin Coalfield, South Shillong Plateau, Meghalaya.

Palaeobotanist.

- Sharma, Chhaya & Chauhan, M. S.**—Studies in the Late Quaternary vegetational history in Himachal Pradesh-4. Rewalsar Lake (II). *Pollen Spores*.
- Sharma, Chhaya & Chauhan, M. S.**—Palaeovegetation and palaeoenvironmental inferences from Quaternary palynostratigraphy of western Indian Plains. *Proc. 7th I.P.C.*, Brisbane, Australia.
- Srivastava, A. K.**—Earliest record of fossil leaf mines from the Late Palaeozoic flora of India and its impact on fossil leaf preservation. *Alcheringa*.
- Srivastava, A. K.**—Observation on the plant fossil assemblages of Belgian Congo preserved in the Museum of Geology Department, Musee Royle de l' Afrique Centrale, Tervuren. *Annual Report Mus. r. Afr. Cent.*
- Srivastava, Suresh C. & Jha, Neerja**—Permian Triassic palynofloral transition in Godavari Graben. *Palaeobotanist*.
- Sukh-Dev & Pandya, Neeru**—Floral contemporaneity and age of Athgarh Formation. *Palaeobotanist*.
- Tewari, R.**—Epidermal morphology of Permian Gondwana gymnosperms. *Palaeobotanist*.
- Tiwari, R. S. & Meena, K. L.**—Pyritic degradation of palynomorphs in Early Triassic assemblage from Raniganj Coalfield, West Bengal. *J. Min. metall. Soc. India*.
- Tiwari, R. S., Srivastava, S. C., Tripathi, A. & Vijaya**—Morphographic study of Permian palynofossils: *Callumispora*, *Parasaccites*, *Crucisaccites*, *Faunipollenites*. *Palaeobotanist*.
- Tiwari, R. S. & Tripathi, A.**—Mesozoic age relationship of Talchir sediments in Brahmini River Section, Talchir Coalfield, Orissa. *Palaeobotanist*.
- Tripathi, S. K. M. & Singh, Trilochan**—Siwalik sediments of Arunachal Himalaya: their palynology, palaeoecology, palaeogeography and correlation. *Palaeobotanist*.
- Venkatachala, B. S.**—Perspectives and new challenges in Indian Palaeobotany. *Frontiers in Botany. Proc. Platinum Jubilee session of Indian Science Congress*, Pune.
- Venkatachala, B. S. & Maheshwari, H. K.**—Indian Gondwana—redefined. *Proc. 7th int. Gondw. Symp.*, Sao Paulo.
- Venkatachala, B. S., Caratini, C., Tissot, C. & Kar, R. K.**—Palaeocene-Eocene marker pollen from India and tropical Africa. *Palaeobotanist*.
- Venkatachala, B. S. & Kar, R. K.**—Occurrence of reworked Australian Permian *Dalbuntyispora* from the Tertiary sediments of north eastern India. *Alcheringa*.
- Venkatachala, B. S., Shukla, M., Sharma, M., Naqvi, S. M., Srinivasan, R. & Udai Raj, B.**—Archaean microbiota from the Donimalai Formation, Dharwar Supergroup, India. *Precambrian Research*.

- Vijaya**—Evolutionary pattern of striations in Indian Gondwana saccate pollen. *Palaeobotanist*.
- Vijaya & Schaarschmidt, F.**—Relationship of circum-Mediterranean and Tethys Himalayan palynoflora during the Permian and Triassic times. *Proc. Symp. circum-Mediterranean Palyn.*
- Yadav, R. R. & Bhattacharyya, A.**—Occurrence of unusual perforation in *Micbelia champaca* L. *Phytomorphology*.
- Yadav, R. R. & Bhattacharyya, A.**—SEM observations on the spiral tickenings in *Micbelia champaca* L. *Curr. Sci.*
- Yadav, R. R., Chandra, A. & Gupta, H. P.**—Palynological investigation of the Arabian Sea, pollen/spores from the recent sediments of Karnataka, India. *Rev. Palaeobot. Palynol.*

Papers Published

- Bajpai, Usha & Maheshwari, H. K. (1988).** Epiphyllous fungi from the Gondwana. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 210-213.
- Barale, G., Banerji, J. & Baloge, P. (1988).** An araucarian cone from Upper Jurassic of Andrangory, Madagascar. *Geophytology*, **18** : 38-40.
- Bande, M. B., Chandra, A., Venkatachala, B. S. & Mehrotra, R. C. (1988).** Deccan Intertrappean floristics and its stratigraphic implications. In : Maheshwari, H. K. (Ed)—*Palaeocene of India*, Indian Association of Palynostratigraphers, Lucknow : 83-123.
- Banerji, Jayasri (1988).** First record of the genus *Culcitites* Appert from India and its significance. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 121-204.
- Bharadwaj, D. C. & Kumar, P. (1988).** Palynology of Jurassic sediments from Iran-II. Zirab area. *Biol. Mem.*, **14**(1) : 57-80.
- Chandra, Shaila & Chandra, Anil (1988).** Vegetational changes and their climatic implications in coal bearing Gondwana. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 74-86.
- Chandra, Shaila & Singh, K. J. (1988).** A new seed-bearing plant organ from the Kamthi Formation of Orissa, India. *Curr. Sci.*, **57** : 996-998.
- Dutta, S. K., Srivastava, Suresh C. & Gogoi, D. (1988).** Palynology of the Permian sediments in Kameng District, Arunachal Pradesh. *Geophytology*, **18** : 53-61.
- Garg, Rahul, Khowaja-Ateequzzaman & Jain, K. P. (1988).** Jurassic and Lower Cretaceous dinoflagellate cysts from India with some remarks on the concepts of Upper Gondwana. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 254-267.
- Jain, K. P.**—Formation of Petroleum. *Encyclopedia India*.
- Khandelwal, A., Wadhvani, K. & Srivastava, A. K. (1988).** A preliminary report of aerospora at two different altitudes at Lucknow. *Indian J. Aerobiol.*, (1) : 53-56.
- Maheshwari, H. K. (Ed.) (1988).** *Palaeocene of India*, Indian Association of Palynostratigraphers, Publ. No. 4.
- Maheshwari, H. K. & Bajpai, Usha (1988).** Northern limits of the eastern Gondwana : palaeobotanical evidence. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 354-368.

- Maheshwari, H. K. & Jana, B. N. (1988).** Palynozonation of Jhuran and Bhuj formations of Kutch Basin. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 177-182.
- Maheshwari, H. K. & Tewari, R. (1988).** Megaspore biostratigraphy of the Gondwana. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 102-105.
- Mehrotra, R. C. (1988).** Some new palm fruits from the Deccan Intertrappean beds of Mandla District, Madhya Pradesh. *Geophytology*, **17** : 204-208.
- Maithy, P. K. & Babu, R. (1988).** The Mid-Proterozoic Vindhyan macrobiota from Chopan, southern Uttar Pradesh. *J. geol. Soc. India*, **31** : 584-590.
- Maithy, P. K., Babu, R., Raina, B. K. & Kumar, G. (1988).** Proterozoic microfossils from the Machhal and Lolab formations of Kashmir Himalaya, India. *N. Jb. Geol. Palaeont. Mb.*, **10** : 639-644.
- Manik, S. R. (1988).** Some new genera of Triassic seeds. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 197-200.
- Navale, G. K. B. (1988).** Three decades of developments in palynopetrology of Indian Permian coals. *Geol. Surv. India Spl. Pub.*, **11**(11) : 465-471.
- Pandya, Neeru (1988).** Geographic distribution of the genus *Cycadopteris* during the Upper Gondwana. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 205-206.
- Prakash, Anand**—Continental Drift. *Encyclopedia India*.
- Raha, P. K., Rajendran, C. P. & Kar, R. K. (1987).** Record of Early Tertiary deposits in Kerala, India and its palaeogeographic significance. *Geophytology*, **17** : 209-218.
- Rajendran, C. P., Rajagopalan, G. & Narayanaswami (1989).** Quaternary geology of Kerala : evidence from Radiocarbon dates. *J. geol. Soc. India*, **33**(3) : 218-222.
- Rajanikanth, A. (1989).** A fossil marine brown alga from the Gangapur Formation, Pranhita-Godavari Graben. *Curr. Sci.*, **58**(2) : 78-80.
- Ram-Awatar (1988).** Palynological dating of Supra-Barakar Formation in Son Valley Graben. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 133-137.
- Rigby, J. F., Chandra, S. & Surange, K. R. (1988).** Glossopterid plant remains in the Permian of Western Australia. *Mem. Ars. Australas Palaeontols*, **5** : 73-78.
- Sarkar, Samir & Singh, H. P. (1988).** Palynological investigation of the Subathu Formation (Eocene) in the Banethi-Bagthan area of Himachal Pradesh, India. *Palaeontographica*, **B209** : 29-109.
- Saraswat, K. S., Sharma, N. K. & Saini, D. C. (1988).** Ancient remains of the

- crop-plants from Narhan excavation—1986 : a report. In : Singh, P. & Tandon, O. P. (eds)—*Archaeological studies (Proc. annl. Conf. Indian Archaeol., Varanasi, 1986)*, Bharat Kala Bhawan, B.H.U., Varanasi : 73-77.
- Saxena, R. (1988).** *Gondisporites imbricatus* Segroves 1970 and its palaeogeographical significance in Gondwanaland. *Minetech.*, **9**(1) : 43-48.
- Saxena, R. K. (1989).** Significance of spore and pollen grain in Palaeocene biostratigraphy. In : Maheshwari, H. K. (Ed.)—*Palaeocene of India*, Indian Association of Palynostratigraphers : 68-82.
- Sharma Chhaya & Chauhan, M. S. (1988).** Palaeoenvironmental inferences from the Quaternary palynostratigraphy of Himachal Pradesh and Kumaon, India. *Proc. Indian natn. Sci. Acad.*, **54A**(3) : 510-523.
- Sharma, K. K., Rajagopalan, G. & Choubey, V. M. (1989).** Radiocarbon dating of charcoal from pre-Indus civilization fire-place, Upper Indus Valley, Ladakh. *Curr. Sci.*, **58**(6) : 306-308.
- Shukla, Manoj.** Oldest evidence of plant (including bacteria, etc.) fossils in the Indian sub-continent *Encyclopedia India*.
- Singh, H. P.** Petroleum palynology. *Encyclopedia India*.
- Singh, H. P. & Venkatachala, B. S. (1988).** Upper Jurassic-Lower Cretaceous spore-pollen assemblage in the peninsular India. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 168-176.
- Srivastava, A. K. (1988).** An insect wing from the Lower Gondwana of India. *J. Paleont.* **62** : 827-828.
- Srivastava, A. K. (1988).** Lower Barakar flora of Raniganj Coalfield and insect/plant relationship. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 138-142.
- Srivastava, A. P. (1987).** F-T dating of stratigraphy using authigenic mineral glauconite. In : Baliga, B. B. (Ed.)—*Proc. 5th natn. Seminar on SSNTD's, Nuclear Tracks* : 229-251.
- Srivastava, A. P. & Rajagopalan, G. (1988).** F-T ages of Vindhyan glauconitic sandstone beds exposed around Rawatbhata area, SW Rajasthan. *J. geol. Soc. India*, **32** : 527-529.
- Srivastava, Shyam C. (1988).** Stratigraphic position and age of plant-bearing Nidpur beds. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 154-160.
- Srivastava, Suresh, C. & Jha, Neerja (1988).** A Lower Triassic palynoassemblage from Budharam area, Godavari Graben, Andhra Pradesh. *Geophytology*, **18** : 124-125.
- Srivastava, Suresh, C. & Jha, Neerja (1988).** Palynology of Kamthi Formation in Godavari Graben. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 123-132.

- ✓ **Srivastava, Suresh, C., Anand-Prakash & Singh, T. (1988).** Permian palynofossils from the eastern Himalaya and their genetic relationship. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 326-338.
- Sukh-Dev (1988).** Floristic zones in the Mesozoic formations and their relative age. In: Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 161-167.
- Sukh-Dev & Rajanikanth, A. (1988).** The Gangapur Formation fossil flora and stratigraphy. *Geophytology*, **18** : 1-27.
- Tiwari, R. S.**—Coal palynology. *Encyclopedia India*.
- Tiwari, R. S. & Vijaya (1988).** Reflection in relationship of Tethyan palynoflora. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist* **36** : 339-353.
- Tripathi, S. K. M. (1988).** Age of the Therria Formation, Meghalaya, India—a review. *Geophytology*, **18** : 121-123.
- Vasudev, V. N., Naqvi, S. M., Shukla, M. & Udairaj, B. (1988).** Stromatolites from the chert Dolomites of Archaean Shimoga Schist Belt—Dharwar Craton, India. *J. geol. Soc. India*, **33** : 201-205.
- Venkatachala, B. S. (1988).** Concepts, limits and extension of the Indian Gondwana—An introduction to the theme. *Palaeobotanist*, **36** : 6-13.
- Venkatachala, B. S., Bande, M. B. & Maheshwari, H. K. (1988).** Past of the present. *Geophytology*. **18** : 47-52.
- Venkatachala, B. S. & Rajanikanth, A. (1988).** Stratigraphic implication of "Late Gondwana" flora of East Coast. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 183-196.
- Venkatachala, B. S. & Tiwari, R. S. (1988).** Lower Gondwana marine incursions : periods and pathways. In : Venkatachala, B. S. & Maheshwari, H. K. (eds)—*Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36** : 24-29.
- Venkatachala, B. S. & Maheshwari, H. K. (Eds) (1988).** *Concepts, limits and extension of the Indian Gondwana. Palaeobotanist*, **36**.
- Yadav, R. R. & Bhattacharyya, A. (1987).** Non-synchrony in the formation of terminal parenchyma in *Michelia* L. *J. Tree Sci.*, **6** : 101-105.

Field Work

J. S. Antal and D. C. Saini

Collected leaf-impressions from the Siwalik sediments near Oodlabari, Bengal.

N. Awasthi and R. C. Mehrotra

Collected leaf-impressions and fruits/seeds from Makum Coalfield, Assam.

N. Awasthi, Mahesh Prasad and Samir Sarkar

Sequential collection of plant megafossils and palynological samples was made from the Suraikhola Siwaliks, Nepal.

Ram Awatar

Palynological samples were collected from Parsora Formation.

Shaila Chandra

Collected Permian and Triassic plant fossils from Ipswich and Moreton basins, Queensland.

Shaila Chandra, M. B. Bande and A. K. Srivastava

Plant fossils were collected from Permian and Tertiary localities around Daltongunj and Ramanujganj.

Collected plant megafossils from the Late Cenozoic sediments of Mahuadarn, Palamu District, Bihar.

J. S. Guleria

Collected fossil woods from Rajasthan, Gujarat and Perim Island.

B. N. Jana

Collected samples from Brahmini River Section near Sarang and Fire Clay quarries in Talbasta region, Orissa.

Pramod Kumar

Visited 35 localities in Narmada, Saurashtra and Satpura basins; samples from inliers of Ellichpur, Nimar Formation and Gardeshwar Formation, Narmada Basin; Dhrangadhra Formation quarries at Than and Morvi areas in Saurashtra Basin and Jabalpur Formation in Satpura Basin were collected.

N. K. Misra and Sanjay Khare

Collected 50 samples from 7 localities in Ratnagiri and Sindhu Durg District, Maharashtra.

P. K. Maithy, Kalyan Lal Meena and Rupendra Babu

Visited areas around Lakheri, Indergarh, Ramganj Mandi and Bhaisongarh in Rajasthan for the collection of macrobiota, stromatolites and samples for microbiota.

Visited Rohtas Formation of Akbarpur and adjoining area and Lower Vindhyan of Nagar-Untari in Bihar for the collection of macrobiota, stromatolites and samples for microbiota.

R. K. Kar and G. K. Trivedi

Collected samples from Therriaghat exposures, Meghalaya and Kopili Formation, Assam.

G. Rajagopalan and A. P. Srivastava

Field trip to Rewa and Sidhi area, M. P. was made to collect glauconitic sandstone samples.

D. C. Saini, J. C. Srivastava and D. Pradhan

Collected living plant specimens from Lucknow.

K. S. Saraswat

Collected archaeobotanical samples from an ancient mound in a village Sanghol, Ludhiana District, Punjab.

Chhaya Sharma

Tested new indigenously fabricated Mackereth corer and collected the lake bottom profiles from Kumaon Himalaya.

Chhaya Sharma, M. S. Chauhan and Asha Gupta

Collected two lake bottom soil profiles, plant specimens and polleniferous material from Kumaon Himalaya

Mukund Sharma

Collected stromatolite samples around Kumsi and Shankargudda area.

Mukund Sharma and V. K. Yadav

Systematic sampling and collection of field data of Late Proterozoic rocks around Rohtasgarh were made.

Manoj Shukla and Mukund Sharma

Systematic sampling of Suket shales and collection of field data from Rampura, Madhya Pradesh were made.

B. D. Singh and V. P. Singh

Collected 127 Bore-hole core coal/shale samples from Pachwara and Brahmini South Extension areas and Ib coal samples from Lalmatia colliery, Gumani Section of the Rajmahal Hills.

K. J. Singh

Collected plant fossils from Ib-River Coalfield.

R. S. Singh and A. Rajanikanth

Palynological sample collection was made from the Mahadek and Jadukata formations, Meghalaya.

Archana Tripathi

Collections were made from Permian and Triassic localities exposed in Lower Tatra Mountains, Czechoslovakia. Visited the drilling site near Prague and collected the samples representing carboniferous strata.

Archana Tripathi, Vijaya, K. L. Meena and Chandra Pal

Collected bore-core samples from Damodar Panagarh, Birbhum and Rajmahal Hills for palynological studies.

B. S. Venkatachala, K. P. Jain, H. K. Maheshwari and Shaila Chandra

Field work undertaken in Triassic and Tertiary localities in Ipswich Basin, Queensland, Australia.

Vijaya

Visited Early Permian section near Mainz, West Germany Tertiary oil-shale locality, Messel, West Germany, Carboniferous localities in Belgium and Cretaceous-Tertiary Geological section in Denmark.

Papers presented at Symposia/Conferences/Meetings

- Awasthi, N. & Mehrotra, R. C.**—*Additions to the megaf flora of Tipam Sandstone of northeast India.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Awasthi, N. & Prasad, Mahesh**—*Plant megafossils from Suraikbola Siwalik in western Nepal, their palaeoecological and phytogeographical implications.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Awasthi, N. & Srivastava, Rashmi**—*Some new carbonised woods from the Neogene of Kerala Coast, India.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Bande, M. B. & Chandra, Shaila**—*Vegetational scenarios around Nagpur-Cbbindwara and Shabpura (Mandla District).* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Banerji, Jayasri**—*Plant fossils from Dubrajpur Formation at Kbatangi Hill, Rajmahal Basin, Bihar and their implication in stratigraphy.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Bajpai, Usha & Tewari, Rajni**—*Plant fossils from youngest Raniganj beds in Jbaria Coalfield.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Bera, S. K. & Gupta, H. P.**—*Correlation between pollen spectra and vegetation of Chbota Sigiri Glacier, Himachal Pradesh, India.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Bhattacharyya, A. & Yadav, R. R.**—*Analysis of tree growth and climate relationship in Deodar.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Bhattacharyya, A. & Yadav, R. R.**—*Tree ring and its role in the reconstruction of drought in India.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Chandra, Shaila & Maheshwari, H. K.**—*On the age of plant-bearing bed exposed on left bank of Gopad River near Nidhpuri Village, Sidbi District, Madhya Pradesh.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Chandra, Shaila, Srivastava, A. K. & Singh, K. J.**—*Plant megafossils from Permian sediments in Sidbi District and their palaeoclimatic bearing.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Chauhan, M. S. & Sharma, Chhaya**—*Modern pollen/spore rain in Kumaon Himalaya, India.* International Conference on Biodeterioration of Cultural Property, Lucknow.
- Gupta, H. P.**—*The Sbola in south Indian mountain; present, past and future.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Gupta, H. P. & Khandelwal, Asha**—*Mangroves of India : history and palynostratigraphy of Chilka Lake, Orissa, India.* Symposium : Vistas in Indian Palaeobotany, Lucknow.

- Gupta, H. P. & Yadav, R. R.**—*History of mangrove vegetation in Paradeep and Jambu, Orissa, India for the past 500 yrs B.P.—a palynological assessment.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Jana, B. N.**—*Palynology of the Mesozoic outcrops of Athgarh Formation exposed near Talbasta, Orissa.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Kar, R. K.**—*Palynological studies of the Barail sequence (Oligocene) in the type area, Assam, north-east India.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Khandelwal, Asha**—*Pollen and spore rain in Lucknow city during 1983-86.* International Conference on Biodeterioration of Cultural Property, Lucknow.
- Khowaja-Ateequzzaman & Jain, K. P.**—*Cauveridinium gen. nov. and related GV type dinocysts taxa : discussion.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Khowaja-Ateequzzaman, Garg, Rahul & Jain, K. P.**—*Archaeopyle types in dinocyst genera Dingodinium and Alterbidinium : a reinterpretation.* 7th International Palynological Conference, Brisbane.
- Khowaja-Ateequzzaman, Garg, Rahul & Jain, K. P.**—*Barremian dinocysts from the subsurface of Palar Basin, east-coast of India.* 7th International Palynological Conference, Brisbane.
- Kumar, Pramod**—*Status of Chaugan beds, Narsinghpur District, Madhya Pradesh.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Maheshwari, H. K.**—*The glossopterid fructification : an overview.* 3rd Conference of the International Organisation for Palaeobotany, Melbourne.
- Maheshwari, H. K.**—*Palynology across Jurassic-Cretaceous boundary in India.* 7th International Palynological Conference, Brisbane.
- Maheshwari, H. K. & Bajpai, Usha**—*Probable ginkgophytosids from the Permian Gondwana.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Maheshwari, H. K. & Tewari, Rajni**—*Epidermal morphology of Lower Gondwana gymnosperms.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Maithy, P. K.**—*First report of tiny pustular "doughnut" shaped stromatolites from the Middle Proterozoic of Vindhyan Supergroup exposed around Robtas.* Indo-Soviet Symposium on Stromatolites and stromatolitic deposits, Dehradun.
- Maithy, P. K.**—*Evidence of metapbytes and metazoan in Indian Precambrian.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Misra, B. K., Saxena, R. & Anand Prakash**—*Spectrofluorimetric study of some resinates from Indian coals and lignites.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Pandya, Neeru & Sukh-Dev**—*Resolution of Gollapalle flora and its dating potential.* Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Pocock, S. A. J., Vasanthi, G. & Venkatachala, B. S.**—*Thoughts on the Circumpollis.* 7th International Palynological Conference, Brisbane.

- Pocock, S. A. J., Vasanthi, G. & Venkatachala, B. S.**—*Evolutionary status of columellate Classopollis, Classodites, Equisetosporites and Cornetipollis*. 7th International Palynological Conference, Brisbane.
- Rajanikanth, A.**—*Fossil calcareous algae from the Kallakudi Limestone, Cauvery Basin*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Rajagopalan, G.**—*Radiocarbon ages of carbonate materials in gangetic alluvium*. Workshop : Gangetic plain-Terra Incognita, Lucknow.
- Rajagopalan, G.**—*Some applications of Radiocarbon and Fission-Track clocks to Indian sediments and fossils*. Symposium : Isotopes in Earth and Planetary Systems, Ahmedabad.
- Rao, M. R.**—*Palynological investigation of Arthungal bore-hole, Alleppey District, Kerala*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Rigby, J. F. & Chandra, S.**—*A review of the Permian flora at Bacchus Marsh, Victoria*. 3rd Conference of International Organisation for Palaeobotany, Melbourne.
- Rigby, J. F. & Chandra, S.**—*Review of microsporangiate organs possibly of Glossopteris in the Permian Gondwana flora*. 7th International Palynological Conference, Brisbane.
- Sarkar, Samir & Singh, H. P.**—*Himalayan Tertiary gymnospermic bisaccate pollen taxa and their extant relationship*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Sarkar, Samir**—*Siwalik pollen succession in Surai Khola, western Nepal and its palaeoecological implication*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Saxena, R. K. & Khare, Sanjay**—*Palynological investigation of Neyveli Formation in Jayamkondocholapuram well-12 in South Arcot District, Tamil Nadu*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Saxena, R. K. & Misra, N. K.**—*Palynofloral assemblage from the Ratnagiri beds of Sindhu Durg District, Maharashtra and its palaeoecological significance*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Saxena, R., Navale, G. K. B., Chandra, D. & Prasad, Y. V. S.**—*Organic petrology of the Permian coal seams susceptible to spontaneous combustion*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Sharma, Chhaya & Chauhan, M. S.**—*Mackereth Corer—a device to collect lake bottom profiles (Poster Display)*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Sharma, Chhaya**—*Palaeovegetational and palaeoenvironmental inferences from Quaternary palynostratigraphy of western Indian plains*. 7th International Palynological Conference, Brisbane.
- Singh, K. J. & Chandra, Shaila**—*Occurrence of an African plant Benlightfootia Lacey & Huard-Moine from the Ib River Coalfield, Orissa, India*. Symposium : Vistas in Indian Palaeobotany, Lucknow.

- Singh, R. S.**—*Palynology of Langrin Coalfield, South Shillong Plateau, Meghalaya*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Singh, H. P. & Rao, M. R.**—*Tertiary palynology of Kerala Coast—an overview*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Singh, H. P. & Sarkar, Samir**—*Vegetational dynamics of Tertiary Himalaya*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Srivastava, A. P.**—*Fission Track ages of fossil woods from Deorikburd, Keria and Mobgaonkalan, Madhya Pradesh*. 6th International Seminar on SSNTD's, Gauhati.
- Srivastava, A. P.**—*Glaucony ages of Vindhyan sediments in Rajasthan*. 6th International Seminar on SSNTD's, Gauhati.
- Srivastava, Shyam C. & Manik, S. R.**—*Rostrumaspermum, a new seed-genus from Triassic of Nidpur, India*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Sukh-Dev**—*Evolutionary imprints in the reproductive biologies of Mesozoic plants*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Sukh-Dev & Pandya, Neeru**—*Floral contemporaneity and age of Athgarb Formation*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Shukla, Manoj, Venkatachala, B. S. & Sharma, Mukund**—*Age of Suket shales (Vindhyan Supergroup, India) : some palaeobiological evidences*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Tewari, V. C. & Shukla, Manoj**—*Stromatolites and microbial fossils from Deoban-Gangolibat Belt, Lesser Himalaya, India*. Indo-Soviet Symposium on Stromatolites and stromatolitic deposits, Dehradun.
- Tiwari, R. S., Vijaya & Schaarschmidt, F.**—*Identity of Gondwana Permian-Triassic palynofloras*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Tiwari, R. S. & Ram-Awatar**—*The Nidpur plant beds, their palynological content and age connotation*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Tiwari, R. S. & Tripathi, Archana**—*Mesozoic age relationship of Talchir sediments in Brahmini River section, Talchir Coalfield, Orissa*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Tiwari, R. S. & Chowdhury, D. K.**—*Palynological dating of newly identified coal-bearing strata in Diwanganj area, West Bengal*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Tripathi, S. K. M. & Singh, Trilochan**—*Sivalik sediments of Arunachal Himalaya : their palynology, palaeoecology, palaeogeography and correlation*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Vasanthi, G., Venkatachala, B. S. & Pocock, S. A. J.**—*The evolution of angiospermid pollen characteristics conjectures and queries*. Symposium : Vistas in Indian Palaeobotany, Lucknow.
- Venkatachala, B. S., Shukla, Manoj, Bansal, Rajendra & Acharyya, S. K.**—*Upper Proterozoic microfossils from Infrakrol Formation, Nainital Synform, Kumaon Himalaya, India*. Symposium : Vistas in Indian Palaeobotany, Lucknow.

- Venkatachala, B. S., Caratini, C., Tissot, C. & Kar, R. K.**—*Palaeocene-Eocene marker pollen from India and tropical Africa*. 7th International Palynological Conference, Brisbane.
- Venkatachala, B. S., Shukla, Manoj, Sharma, Mukund, Naqvi, S. M. & Srinivasan, R.**—*Archaean microbiota from the Donamalai Formation, Dharwar Supergroup, India*. 7th International Palynological Conference, Brisbane.
- Venkatachala, B. S., Naqvi, S. M., Chadha, M. S., Shukla, Manoj, Srinivasan, R., Balesh-Kumar, Mathur, R., Balaram, V., Natarajan, R., Sharma, Mukund, Uday Raj, B., Subba Rao, D. V., Manikyamba, C., Krishna Murthy, B. S. S., Hussain, S. & Bansal, Rajendra**—*Geology, geochemistry and palaeobiology of Precambrian stromatolites and associated sediments from Dharwar Craton—constraints on Archaean biogenic processes*. Indo-Soviet Symposium on Stromatolites and stromatolitic deposits, Dehradun.
- Vijaya & Schaarschmidt, F.**—*Relationship of circum-Mediterranean and Tethys Himalayan palynoflora during the Permian and Triassic times*. Symposium on Circum-Mediterranean Palynology, The Netherlands.
- Vijaya**—*Permo-Triassic boundary in Indian Peninsula*. Meeting of Arbeitskries fur palaobotaniks und palynologie.

Lectures Delivered

- Rahul Garg**—*Radiolaria and their significance in palaeoceanography*. Geology Department, Lucknow University.
- K. P. Jain**—*Fossil dinoflagellates and their geological applications*. Geology Department, Lucknow University.
- G. Rajagopalan**—*Dating of Quaternary sediments*. G.S.I., Northern Region, Lucknow.
- G. Rajagopalan**—*Techniques of dating and dating of archaeological material*. X UNESCO Training Programme, N.R.L.C., Lucknow.
- G. Rajagopalan**—*Radiometric dating programme at BSIP*. Geology Department, Gauhati University, Gauhati.
- K. S. Saraswat**—*Perspectives of Indian palaeoethnobotany*. Zentralinstitut für Genetik und Kulturpflanzenforschung, Gatersleben.
- K. S. Saraswat**—*Trends in Harappan plant economy*. National Museum, New Delhi.
- K. S. Saraswat**—*Iron-age plant economy at Narban, Gorakhpur District, Uttar Pradesh*. Workshop of All India Co-ordinated Research Project of Ethnobiology, Paryavaran Bhawan, Lodhi Road, New Delhi.
- Rakesh Saxena**—*Rock weathering*. X UNESCO Training Programme, N.R.L.C., Lucknow.
- Jyotsana Rai**—*Calcareous nannoplankton*. Geology Department, Lucknow University.
- A. P. Srivastava**—*Application of F-T dating method to sedimentary rocks*. Geology Department, Gauhati University.
- Archana Tripathi**—*Aspects of palynology in Indian Gondwanas*. Palaeontology Department, Charles University, Prague, Czechoslovakia.
- Archana Tripathi**—*Palynological zones and their climatic inference in the coal-bearing Gondwana of India*. Palaeontological Institute, Koln, West Germany.
- B. S. Venkatachala**—*Fossil fuels—the entrapped plant energy*. Address to the Indian Science Writers Association, U.P. Chapter.
- B. S. Venkatachala**—*Perspectives in Precambrian Palaeobiology—A Biologist's view*. Keynote Address—Indo-Soviet Symposium on Stromatolites and stromatolitic deposits, W.I.H.G., Dehradun.

Technical Assistance rendered to other Agencies

Training Provided to outsiders

Mr Rakesh Harsh, Department of Botany, Jodhpur University, on wood anatomy.

Mr B. R. Jha, Geology Department, Ranchi University, in palynological techniques.

Mr S. Rabindranath, I.I.T., Bombay, on nannoplankton research.

Mr P. K. Sinha, G.S.I., Raipur, M.P., on Triassic plant megafossils.

Dr Abu Talib, Geology Department, A.M.U. in Palaeozoic and Mesozoic palynology.

Technical Assistance to Agencies/Universities/Institutes

Radiocarbon dating of samples for:

French Institute, Pondicherry

National Institute of Oceanography, Goa

Physical Research Laboratory, Ahmedabad

National Geophysical Research Institute, Hyderabad

Geological Survey of India, Mangalore

S.E.M. Facility

National Botanical Research Institute, Lucknow

Geological Survey of India, Lucknow

Lucknow University, Lucknow

Government Science College, Jabalpur

Banaras Hindu University, Varanasi

Patna University, Patna

University of Gulbarga, Gulbarga

Model Science College, A.P.S. University, Rewa

Others

Aligarh Muslim University, Aligarh

Coal India Limited

Geological Survey of India

Deputation/Training/Study Abroad

Anil Chandra

Visited Geologische-Palaeontologisches Institute und Museum der Universitaet, Kiel and Alfred-Wegener Institute, West Germany during February-March, 1989 under INSA International Collaboration and Exchange of Scientists Programme

Shaila Chandra

Visited Queensland Geological Survey, Brisbane to complete work on Australian plant fossil during 20 July-20 September, 1988. Also participated in 3rd Conference of International Organisation for Palaeobotany, Melbourne in August, 1988 and 7th International Palynological Conference, Brisbane in August-September, 1988.

K. P. Jain

Participated in the 7th International Palynological Congress at Brisbane, Australia during August-September, 1988.

B. N. Jana

Visited Institute of Regional Geology and Palaeontology, Faculty of Mining and Geology, Belgrade University, Belgrade, Yugoslavia during March-April, 1989 under INSA's International Collaboration and Exchange of Scientists Programme. Learnt maceration technique to isolate spores and pollen from metamorphic rocks and made a comparative study of Jurassic-Cretaceous palynoflora of India and Yugoslavia.

H. K. Maheshwari

Participated in the proceedings of 3rd Conference of the International Organisation for Palaeobotany, Melbourne in August, 1988 and 7th International Palynological Conference, Brisbane in August-September, 1988.

R. K. Saxena

Visited Poland under International Collaboration and Exchange of Scientists Programme of INSA, for a period of 3 months from February, 1989.

Chhaya Sharma

Attended 7th International Palynological Congress, Brisbane in August-September, 1988.

A. K. Srivastava

Visited University Claude Bernard, Lyon, University de Paris, Louis Pasteur University, Strasbourg, University of Science and Technology, Lille and Natural History Museum, Paris during October-November, 1988 on an INSA International Collaboration and Exchange of Scientists Programme. Also visited University of Liege, Musee Royle de l' Afrique (Belgium), University of Utrecht (The Netherlands),

British Museum of Natural History, London and Royle Holloway and Bedford New College, Egham.

Archana Tripathi

Visited Czechoslovakia under INSA International Collaboration and Exchange of Scientists Programme during September, 1988. Visited Department of Palaeontology, Charles University and Ceskoslovenska Akademie ved Geologicky Ustav, Geological Survey of Prague, Prague Botanical Institute, Czechoslovak Academy of Sciences, Pruhonica; Geological Institute of D.S. Bratislava. The object of this visit was to study the Palaeozoic and Mesozoic palynological assemblages from Europe and to make a comparative assessment with those known from India.

During October-November, 1988 visited Palaeontological Institute, Cologne; Senckenberg Museum, Frankfurt; Institute fur Palaontologie, Bonn; Technical University, West Berlin; Natural History Museum, London; Royal Holloway and Bedford New College, Egham; National Museum of Wales and University College of Cardiff, Cardiff.

B. S. Venkatachala

Participated in the 7th International Palynological Congress at Brisbane, Australia during August-September, 1988. During the course of Congress convened a symposium on Tropical Tertiary Palynology. Also participated in 3rd Conference of the International Organization of Palaeobotany, Melbourne in August, 1988 and chaired a session of scientific deliberations.

Vijava

Study visit to Germany and other laboratories in Europe, under the auspices of the Alexander von Humboldt Foundation Fellowship (September, 1987 to January, 1989). The scientific Programme under this Fellowship was centered around the study of Permian and Triassic palynological material from circum-Mediterranean Tethys belt and Germanic deposits

Courses/Lectures in the Institute by outside scientists

Pankaj Sharma,
University of Pennsylvania,
Philadelphia, U.S.A.

: Radiocalcium: feasibility of dating
bones and rocks.
August, 1988

Kunwar Bahadur
Consultant, Electron Microscopy,
Toshniwal Instruments

: TEM techniques with special reference
to fossil study.
December, 1988

Workshop/Conference Sponsored

Symposium on: Vistas in
Indian Palaeobotany

: November 14-16, 1988

Deputation to Conference/Symposium/Seminar/ Workshop/Expedition

- | | |
|--|--|
| A. Rajanikanth
S. P. Chadha
V. Nirmala
Madhukar Arvind
B. S. Venkatachala | — Proficiency in Word Processing (PWP), Computer Centre, Integrated Software Systems Pvt. Ltd., Lucknow
April, 1988
— Symposium on Frontiers in Bio-organic Chemistry and Biotechnology, B.A.R.C., Bombay
April, 1988 |
| S. K. Bera | — Multidisciplinary expedition to Chhota Shigiri Glacier (Sponsored by Department of Science & Technology) July, 1988 |
| B. S. Venkatachala
H. K. Maheshwari
Shaila Chandra | — 3rd International Organisation of Palaeobotany Conference, Melbourne, Australia
August, 1988 |
| B. S. Venkatachala
K. P. Jain
H. K. Maheshwari
Shaila Chandra
Chhaya Sharma | — 7th International Palynological Congress, Brisbane, Australia
August-September, 1988 |
| B. S. Venkatachala
Manoj Shukla
Mukund Sharma
Rajendra Bansal
G. Rajagopalan | — Indo-Soviet Symposium on Stromatolites and Stromatolitic Deposition, W.I.H.G., Dehradun
September-October, 1988
— Workshop on Gangetic Plain—Terra Incognita, Geology Department, Lucknow University, Lucknow
October, 1988 |
| 27 Scientists presented research papers at the symposium | — Vistas in Indian Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow
November, 1988 |
| B. S. Venkatachala
Mukund Sharma | — National Seminar on Review and update of thrust areas in Life Sciences, Sanjay Gandhi Post-Graduate Institute of Medical Sciences, Lucknow
December, 1988 |
| M. S. Chauhan
Chhaya Sharma
Asha Khandelwal | — International Conference on Bio-deterioration of Cultural Property, Lucknow
February, 1989 |
| G. Rajagopalan
C. M. Nautiyal | — Isotopes in Earth and Planetary Systems, Physical Research Laboratory, Ahmedabad
February, 1989 |
| G. Rajagopalan
A. P. Srivastava | — Sixth National Seminar on SSNTDs', Gauhati
March, 1989 |

Representation in Committees/Boards

- | | |
|---------------------------|--|
| Jaswant S. Antal | . Editor, Geophytology |
| Nilamber Awasthi | . Chief Editor, Geophytology
. Member, Organising Committee, Symposium on: Vistas in Indian Palaeobotany |
| Jayasri Banerji | . Member, Executive Council, The Palaeobotanical Society |
| Anil Chandra | . Member, Executive Council, Indian Society of Geoscientists |
| Shaila Chandra | . Vice-President, Indian Society of Geoscientists
. Member, Gondwana Subcommission |
| Rahul Garg | . Member, Managing Council, Indian Association of Palynostratigraphers
. Convener, Reception Committee, Symposium on: Vistas in Indian Palaeobotany |
| Hari P. Gupta | . Business Manager, Indian Association of Palynostratigraphers |
| Krishna P. Jain | . Secretary, Indian Association of Palynostratigraphers
. Member, Organising Committee, Symposium on: Vistas in Indian Palaeobotany |
| Asha Khandelwal | . Joint Secretary, The Palaeobotanical Society |
| Hari K. Maheshwari | . Member, Committee for Fossil Plants, International Association for Plant Taxonomy
. Editor, The Palaeobotanist
. Editor, Indian Association of Palynostratigraphers
. Member, Organising Committee, Symposium on: Vistas in Indian Palaeobotany
. Co-convener, National Committee for IGCP Project 237, Gondwana Floras
. Co-editor, Asian Journal of Plant Science |
| Prabhat K. Maithy | . Member, Editorial Board, Geoviews |
| Basant K. Misra | . Joint Secretary, Indian Society of Geoscientists |
| Garud K. B. Navale | . Member, International Committee of Coal Petrology |

- . Member, International commission of Coal Nomenclature and Analysis
 - . Member, Editorial Board, International Journal of Coal Geology
 - . Member, Indian Standards Institution (Coal)
 - . Vice-President, Coal Petrological Society of India
- Anand Prakash**
- . Treasurer, Indian Association of Palynostratigraphers
- G. Rajagopalan**
- . Chief Editor, Indian Society of Geoscientists, Lucknow
 - . Member, Advisory Committee, Regional Sophisticated Instrumentation Centre (CDRI), Lucknow
 - . Member, Academic Committee of School of Archaeological Dating, Jadavpur University, Calcutta
 - . Member, National Organising Committee, Nuclear Track Society of India, Calcutta
- M. R. Rao**
- . Joint Secretary, Indian Society of Geoscientists
- Ramesh K. Saxena**
- . Secretary, Indian Society of Geoscientists
 - . Member, Editorial Board, Bulletin ISG
- Manoj Shukla**
- . Editor, Geophytology
- Hari P. Singh**
- . Secretary, The Palaeobotanical Society up to 31st December, 1988
 - . Treasurer, The Palaeobotanical Society from 1st January, 1989
 - . Editor, The Palaeobotanist
 - . Member, Editorial Board, Geophytology
 - . Member, Organising Committee, Symposium on: Vistas in Indian Palaeobotany
- A. K. Srivastava**
- . Treasurer, Indian Society of Geoscientists
 - . Member, Editorial Board, Bulletin ISG
- Suresh C. Srivastava**
- . Secretary, The Palaeobotanical Society
 - . Member, Managing Council, Indian Association of Palynostratigraphers
 - . Member, Editorial Board, Geophytology
- Sukh-Dev**
- . Treasurer, The Palaeobotanical Society up to 31st December, 1988

- . Member, Editorial Board, *Geophytology* up to 31st December, 1988
- Ram S. Tiwari**
- . Editor, *The Palaeobotanist*
 - . Member, Executive Council, The Palaeontological Society of India
 - . Member, Managing Council, Indian Association of Palynostratigraphers
 - . Vice-President, International Association of Applied Biology
 - . Member, Advisory Committee for Science Programme, All India Radio
 - . Joint Secretary, The Palaeobotanical Society up to 31st December, 1988
 - . Secretary, Organising Committee, Symposium on: Vistas in Indian Palaeobotany
 - . Member, National Working Group of Upper Permian Correlation
 - . Councillor, Indian Society of Geoscientists
 - . Co-editor, *Asian Journal of Plant Science*
- Surya K. M. Tripathi**
- . Member, Executive Council, The Palaeobotanical Society
- B. S. Venkatachala**
- . Member, Committee for Fossil Plants, International Association for Plant Taxonomy
 - . Council Member, International Federation of Palynological Societies
 - . President, The Palaeobotanical Society
 - . Chairman, Symposium on Tropical Tertiary Palynology, 7th International Palynological Conference, Brisbane, Australia
 - . Session Chairman, 3rd International Organization of Palaeobotanical Conference, Melbourne, Australia
 - . Chairman, Organising Committee, Symposium on Vistas in Indian Palaeobotany, November, 1988, Lucknow
 - . Member, Research Advisory Committee, Wadia Institute of Himalayan Geology, Dehradun
 - . Member, Editorial Board, *Acta Palynologica*, Montpellier, France
 - . Chief Editor, *The Palaeobotanist*

Honours and Awards

C. M. Nautiyal

“INSA medal for young scientists” by Indian
National Science Academy

Publication

The Palaeobotanist

Volume 36—a special volume on “Concepts, limits and extension of the Indian Gondwana” was brought out (Editors: B. S. Venkatachala & Hari K. Maheshwari).

Manuscripts of Volume 37, number 1 were processed, also the proofs of this issue were checked for publication. Manuscripts of volume 37, number 2 are under process for publication.

Birbal Sahni Memorial Lecture

Seventeenth Birbal Sahni Memorial Lecture “Why basic science?” delivered by Professor T. S. Sadasivan, Centre of Advanced studies, University of Madras, Madras was sent to Press.

Annual Report

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

The publications of the Institute netted an income of Rs. 1,62,722.75 out of which about Rs. 1,09,519.00 were earned in foreign exchange approximately equivalent to U.S. \$ 6,099.00 plus 678.00.

Library

The holdings of the Library are:

Particulars	Additions during 1988-89	Total
Books	60	4234
Journals	261	8769
Reprints	764	32415
Microfilms/Fisches	—	290
Theses	3	71
Reports	—	46
Maps & Atlases	2	54
Reference Books	9	176

The services of the Library were also made available to scientists from other organisations and universities. The total number of registered borrowers is 139. Seventy two periodicals are procured on exchange basis. Seventy current periodicals are being subscribed by the library.

Reprint Section

(i) Research papers of which reprints purchased	48
(ii) Reprints sent out in exchange	3049
(iii) Institutions on exchange list	63
(iv) Individuals on exchange list	411

Library facility provided to :

Geological Survey of India, Raipur
 Bangalore University, Bangalore
 Government College, Dharmasala
 Government Science College Rewa
 Lucknow University, Lucknow
 Madras Christian College, Tambaram, Madras
 Jodhpur University, Jodhpur
 Aligarh Muslim University, Aligarh

Computerisation of References

A computer programme has been developed to retrieve references on different categories. All the papers published in the journal (Precambrian Research and Journal of Geological Society of India) have been classified and fed in the computer.

Herbarium

An inventory of Herbarium holdings and taxonomic updating of herbarium sheets are in progress. Pollen slides are being rearranged. Six hundred specimens collected from Gorakhpur, Pratapgarh, Allahabad, Lucknow and Oodlabari (West Bengal) were identified. Arrangement of leaf specimens, wood discs and their core samples having annual rings and also the photonegatives of research papers on living plant materials has been initiated.

The up-to-date position of reference collection of herbarium sheets, wood specimens, wood slides, polleniferous material, pollen slides, fruits and seeds is as follows:

Particulars	Addition during 1988-89	Total
<i>Herbarium</i>		
Herbarium sheets of plant specimens	310	11,608
Herbarium sheets of leaf specimens	220	220
<i>Xylarium</i>		
Wood blocks	28	3,730
Wood discs	24	24
Wood core samples	28	28
Wood slides	272	4,612
<i>Sporotbek</i>		
Polleniferous materials	150	150
Pollen slides	—	11,384
<i>Carpotbek</i>		
Fruits/Seeds	110	2,021
Photonegatives	5	5

Scientists of various organisations/institutions consulted the herbarium for their research work.

Museum

On 28 February, 1989, the National Science Day, an exhibition was arranged in co-ordination with the Herbarium on the theme Pandit Jawaharlal Nehru and his association with the Institute. Teachers and students of local colleges took keen interest in this exhibition. The accompanying teachers were presented plant fossils for creating more awareness among the students about plant fossils and their significance for the society.

Sets of plant fossils were also sent to 22 educational centres elsewhere in the country and one centre each in The Netherlands and France. Video-cassettes on various aspects of earth and its history have been procured.

During the session, besides students from 18 educational institutions a number of citizens of Japan, Thailand, U.S.S.R. and U.S.A. visited the Museum.

Type and Figured specimens/slides/negatives

The general collections are being classified in four categories, viz., specimens to be retained for study, specimens good for display, specimens for gift/exchange and specimens of no further use. This has released space to accommodate new collections made during the year.



A view of the Museum

Type and figured specimens/slides/negatives of 55 research papers were submitted to the repository of the Museum. Creation of database for the catalogue of type and figured specimens is under progress. The position as on 31-03-1989 is as under:

	Additions during the year	Total
Type and figured specimens	254	4,470
Type and figured slides	557	9,864
Negatives of the above	1241	12,267

New Collections

Specimens/samples collected from 168 localities within the country were deposited with the Museum:

Department	Specimens	/	Samples
Non-Vascular Plants	—		38
Palaeophytic Evolutionary Botany	867		8
Cenophytic Evolutionary Botany	1551 432		37
Quaternary Biogeography and Archaeobotany	—		253
Pre-Gondwana & Gondwana Palynostratigraphy	—		314
Post-Gondwana Palynostratigraphy of Paninsular India	—		38
Post-Gondwana Palynostratigraphy of Extra-Peninsular India	—		57
Planktonology	—		441
Radiometric Dating	—		18
Director's laboratory	93		292
Biodiagenesis	—		145

Specimens/samples received for investigation

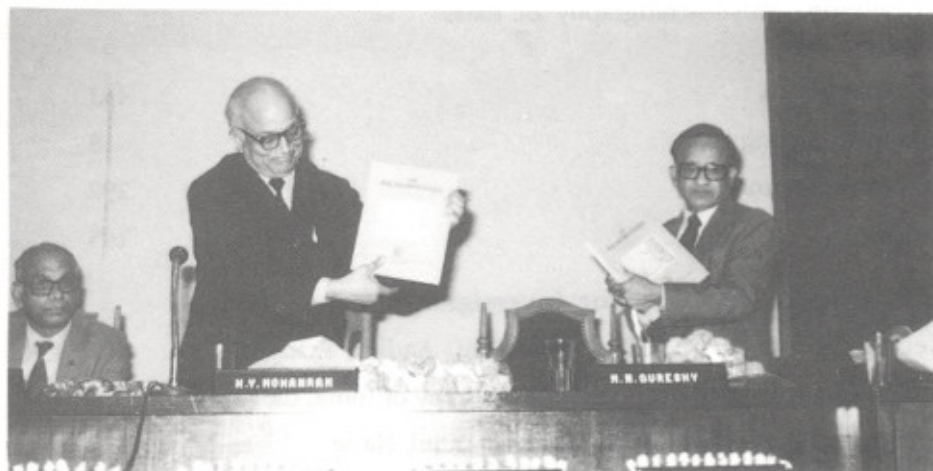
1. Geological Survey of India, Khammam, Andhra Pradesh	102
2. Paleontological Division, Geological survey of India, Calcutta	4
3. Geological Survey of India, Madras, Tamil Nadu	112
4. Geological Survey of India, Adilabad District, Andhra Pradesh	114
5. Mineral Exploration Department, Rajkot, Gujarat	7
6. National Geophysical Research Institute, Hyderabad	7

Republic Day

The Republic Day celebration, on January 26, 1989 began with unfurling of the National Flag by the Director, Dr B. S. Venkatachala. Later, he addressed the staff and exhorted the scientists to meet their societal obligations by taking science to people for bringing in general awareness and scientific culture. The B.S.I.P. staff along with active co-operation of F.C.C., J.C.C. and Ladies Club of the Institute organised programmes of out door games and a cultural show. The cultural programme was organised in the auditorium of the Institute. The staff and their family members participated in a variety of items like dance, drama, music and fancy dresses. The children of the staff members also participated in debates on "Science in the service of mankind" and "Chacha Nehru". The prize distribution (courtesy B.S.I.P. Ladies Club) were done by Smt. Jaya Venkatachala. The National Song "Vande Mataram" concluded the cultural programme.

Founder's Day

On 14th November, 1988, birthday of the Founder, Professor Birbal Sahni, "*Pusbpanjali*" was offered at his Samadhi. In the afternoon, Professor V. S. Ramadas, F.N.A., University of Hyderabad, delivered the 18th Birbal Sahni Memorial Lecture on "Photosynthetic efficiency—adaptation strategies for resource poor environment".



Dr M. N. Qureshi releasing the special Volume '*Concepts, limits and extension of the Indian Gondwana*' on 14th November, 1988. Professor H. Y. Mohan Ram, Chairman, Governing Body and Professor Ram Das are also seen in the picture.

Symposium on Vistas in Indian Palaeobotany

A Symposium on "Vistas in Indian Palaeobotany" was inaugurated on the Founder's Day by Professor H. Y. Mohan Ram, Chairman of the Governing Body. Professor Mohan Ram stressed the use of tools and techniques for palaeobotanical research to understand past climatic and evolutionary trends and to forecast future climatic behaviour. Dr B. S. Venkatachala, Director outlined perspectives of Indian Palaeobotany and its bearing on supporting branches. Professor D. D. Pant, Allahabad delivering the keynote address narrated some important incidents of plant evolution.

The Institute-University interaction Group met to formulate a working plan to promote the science of palaeobotany and to revise curriculum of Palaeobotany at graduate and postgraduate level. The symposium was organised jointly with the Palaeobotanical Society and Indian Association of Palynostratigraphers.



Ms C. Tissot, French Institute, Pondicherry explaining her findings on the Late Holocene environment in Poster Session of the symposium on : *Vistas in Indian Palaeobotany* held at the Institute.

Scientists

Director

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

Deputy Director

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

Assistant Directors (Special Grade)

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

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

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

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

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

Assistant Directors

Nilamber Awasthi, Ph.D.

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

Ms Shaila Chandra, Ph.D.

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

Syed A. Jafar, Dr.Phil.nat.

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

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

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

Sukh-Dev, Ph.D., F.Pb.S.

Shyam C. Srivastava, Ph.D.

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

Senior Scientific Officers

Krishna Ambwani, Ph.D.

Mohan B. Bande, Ph.D.

Ms Jayasri Banerji, Ph.D.

Rahul Garg, Ph.D.

Jaswant S. Guleria, Ph.D.

Hafiz A. Khan, Ph.D.

Pramod Kumar, Ph.D.

Chandra M. Nautiyal, Ph.D.

Kripa S. Saraswat, Ph.D.

Ramesh K. Saxena, Ph.D.

Ms Chhaya Sharma, Ph.D.

Manoj Shukla, Ph.D.

Ashwini K. Srivastava, Ph.D.

Gajendra P. Srivastava, M.Sc.

Ms Archana Tripathi, Ph.D.

Ms Vijaya, Ph.D.

Junior Scientific Officers

Anil Agarwal, Ph.D.
Khowaja Atequazzaman, M.Sc.
Ram Awatar, D.Phil.
Ms Usha Bajpai, Ph.D.
Samir K. Bera, M.Sc.
Amalava Bhattacharyya, Ph.D.
Ms Chanchala, Ph.D.
Brijendra N. Jana, Ph.D.
Ms Neerja Jha, Ph.D.
Ms Asha Khandelwal, Ph.D.
Madhav Kumar, Ph.D.
Jagannath P. Mandal, Ph.D.
Bhagwan D. Mandaokar, Ph.D.
Kalyan L. Meena, Ph.D.
Rakesh C. Mehrotra, Ph.D.
Basant K. Misra, Ph.D.
Mahesh Prasad, Ph.D.
Annamraju Rajanikanth, Ph.D.
Mulagalapalli R. Rao, Ph.D.
Dinesh C. Saini, Ph.D.
Omprakash S. Sarate, Ph.D.
Samir Sarkar, Ph.D.
Rakesh Saxena, Ph.D.
Mukund Sharma, M.Sc.
Kamal J. Singh, Ph.D.
Rama S. Singh, Ph.D.
Abhaya P. Srivastava, Ph.D.
Ms Rajni Tewari, Ph.D.
Surya K. M. Tripathi, Ph.D.
Ram R. Yadav, Ph.D.

Senior Scientific Assistants

Rupendra Babu, Ph.D.
Anant P. Bhattacharyya, Ph.D.
Mohan S. Chauhan, Ph.D.
Ms Asha Gupta, Ph.D.
Surendra R. Manik, M.Sc.
Kindu L. Meena, M.Sc.
Ms Neeru Pandya, M.Sc.
Ms Jyotsana Rai, M.Sc.
Ms Alpana Singh, M.Sc.
Bhagwan D. Singh, Ph.D.
Ms Rashmi Srivastava, Ph.D.
Gyanendra K. Trivedi, Ph.D.

Sponsored Projects

Rajendra Bansal, M.Sc.

Avatar S. Chopra, M.Sc.
D. K. Chowdhury, M.Sc.
Sanjay Khare, M.Sc.
Umesh C. Mainali, M.Sc.
N. K. Misra, M.Sc.
N. C. Pant, M.Sc.
Om Prakash Singh, M.Sc.
Vinod K. Yadav, M.Sc.

Emeritus Scientist

R. N. Lakhanpal, Ph.D., F.B.S., F.Pb.S., F.N.A.Sc., F.A.Sc., F.N.A.

Technical and Administrative Personnel

Publication

Jaswant Singh, M.Sc. (Joint Editor)

Library

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

Ajai K. S. Rathore, B.Sc., B.Lib.Sc. (Librarian)

Ms Kavita Kumar, B.Sc., B.Lib.Sc. (Library Assistant)

Museum

Naresh C. Saxena, B.A. (Museum Assistant)

Prem Prakash, B.Sc. (Jr. Museum Assistant)

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

Herbarium

Diwakar Pradhan, B.Sc. (Herbarium In-charge)

Jagdish C. Srivastava, M.Sc. (Herbarium In-charge)

Laboratory Services

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

Lalit M. Sanwal, B.Tech. (J.T.O.)

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

Ms Kamala Amaralal, B.Sc. (S.T.A.)

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

Ms Indra Goel, B.Sc. (S.T.A.)

Ms Asha Guleria, B.Sc. (S.T.A.)

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

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

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

Ms Sunita Khanna, B.Sc. (J.T.A.)

Ms Reeta Banerji, B.Sc. (L.A.)

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

Ramesh C. Misra, B.Sc. (L.A.)

Chandra Pal, B.Sc. (L.A.)

Vijay P. Singh, B.Sc. (L.A.)

Avinesh K. Srivastava, B.Sc. (L.A.)

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

Technical Services

Madhukar Arvind, B.Sc. (Computer Operator)

Chandra Bali (Section Cutter)

Alok K. Ghosh (Electrician)

Chhotey Lal (Section Cutter)

Vijai S. Panwar (Glass Blower)
Purshottam S. Saluja (Mechanic)

Photography and Drawing

Paresh C. Roy (Photographer)
Pramod K. Bajpai (Artist)
Pradeep Mohan, B.Sc. (Dark Room Assistant)

Administration

Surendra B. Verma, B.Com., D.P.A., M.A., LL.B. (Registrar)
Suraj P. Chadha, B.A. (P.S. to Director)
Hari S. Srivastava, B.Com. (Office Assistant)
Bhagwan Singh (Office Assistant)
Ms Prem Kanti Srivastava (Receptionist)
Radha B. Kukreti (Care Taker)
Ramesh Chandra (U.D.C.)
Nitya N. Joshi (U.D.C.)
Ms V. Nirmala (L.D.C.)
Ms P. Thomas (L.D.C.)
Ms Usha Chandra (Telephone Operator)
Hari Lal (L.D.C.)
Koshy Thomas (L.D.C.)
Gopal Singh, B.A. (L.D.C.)

Accounts Section

J. C. Singh, M.A. (Accounts Officer)
Tej N. Shukla, B.A. (Accountant)
Baresh K. Jain, B.A. (Assistant—Finance & Accounts)
Raj K. Takru, B.A. (U.D.C.)
Ms Swapna Acharya, B.A. (L.D.C.)
Raj K. Kapoor, B.A. (L.D.C.)
Dhoom Singh, B.A. (L.D.C.)

Stores

Nirmal K. Khasnavis, B.Sc., LL.B. (Deputy Registrar)
Indra J. Mehra, B.A. (Assistant)
Inder J. S. Bedi (U.D.C.)
Ms Ruchita Chatterji, M.A. (L.D.C.)
Kunwar P. Singh (L.D.C.)

Sponsored Projects

Mohd. Asalam (T.A.)
Jagdish Prasad (T.A.)

Drivers

Hanuman Prasad
Lallan

Balbir Singh
Nafees Ahmed

General help

Bipat (Mali-skilled)
Chaitu (Mali-skilled)
Rameshwar Prasad Pal (Mali-unskilled)
K. C. Chandola (Attendant)
Prem-Chandra (Attendant)
Sunder Lal (Attendant)
Raja Ram (Attendant)
Satruhan (Attendant)
Rajendra Kumar (Peon)
Haradhan Mahanti (Peon)
Kailash Nath (Peon)
Sri Ram (Peon)
Bam Singh (Peon)
Ram Singh (Peon)
Kedar Nath Yadav (Peon)
Sarju Prasad (Daftari)
Sia Ram (Duplicating Machine Operator)
Ram Deen (Chowkidar)
Ram Dhari (Chowkidar)
Bishnu Dutt (Chowkidar)
Vishnu Kumar (Chowkidar)
Kesho Ram (Chowkidar)
Prem Shanker (Chowkidar)
Ms Maya Devi (Safaiwali)
Ram Kishan (Safaiwala)
Chhange Lal (Safaiwala)
Mewa Lal (Safaiwala)
Ms Munni (Safaiwali)

Appointments and Promotions

Scientific Staff

- Dr K. P. Jain, A.D. promoted as A.D. (Spl. Grade) w.e.f. 20.4.88
Dr Hari K. Maheshwari, A.D. promoted as A.D. (Spl. Grade) w.e.f. 20.4.88
Dr G. K. B. Navale, A.D. promoted as A.D. (Spl. Grade) w.e.f. 20.4.88
Dr R. S. Tiwari, A.D. promoted as A.D. (Spl. Grade) w.e.f. 20.4.88
Dr S. A. Jafar, S.S.O. promoted as A.D. w.e.f. 21.4.88
Smt Rajni Tewari, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Dr A. Rajanikanth, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Dr R. C. Mehrotra, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Sri S. K. Bera, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Dr A. P. Srivastava, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Sri Khowaja-Ateequzzaman, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Sri Mukund Sharma, S.R.F. appointed as J.S.O. w.e.f. 21.4.88
Dr D. C. Saini appointed as J.S.O. w.e.f. 21.4.88
Dr Ram Awatar, S. S. A. appointed as J. S. O. w.e.f. 21.4.88
Dr K. J. Singh, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Dr O. S. Sarate, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Dr Kalyan L. Meena, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Dr Mahesh Prasad, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Dr B. D. Mandaokar, S.S.A. appointed as J.S.O. w.e.f. 21.4.88
Dr A. Bhattacharyya, S.S.A. promoted as J.S.O. w.e.f. 25.4.88

Technical Staff

- Sri Prem Prakash promoted as S.T.A. (M) w.e.f. 21.7.88
Sri A. K. Srivastava promoted as J.T.A. w.e.f. 21.7.88
Smt Reeta Banerji promoted as J.T.A. w.e.f. 21.7.88
Sri Chandra Pal promoted as J.T.A. w.e.f., 21.7.88
Sri V. P. Singh promoted as J.T.A. w.e.f. 21.7.88
Sri R. C. Misra promoted as J.T.A. w.e.f. 21.7.88
Sri Keshav Ram promoted as Lab. Asst. w.e.f. 21.7.88
Smt Kavita Kumar promoted as Librarian w.e.f. 21.7.88

Sri Pradeep Mohan promoted as Photographer w.e.f. 21.7.88

Administration

Sri J. C. Singh, appointed as Accounts Officer w.e.f. 16.5.88

Pro-Tempo-Officiating Arrangements

Sri H. S. Srivastava as Section Officer (General) w.e.f. 19.8.88

Sri Bhagwan Singh as Section Officer (Admin.) w.e.f. 19.8.88

Sri I. J. Mehra as Sr Assistant (upgraded) w.e.f. 19.8.88

Sri I. J. S. Bedi as Sr Assistant w.e.f. 19.8.88

Sri Ramesh Chandra as Assistant w.e.f. 19.8.88

Sri N. N. Joshi as Sr Assistant w.e.f. 19.8.88

Sri R. K. Takru as Sr Assistant w.e.f. 19.8.88

Smt Usha Chandra as U.D.C. w.e.f. 19.8.88

Sri R. K. Kapoor as U.D.C. w.e.f. 19.8.88

Sri Hari Lal as U.D.C. w.e.f. 19.8.88

Smt V. Nirmala as U.D.C. w.e.f. 19.8.88

Smt P. Thomas as U.D.C. w.e.f. 19.8.88

Sri Dhoom Singh as Cashier w.e.f. 19.8.88

Smt Ruchita Chatterji as Store Keeper w.e.f. 19.8.88

Category "D"

Sri Rajendra Kumar as Attendant w.e.f. 19.8.88

Sri Chhange Lal as Attendant w.e.f. 19.8.88

Sri Haradhan Mahanti as Attendant w.e.f. 19.8.88

Sri Raja Ram as Attendant w.e.f. 19.8.88

Sri Ram Singh as Attendant w.e.f. 19.8.88

Sri Sarju Prasad as Daftari (upgraded) w.e.f. 19.8.88

Sri Sia Ram as Dupl. Machine Operator w.e.f. 19.8.88

Sri Rameshwar P. Pal as Mali (Skilled) w.e.f. 21.3.89

Retirements

Smt P. K. Srivastava, Receptionist —31.10.88

Sri Chaitu, Mali-skilled —30.11.88

Sri Bipat, Mali-skilled —28.02.89

Organisation Structure

Governing Body

Chairman

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

Members

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

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

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

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

Dr S. C. D. Sah,
Vikashpuram,
Dehradun 248 001

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

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

Secretary

Dr B. S. Venkatachala,

Director, Birbal Sahni Institute of Palaeobotany,
Lucknow 226 007

Assistant Secretary (Non-member)

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

Finance and Building Committee

Chairman

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

Members

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

Sri S. C. Jain,
Divisional Engineer (Retd.), Northern Railway,
A-431, Indira Nagar
Lucknow 226 016

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

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

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

Secretary

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

Research Advisory Council

Chairman

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

Members

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

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

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

Dr S. K. Jain,
A-26, Mall Avenue Colony,
Lucknow 226 001

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

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

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

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

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

Deputy Director-General, Geological Survey of India,
Northern Region, Lucknow—Special invitee.

Convener

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

Departments

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

Internal Committees

- 1. Research Programming Committee**
 B. S. Venkatachala —Convener
 H. P. Singh
 Hari K. Maheshwari
 N. Awasthi
- 2. Excursion Committee**
 P. K. Maithy —Convener
 A. K. Srivastava
- 3. Instrument Maintenance Committee**
 K. P. Jain —Convener
 Anand Prakash
- 4. Quality Control Committee**
 Suresh C. Srivastava —Convener
 B. K. Jain
 Bhagwan Singh
- 5. Purchase Committee**
 B. S. Venkatachala —Convener
 H. P. Singh
 K. P. Jain
 Suresh C. Srivastava
 Registrar
 Accounts Officer
 Deputy Registrar (S)
- 6. Maceration Committee**
 Ramesh K. Saxena —Convener
 Rahul Garg
 Archana Tripathi
- 7. Scientific Display Committee**
 Shaila Chandra —Convener
 Asha Khandelwal
 P. K. Bajpai
 Sunita Khanna
- 8. Building Construction and Maintenance Committee**
 Hari K. Maheshwari —Convener
 Anand Prakash
 Registrar
 Deputy Registrar (E)
 P. K. Bajpai

- 9. Vehicle Maintenance Committee**
 Anand Prakash —Convener
 Registrar
 Vehicle In-charge
- 10. Garden Maintenance Committee**
 Anil Chandra —Convener
 M. R. Rao
 Samir Sarkar
- 11. Canteen Committee**
 Sukh Dev —Convener
 P. K. Bajpai —Secretary
 K. Amarlal —Treasurer
 N. C. Saxena
 H. S. Srivastava
- 12. Faculty Consultative Committee**
 Nilamber Awasthi —Chairman
 Suresh C. Srivastava —Secretary
 Rahul Garg
 Ms Asha Gupta
 A. K. Srivastava
 Gajendra P. Srivastava
- 13. Joint Consultative Committee**
 Diwakar Pradhan —Chairman
 V. Nirmala —Secretary
 Reeta Banerjee
 N. K. Khasnavis
 V. S. Panwar
 L. M. Sanwal
 R. K. Takru

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

We have audited the annexed Balance Sheet of Birbal Sahni Institute of Palaeobotany, Lucknow as at 31st March, 1989 and its relative Income & Expenditure Account and Receipts & Payment Account for the year then ended with the records produced before us.

In our opinion and to the best of our information and according to the explanations given to us the said accounts read with the comments thereon 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, 1989;
- (ii) in the case of Receipts and Payment Account of the transactions of the Institute for the year;
- (iii) in the case of Income and Expenditure Account, of the excess of Income over Expenditure for the year ended on that date.

For KISHORE & KISHORE
Chartered Accountants

(R. K. MATHUR)
Partner

Place : Lucknow

Date : 23rd August, 1989.

**Comments on the Accounts of
Birbal Sahni Institute of Palaeobotany, Lucknow
as at 31st March, 1989**

1. Accounts have been maintained on hybrid system.
2. Fixed assets are at cost and no depreciation has been provided.
3. Balances of various projects and seminars have not been incorporated in the Balance Sheet and Income & Expenditure Account.
4. Recoveries of Loans and Advances from employees till last year were being classified under "Advance Fund for Employees". The accumulated balance of last year and recoveries during the year amounting to Rs. 20,81,563.43 have this year been merged with Excess of Income over Expenditure.
5. Building Material, when purchased, stood charged to 'Building Works under construction' till last year. The building has since been taken over by the Institute, the total expenditure under this head has now been transferred to "Works & Building". Completion certificate of various works wherever required is to be obtained.
6. Out of Works and Building shown as Rs. 50,17,453.36 last year, Founders' Donation of Rs. 50,000/- has this year been separately projected under the same head.
7. Advances have directly been charged to the final Head of Expenditure instead of being debited to Advance Account. Some of the advances which missed to be included in the list of unsettled advances, resulted in inflating the expenditure/assets to that extent.
8. The figures have been recasted and regrouped wherever deemed necessary.

For KISHORE & KISHORE
Chartered Accountants

(R. K. MATHUR)
Partner

Place : Lucknow

Date : 23rd August, 1989.

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

<i>Liabilities</i>	<i>Previous Year 1987-88</i>	<i>Current Year 1988-89</i>
Capital	2,58,67,040.57	3,06,33,837.82
Excess of Income over Expenditure	32,75,305.14	28,21,461.90
Donation/Gifts	4,09,348.40	4,12,943.65
General Provident Fund	41,72,604.37	50,55,717.67
Security & earnest money deposits	32,648,90	52,756.14
Total	3,37,56,947.38	3,89,76,717.18

Sd.
J. C. Singh
(Accounts Officer)

PALAEOBOTANY, LUCKNOW**31st March, 1989**

<i>Assets</i>	<i>Previous Year 1987-88</i>	<i>Current Year 1988-89</i>
Land & building	50,49,745.26	49,94,466.50
Apparatus & equipment	1,38,57,397.22	1,62,28,014.07
Vehicle	6,51,398.57	6,51,398.57
Furniture & fixtures	17,48,206.11	18,11,943.54
Books & Journals	12,07,044.00	14,87,046.26
Investment	80,687.50	97,687.50
Unesco Coupons	793.02	793.02
Advances		13,63,711.43
Deposit with CPWD		13,95,559.00
Security deposits		3,000.00
Loans	41,45,186.10	21,65,435.57
General Provident Fund	41,72,604.37	50,55,717.67
Closing stock		13,234.10
Cash Balance :		
(i) In Hand	185.15	276.35
(ii) In Bank	28,43,700.08	37,08,433.60
Total	3,37,56,947.38	3,89,76,717.18

Sd.
S. B. Verma
(Registrar)

Sd.
B. S. Venkatachala
(Director)

