

Annual Report
1989-90



BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY
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Cover photo : *Herendeenia postprojecta*, a marker dinoflagellate cyst species of Late Hauterivian-Aptian in subsurface of Palar Basin.

Back Cover photo : *Carnoconites rajmahalensis* Bose, Pal & Harris from the Early Cretaceous of Rajmahal Hills.

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Foreword

Palaeobotany in India is acquiring new dimensions through advances in information technology, emphasis on additional data on geophysical and geological parameters and its application in ocean development and-environment. Birbal Sahni Institute of Palaeobotany, Lucknow is dedicated to promote research on fundamental as well as applied aspects of Palaeobotany in modern perspective, through an integrated multidisciplinary approach.

The primary aim of research activities at the Birbal Sahni Institute is to understand the interaction between bio- and geo-spheres and its bearing on evolutionary processes, more particularly as related to plant life. To achieve the projected targets, a realistic and synergistic approach was followed. A summary of significant results achieved during 1989-1990 academic year follows.

Cyclicity of stromatolite forms has been noticed in the Chert-Dolomite Member of the Vanivilas Formation of Chitradurga Schist Belt in the Dharwar Craton dated at > 2.6 Ga. Discovery of algal mat-like structures from the Banded Iron Formation in Donimalai, Bhimangundi and Timmapranguddi areas, also from the Dharwar Craton suggest a biological origin.

Study of fossil metazoans in the Vindhyan sediments indicates the presence of ediacaran metazoans in the upper part (upper Bhandar) and pre-ediacaran fossils in the lower part (Upper Semri). The records of pre-ediacaran metazoans throw new light on the antiquity and ancestry of metazoans in India.

Carbon and Oxygen isotopic ratio of the Deoban dolomites in the Lesser Himalayan area indicated enrichment of Carbon and depletion of Oxygen, signifying high organic activity which is also supported by the abundance of plankton and acritarchs.

Fission track (F-T) age measurements of 1125 ± 18 Ma for Vindhyan exposures around Sidhi District, M.P. suggest that the glauconite deposits belong to Kheinjua Formation (Semri Group). In Son Valley F-T age of 950 Ma for the glauconite sample at Baghwar (near Churhat, M.P.) possibly marks the boundary of Lower and Upper Vindhyan.

Remains of thalloid and leafy liverworts have been reported from the Talchir Formation of Umaria Coalfield. Four ginkgophyte leaf genera, viz., *Saportaea*, *Rhipidopsis*, *Psymphyllum* and *Ginkgoites* have been recorded from the Permian sediments of Rajmahal Basin. New types of gynoclad and androclad have been found in the same sediments. Analysis of epidermal features of *Glossopteris* from the Barakar Formation of Churulia Area, Raniganj Coalfield revealed the occurrence of several new species.

Stratigraphic appraisal of megaflora of the Barakar formation in Raniganj Coalfield reveals that some characteristic Karharbari forms, e.g., species of the genera *Gangamopteris*, *Noeggerathiopsis* and *Euryphyllum* extended into the lower part of Barakar Formation but became extinct in its upper part in which *Glossopteris* predominates.

Predominance of striate-disaccate pollen in Jorethang Namchee Section (Sikkim) suggests correlation with palynological assemblages of Upper part of Barakar Formation of peninsular Gondwana. Palynofossils recovered from subsurface coals of Saurang Area (Bhutan) indicate a Late Permian age. The palynological assemblage of coal-balls from West Siang District shows an association of Late Triassic elements with Early Permian palynofossils.

Organic petrological study of coals from Son Valley has revealed the presence of high volatile bituminous coals in Chirimiri Coalfield and occurrence of better quality of coal westwards in Turra Coal Seam (Singrauli Coalfield). Biopetrological study of coal-bearing sequence in Singrauli Coalfield has led to the development of compositional models to review microfacies types and palaeodepositional history.

Two new genera, viz., *Rostrumaspermum* and *Krauselitbeca* have been proposed for a pineaceous seed and a lycopsid sporangia recovered from Gondwana exposures near Nidhpuri. *Phyllopteroides laevis*, index-fossil for Neocomian in Australia, has been discovered from Rajmahal Hills, Bihar. Palaeoclimatic inferences have been derived based on predominance of cycadophytes in the megaf flora of Rajmahal Formation in Chunakhal area. Angiospermous pollen, viz., *Clavatipollenites*, *Liliacidites* and *Retimonocolpites* have been recorded from the Intertrappean bed in a borecore from Rajmahal Basin and an Early Cretaceous age has been assigned. Nannoplanktons recovered from black shale sediments (equivalent to Pariwar Formation) in Jaisalmer Basin indicate the presence of CC7 *Chiastozygus litterarius* Zone of Aptian-Early Albian age.

Palynological study of Subathu sediments in north-western part of Punjab Basin shows relationship between changing environment and species diversity and compositional variation of palynofossils in south-eastern and north-western parts of the basin.

Presence of leaves of *Polyalthia*, *Dipterocarpus*, *Calophyllum*, *Mangifera*, *Cynometra*, *Wintenia* and *Myristica* in the Lower and Middle Siwalik sediments of Surai Khola, Nepal, indicates a very warm and humid climate. During the Upper Siwalik the evergreen elements were replaced by the moist deciduous and dry deciduous ones.

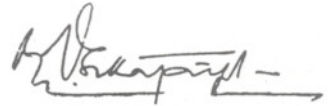
Fossil woods referable to *Dipterocarpus*, *Holoptelea*, *Lagerstroemia*, *Ziziphus*, *Dialium*, etc. recorded from Neogene of Bikaner, Rajasthan, suggest a moist humid climate. A fossil wood resembling that of tropical African genus *Baphia* has been reported from Jaisalmer. On spore-pollen evidence, Palaeocene-Eocene age for Barmer Sandstone Formation has been concluded. Middle Miocene and Pliocene megafossil records from Kerala coast indicate prevalence of excessive humid conditions.

Biodiagenetic investigations of Panandhro lignite in Kutch Basin indicated the presence of brackish water milieu during the deposition in a shallow and gradational sinking basin. It has been inferred to be better suited for extraction of organic chemicals apart from briquetting. Presence of grey amorphous organic matter in the Karewa sediments has been documented. Its record from fresh water sediments is significant.

The coals from Makum Coalfield, Upper Assam contain high amount of hydrogen-rich macerals. Occurrence of framboidal pyrite and primary calcite suggests that these coals were deposited under anaerobic and brackish water conditions in a protected shallow basin of a prograding delta complex.

Pollen analysis of profiles from Silent Valley indicates a close evergreen forest growing under a warm-humid climatic regime. Pollen data from Nalabana Island in Chilka Lake suggests deltaic environments around 1,000-2,000 years B.P.

Predominance of mixed Oak-chirpine forest is suggested around Naukuchia Tal some 4,000 yrs B.P. Study of sedimentary facies, spore pollen and palynofacies distribution of mud-bank and Vembanad Lake, Kerala revealed significant results. Neogene tropical Diatoms zones (NTD) 6, 7, 8 and 9 are recognised in North Coast and Champni Jetting sections of Nancoury Island, Andamans.



(B. S. VENKATACHALA)
Director

Research

Inter-Departmental Projects

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

Studied remains of *Krisbnania*, a photosynthesizing organism possibly belonging to Chlorophyceae inhabiting shorelines, from the Rohtas Formation (± 1000 Ma) exposed around Rohtasgarh, Bihar. *K. acuminata* has been identified and a new form is described. Middle Proterozoic planktonic macrobiota *Shoubusia* and *Grypania* are recorded from the Rohtas Formation, Murlipahar, Rohtas District, Bihar.

An assessment of the macrobiota from the Proterozoic sequence of India has shown that the diversification of Metaphytes and Metazoan lineages began earlier than 1000 Ma.

Ediacaran Metazoan remains, *Ediacaria flindersi*, *Cyclomedusa davidi*, *Medusinites asteroides*, cf. *Arumbaria banksi*, *Dickinsonia elongata* and *Beltanelliformis brunsa* have been recorded from Dholpur Shale Formation, the youngest bed of the Vindhyan succession exposed near Lakhari, Rajasthan. This record indicates that the uppermost stratigraphical limit of the Vindhyan in Rajasthan is equivalent to Vendian.

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

Organic-walled microfossils, comprising acritarchs and vendotaenids, are reported for the first time from the Ganurgarh Shale Formation, Bhandar Group exposed near Hoshangabad, Madhya Pradesh. The acritarchs are characterized by large-sized sphaeromorphids while vendotaenids are represented by the first multicellular sheath. The Leiosphaerid-Vendotaenid assemblage in its composition is comparable to the known organic-walled microfossils from Vendian/Ediacaran strata, thus supporting a Vendian age (± 650 Ma) for the Ganurgarh Shale Formation.

P. K. Maithy and Rupendra Babu

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

Thin sections of cherty nodules occurring within the dark grey to black carbonaceous slates of Infra-Krol sediments from Nainital Synform of Kumaon Himalaya were further studied for microfossils. These are assigned to *Gunflintia minuta*, *Eomycetopsis robusta*, *Palaeolyngbya barghoorniana*, *Siphonophycus kestron*, *Animikiea septata*, *Myxococcoides minor*, *Palaeoanacystis vulgaris*, *Huroniospora psilata*, *Eospaera* sp., *Sphaeranasillos irregularis*, *Melanocyrrillium* sp. (vase-shaped microfossils) and associated unnamed "A". They are distributed randomly in the matrix containing organic matter which imparts brown to dark brown colour to the chert matrix. The fossiliferous nodules may have been transported and redeposited along with the Infra-Krol slates. The vase-shaped microfossils possibly indicate an Upper Riphean-Lower Vendian or even younger age for this assemblage.

Manoj Shukla (and S. K. Acharyya, GSI)

A synthesis of the palaeobiological data on Late Proterozoic Deoban Formation of Lesser Himalaya integrating data on stromatolites, microfossils, isotopic compositions and field based sedimentary features indicates that the lower part of the Deoban Formation represented by cherty dolomites with interbedded lenses of black chert represents carbonate tidal flat environment as evinced by the presence of primary sedimentary structures such as wavy bedding, parallel bedding, ripple bedding and microcross bedding. The black chert biota found in association with the sedimentary structure are non-mat benthos with subsidiary plankton represented by vase-shaped microfossils and smooth spheroidal forms like *Kildinosphaera*. The non-mat benthos are generally confined to restricted subtidal environments. A few *Melanocyrrillium* (vase-shaped microfossil) that are present, can be attributed to an open sea environment. The overlying oolitic intraclastic limestone shows influx of clastic material which grades upwards to calcarenite. The presence of sandy limestone and intraclasts containing dominant plankton is suggestive of disturbed shelf conditions resulting in the influx of clastic material from the open sea. The carbon and oxygen isotopic ratios of the Deoban dolomites in the area indicate enrichment of C and depletion of O signifying high organic activity which is also supported by the abundance of plankton and acritarchs.

The high energy conditions of the shallow warm marine environment were changed to moderate and low energy conditions in the upper part supporting growth of columnar stromatolites. The bedded cherts present almost at the top of the sequence represent subtidal depositional environment containing coccooid mat benthos.

Manoj Shukla (and V. C. Tewari, WIHG, 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

Nine glauconitic sandstone samples from Vindhyan exposures at Bordi, Khyra and Baghwar localities around Sidhi, Madhya Pradesh have been processed for F-T dating. The magnetic current in Frant Isodynamic separator was set at a value of 0.6 Amp. to get the best separation of glauconitic grains. The F-T ages obtained for these samples from Bordi (Bo), Khyra (Kh) and Baghwar (Br) are Bo/1-1125 \pm 230 Ma, Bo/3-1150 \pm 220 Ma, Bo/4-1110 \pm 190 Ma, Kh/1-1095 \pm 215 Ma, Kh/2-1120 \pm 200 Ma, Kh/3-1130 \pm 205 Ma, Kh/4-1145 \pm 210 Ma, Br/1-985 \pm 160 Ma and Br/2-170 Ma. F-T age results from all the localities except Baghwar indicate that the samples belong to the same bed with an average F-T age of 1125 \pm 18 Ma and that the glauconitic bed, exposed at the localities around Sidhi, belongs to Kheinjua Formation of Semri Group. F-T age indicates that the bed at Baghwar may represent either topmost Semri or lowermost Kaimur. These are the first radiometric age measurements for Vindhyan exposures around Sidhi area. F-T dating measurements on five glauconitic sandstone samples from Koludih, Hatwa Khas and Garua are in progress.

The length calculations from measurements for one hundred tracks have been carried out on the Apatite grains separated from beach granite to determine the F-T age correction due to annealing.

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

Well-preserved lycopodean axes are recorded from the Ganjra Nala Section of South Rewa Gondwana Basin, Birsinghpur-Pali Coalfield. Specimens of lycophytes recorded from the earlier Permian Gondwana beds of India are critically examined. The genus *Cyclodendron* is transferred under *Lycopodiopsis* and a new combination, *Lycopodiopsis lesliei* (Seward) is proposed.

Shaila Chandra and A. K. Srivastava

Four genera of thalloid as well as leafy liverworts are reported from the Talchir Formation of Umaria Coalfield. These are the oldest definite records of bryophytes from India.

Shaila Chandra

Plant fossils are described from the Talchir Formation exposed in Chandas Nala Section, Anuppur Area, Shahdol District. The assemblage is represented by six species of *Gangamopteris* and one species each of *Glossopteris*, *Noeggerathiopsis* and *Vertebraria*. Many stem impressions showing grooved surface with or without nodes

and internodes are also recorded. The known fossil assemblages of the Talchir Formation are analysed and discussed. The combined evidences indicate the presence of three floral zones during the early stage of *Glossopteris* Flora. It has been concluded that the forms without midrib of *Gangamopteris* type were adopted during the early phase of *Glossopteris* Flora and this form resulted into the development of midrib forms of *glossopterid* type in the later phase.

The fossil plant assemblage around Marhwas area in Sidhi District is represented by one species each of *Trizygia*, *Neomariopteris*, *Scutum*, a fern and 24 species of *Glossopteris*. Floristic composition indicates Raniganj-Kamthi affinities. Well-preserved plant fossils with the dominance of *Glossopteris* leaves indicate warm temperate climate. However, high percentage of small-sized leaves and poor representation of pteridophytes in the flora suggest drier conditions and low humidity.

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

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

Objective : *Morphotaxonomy, correlation and age determination*

Quantitative estimation of the palynoaassemblage recovered from core samples of Bore-hole SPB-17, Sohagpur Coalfield and the presence of striate-disaccate and associated elements therein equate the Middle Pali assemblage with that of the Raniganj Formation. Thirty samples from Parsora Formation proved to be barren of microfossils.

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*

Petrological evaluation of several local coal seams (from 8 collieries) in Chirimiri Coalfield revealed that there are three main seams. Coal samples have revealed variable vitric to mixed (both reactive and non-reactive rich) coal types. The rank (by vitrinite reflectance—0.65-0.92%, in oil) suggests inferior quality of high-volatile bituminous coal type.

Biopetrographic evaluation of Tura coal seam from 6 lateral sections in the Singrauli Coalfield suggests better quality coal (rank wise also) in the western part indicating its use for blending properties. The seam in the eastern part consists chiefly of mixed and fusic coal types, whereas, in the western part of the basin it is characterised by dominantly vitric and mixed coal types. It is presumed that frequent oxic fluctuations were prevalent during the formation of the seam in the eastern part.

Various compositional models utilizing petrological and reflectance data of Singrauli, Umaria, Korar, Sohagpur, Chirimiri, Johilla coalfields have been developed

to ascertain the nature and composition of different coal types in Son Valley Basin in relation to palaeodepositional realms.

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

The Jhingurdah coal seam (47 samples) of Raniganj Formation from Singrauli Coalfield contains higher amounts of sporinite (7.39% vs 5.16 m.m.f.), liptodetrinite (4.15% vs 4.13% m.m.f.) and total liptinite (15.53% vs 14.28% m.m.f.) than the coal seams (36 samples) of Raniganj Formation of Raniganj Coalfield. The latter coals have higher contents of perhydrous vitrinite (30.64% vs 25.57% m.m.f.) and resinite (0.6-3.5% vs 0.2-2.2% m.m.f.). In comparison to the Barakar coal seams of Son Valley, the coal seams of Raniganj Formation of both Son and Damodar Valleys have lower amount of total liptinite content. However, the Raniganj coal seams have distinctly higher proportion of perhydrous vitrinite. The study indicates definite differences in the depositional settings and floral communities of Barakar and Raniganj coal seams in Son Valley as well as between Raniganj coal seams of the Son and Damodar valleys that control the variable coal composition pattern.

Singrauli Coalfield has the full sequence of coal-bearing Permian deposits right from Karharbari to Raniganj. Taking this as a case study, compositional models based on coal microconstituents have been prepared to review the microfacies types in Permian coal seams of Indian Gondwana and their palaeodepositional history.

B. K. Misra and B. D. Singh

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

Objective : Morphotaxonomy, palaeoecology and bio-stratigraphy

Several sporangia from Nidpur have been studied. Four distinct taxa based on their microspore contents and epidermal features have been recognised. Among these a new sporangial genus *Krauselitheca* is fairly represented. Its microsporangia contain cingulate spores and show identical epidermal features with the leaf of *Selaginellites* indicating its affiliations with lycopsids. The proposed affinity is confirmed from a report of megaspores of lycopsid alliance from Nidpur beds.

Other sporangia contain bisaccate (nonstriate) pollen. A new seed-genus *Rostrumaspermum* bearing archegonia with short tubular neck depicts identity with conifers and settles precisely pineaceous affiliation.

Extensive study of cutinized membranes of seed taxa have played a vital role in differentiating plant groups like pteridospermales, cycadales and conifers.

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

Ginkgophyte leaves have been recorded from the Permian Gondwana of Rajmahal Basin. The leaves belong to the genera *Saportaea*, *Rhipidopsis*, *Psygmophyllum* and *Ginkgoites*. The occurrence of the genus *Saportaea* at locations as distant as West Virginia (U.S.A.), New Brunswick (Canada), Shansi (China) and Rajmahal (India) is interesting.

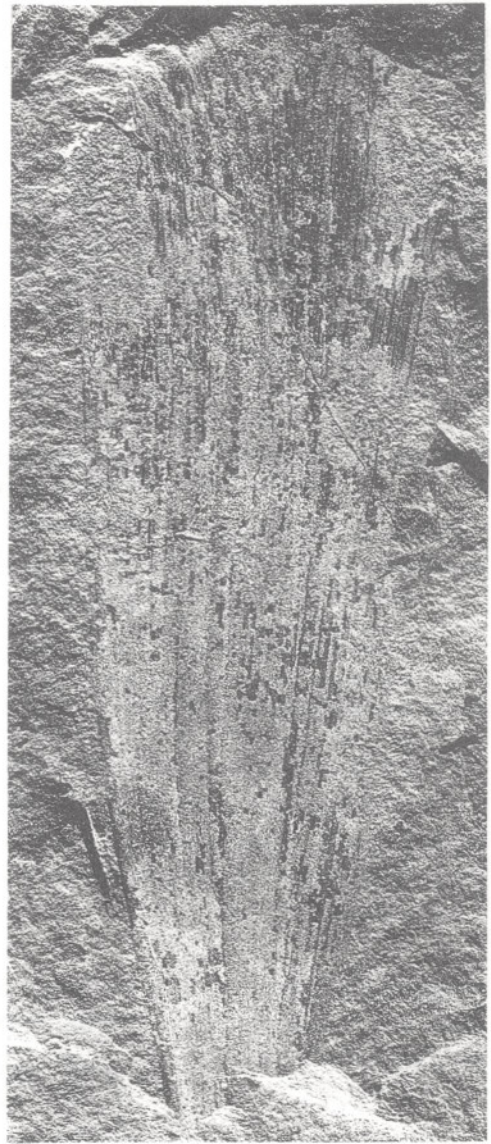
New types of gynoclad and androclad have been found from Rajmahal Basin. Detailed study and photography of the infructescences have been done. Study of "trace" fossils from the same area was also completed.

Hari K. Maheshwari and Usha Bajpai

Observation, description, identification and comparison of plant fossil assemblages from the open cast mine of Tara Colliery, Khudia and Pusai Nala



A seed-bearing capitulum from the Barakar Formation, Raniganj Coalfield.



Cordaites sp. from the Barakar Formation of Raniganj Coalfield.

sections of the Barakar Formation in Raniganj Coalfield have been completed. The assemblages are mainly represented by several species of *Glossopteris*, e.g., *G. communis*, *G. indica*, *G. browniana*, *G. stenoneura*, *G. augustifolia*, *G. intermittens*, *G. damudica*, *G. raniganjensis*, *G. varia*, *G. vulgaris* and *G. churiensis*. Leaves of *Cordaites* and scale leaves referable to *Eretmonia* and *Lidgettonia* type of glossopterid fructifications have also been recorded in the assemblages.

It has been observed that the flora of lower seams of Barakar Formation is closely comparable with the underlying flora, i.e., Karharbari flora. The Karharbari forms, e.g., *Gangamopteris*, *Noeggerathiopsis*, *Euryphyllum* are altogether absent in the flora of upper seams of Barakar Formation. The floras of upper seams are mostly

represented by the species of *Glossopteris*. The study indicates that some Karharbari elements continued in the Lower Barakar and became extinct only during the Upper Barakar floral phase.

A. K. Srivastava

Nineteen species of the genus *Glossopteris* have been described from the Barakar Formation of Churulia area, Raniganj Coalfield, India. Epidermal features of 16 species have been investigated. In the rest, the carbonified crust is not preserved. Nine species are new, viz., *G. asansolensis*, *G. bunburyana*, *G. danae*, *G. manjuae*, *G. schopfii*, *G. schimperi*, *G. ednae*, *G. kusumae* and *G. roylei*. Nomenclature of *G. damudica* have been revised and the new species *G. danae* is established on the basis of revised nomenclature.

Hari K. Maheshwari and Rajni Tewari

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

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

On the basis of study of fern foliage, *Neomariopteris* from Upper Permian beds in Ganganagar Nala, near Brijraj Nagar, Ib-river Coalfield, a model of the plant has been reconstructed.

K. J. Singh and Shaila Chandra

Processing and study of specimens from the Karharbari/Barakar Formation of Belpahar and Lajkura areas have been completed. The flora comprises some interesting fructifications besides *Ottokaria*, *Senotheba* and *Scutum*.

Shaila Chandra and K. J. Singh

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

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

Megaspores recovered from coal and associated sediments of assise a schistes houille (late Early Permian) from Zaire were processed for SEM studies. The megaspores were studied for external features of the sporoderm. Typical gulate forms have also been found.

Usha Bajpai

A manuscript on 12 species of megaspores recovered from Lower Barakar sediments of Giridih, Hutar, Umaria and Pali coalfields was prepared. Photography has been completed.

Rajni Tewari and Hari K. Maheshwari

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

Objective : *Morphotaxonomy, relationship and evolutionary linkages*

Morphotaxonomic studies of conifer genera *Harrisiophyllum* and *Araucarites* from Sehora have been completed. *Harrisiophyllum* is represented by two species, viz., *H. linearis* and *H. oblanceolatus* which were so far known from Bansa beds only. A new species of *Equisetum* has also been reported.

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 bio-stratigraphical implications*

Araucarioxylon santalensis, *Podocarpoxyylon krausellii* and *P. rajmahalense* have been identified from Kota Formation. A new species *Elatocladus vemavarmensis* has also been described from Early Cretaceous of East Coast. The new additions to flora of Gollapalle Formation are *Ptilophyllum*, *Williamsonia*, *Bucklandia*, *Pagiophyllum*, *Brachyphyllum* and *Araucarites*. The flora is dominated by conifers.

Sukh-Dev and Neeru Pandya

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

Objective : *Morphotaxonomy, floral succession and age determination*

Gymnospermic remains from the Rajmahal Formation of Chunakhal Rajmahal Hills have been investigated. The assemblage includes: *Pachypteris indica*, *Ptilophyllum cutchense*, *P. acutifolium*, *Cycadolepis pilosa*, *Zamites chunakhalensis* sp. nov., *Pterophyllum incisum*, *Pterophyllum morrisianum*, *Taeniopteris* sp. cf. *T. spatulata*, *Ctenis rajmahalensis*, *Elatocladus confertus* and *E. jabalpurensis*. Predominance of cycadophytes with gymnosperms depicts tropical sub-tropical climate during that period.

A manuscript on diversifications in osmundaceous fronds from Lower Cretaceous of Chunakhal, Rajmahal Hills, Bihar has been finalized, and *Osmundopsis*, *Cacumen* and *Phyllopteroides laevis* (a Neocomian index species of Eastern Australia) are recorded.

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*

A reconstruction sketch of *Pentoxylon* plant has been made by placing together all the known plant organs of the taxon. In which the patterns of leaf arrangement,

placement of micro- and mega-sporangiate organs have been shown upon the branches.

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 from four Intertrappean beds in bore core RJNE-32 within a depth level of 291.00-95.50 m has been studied. The palynoflora is dominated by *Araucariacites*, *Podocarpidites* and *Callialasporites* along with rare occurrence of angiospermous pollen of several types, viz., *Clavatipollenites*, *Liliacidites*, *Retimonocolpites*, *Stephanocolpites* and *Stellatopollis*. Based on the spore-pollen assemblage an Early Cretaceous age is assessed. The radiometric dating of certain traps in Rajmahal suggests possibility of its being older than 105 ± 5 Ma.

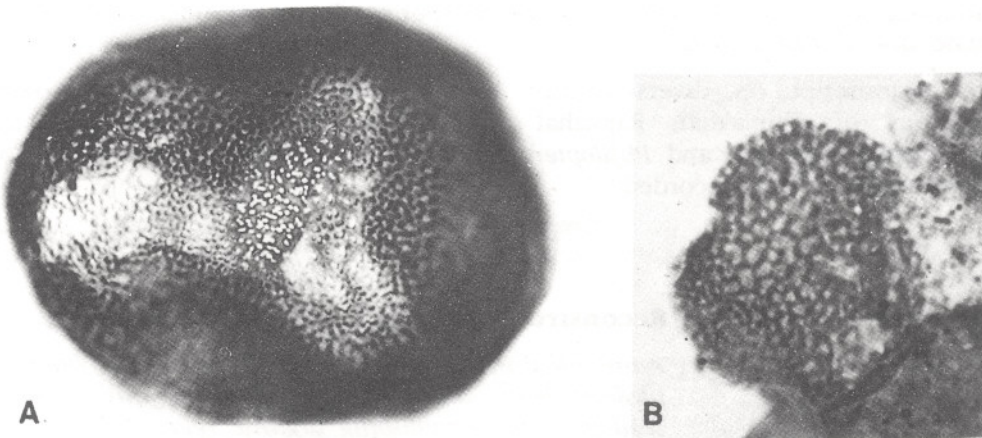
R. S. Tiwari and Archana Tripathi

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

Objective : *Palynological dating, palynostratigraphy and biozonation*

Compilation and interpretation of palynological data in bore-holes from RAD-6 and RAD-8 in eastern part of Raniganj Coalfield area have been done. Adding to the lateral extension, this study has supplemented the known sequential palynoassemblages at P/T boundary in this area.

R. S. Tiwari, Vijaya and K. L. Meena



Early Cretaceous angiosperm pollen from subsurface Intertrappean sediments of Rajmahal Basin: **A**, aff. *Clavatipollenites* sp. 1 ($61 \times 81 \mu\text{m}$); **B**, cf. *Stephanocolpites* sp. ($20 \mu\text{m}$).

Evolutionary patterns of striations and taeniae in Indian Gondwana saccate pollen were evaluated and their proliferation, diversification and decline were traced through Permian and Triassic times.

Vijaya

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

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

Studies on bore-hole GAM-7 from Mailaram area led to the identification of Talchir, Barakar, Raniganj and Triassic palynozones. Bore-hole GAM-8 from the same area also shows Lower Kamthi (Raniganj) and Barakar palynofloras which are correlatable with those of the Bore-hole GAM-7. Bore-hole SSA-10 from Chintalpudi sub-basin contains 10 coal seams, all of which show striate disaccate dominant assemblages correlatable to the Lower Kamthi palynoflora. In bore-holes GAM-3 and GAM-5, Kamthi palynoflora has been recovered while in GAM-10 a complete palynological sequence from Talchir to Kamthi formations has been identified.

Suresh C. Srivastava and Neerja Jha

A succession of palynozones from Karharbari to Middle Kamthi has been established in four bore-holes, viz., GM-3, 4, 5 and 8 from Manuguru area. The Karharbari palynozone characterised by radial monosaccate pollen and trilete *Callumispora* correlates with the main working coal seams in Manuguru area. The Barakar coal seams characterised by *Scheuringipollenites* are at present not being mined. Presence of Barren Measures is proved palynologically in these bore holes. The Upper Permian (Lower-Middle Members of Kamthi Formation) contains workable coal seams and are characterised by striate disaccate pollen and early appearance of *Falcisporites*, *Klausipollenites* and *Vitreisporites*.

Neerja Jha

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

Objective : *Palynostratigraphy and biozonation*

Samples at various depth-levels in 450 m deep Bore-hole TCW-25 of Talchir Coalfield have yielded rich palynoflora. The quantitative assessment of samples at 405 m depth shows dominance of *Parasaccites*, associated with *Plicatipollenites* and *Vesicaspora* indicating Talchir level at 136 m depth. The assemblage shows abundance of *Striatopodocarpites* in association with *Crescentipollenites*, *Faunipollenites*, *Klausipollenites*, and a few alete forms at depth level 70.80 m. The palynoflora contains *Striatopodocarpites*, *Crescentipollenites*, *Densipollenites* and *Verticipollenites*. A Late Permian age is thus evident for 136 to 70.80 m interval.

Archana Tripathi

None of the 25 samples from Brähmini River Section near Sarnu in Orissa yielded palynofossils. Fifty samples of Bore-hole TCW-24 of Talcher Coalfield were processed and palynology of 15 productive samples has been done.

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 from sediments of Morghat section, Hoshangabad District, Madhya Pradesh is dated as Late Jurassic/Early Cretaceous. It resembles the palynoflora of the Jabalpur Formation.

Palynoflora recorded from Khardi Nadi and Napupura sections (Jatamao), Hoshangabad District, Madhya Pradesh is also of Late Jurassic/Early Cretaceous age.

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*

A detailed study of petrographic composition together with chemical analysis of some Permian Raniganj coal seams has shown the sign of hydrocarbon progenitors, i.e., presence of fluorescing vitrinite, fluorinite, liptodetrinite, bituminite, green and yellow fluorescing resins, etc. Spontaneous combustibility in the same Permian coal seams has also been made, vis-a-vis stratigraphy is attributed to coal composition, geology, tectonics and coal facies relationship.

Petrographic characterization of East Bokaro coals has shown conformity in the trends of facies resolution with West Bokaro Basin. The characteristic occurrence of exudatinitite filled along vitrite cracks has also been noticed. The fluorescing intensity of the sporinite recorded suggests these coals to be in orange to red region and shows conformity in trends of rank pattern fluorescence properties of these coals.

Rakesh Saxena and G. K. B. Navale

Organic compositional studies of coal from Hura and Chuperbhita areas of Rajmahal Basin revealed that they contain variable proportions of reactive constituents (vitrinite 1.0-80.8%) with occasionally dominant non-reactives (inertinite 8.0-72.0%) and poor exinites (0.2-12.2%). The coals are of inferior quality because of the pre-dominance of mixed coal types associated with dispersed inorganic matter. The vitrinite reflectance (0.43-0.56% in oil) suggests sub-bituminous A to high-volatile bituminous C rank to the coals. It appears the coals were formed in a rapidly fluctuating environment (aerobic to anaerobic) under relatively cold to gradually warming conditions.

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

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

The palynoassemblage from Jorethang-Namchee area in Sikkim is rich in striate disaccate pollen and is correlatable with the Upper Barakar of Peninsular Gondwana. The sub-surface coal in Saurang area, Bhutan is characterised by the preponderance of striate-disaccate pollen with rare *Gondisporites*, *Weylandites* and *Gnetaceaepollenites* indicating an Upper Permian affinity.

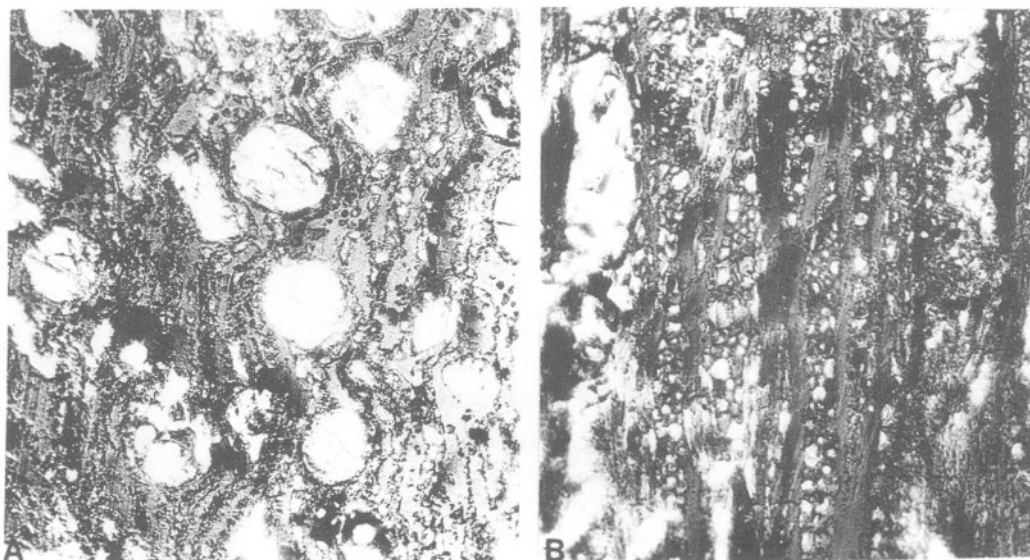
In coal-balls from West Siang District the palynotaxa *Staurosaccites*, *Playfordiaspora*, *Guttatisporites* and *Densoisporites* are found in association with *Parasaccites* and *Callumispora* assemblage.

Suresh C. Srivastava and A. P. Bhattacharyya

Organic petrological study of Permian coal samples from Arunachal Pradesh indicates that these coals are dominantly composed of highly reflecting vitrinite and fusinite maceral groups. In comparison to coals of Peninsular Gondwana the coals have attained much higher rank. The increase in rank was primarily affected by the intense tectonic activity in the Himalaya.

Biopetrological study of Tertiary coals from Subansiri area of Arunachal Pradesh indicates that these coals are of lignitobituminous type and the rank of coal increases progressively towards the main boundary fault.

Anand-Prakash



Fossil wood of *Hopenium payangadiensis* sp. nov. from Kerala Coast: **A**, Transverse section, **B**, Tangential longitudinal section.

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

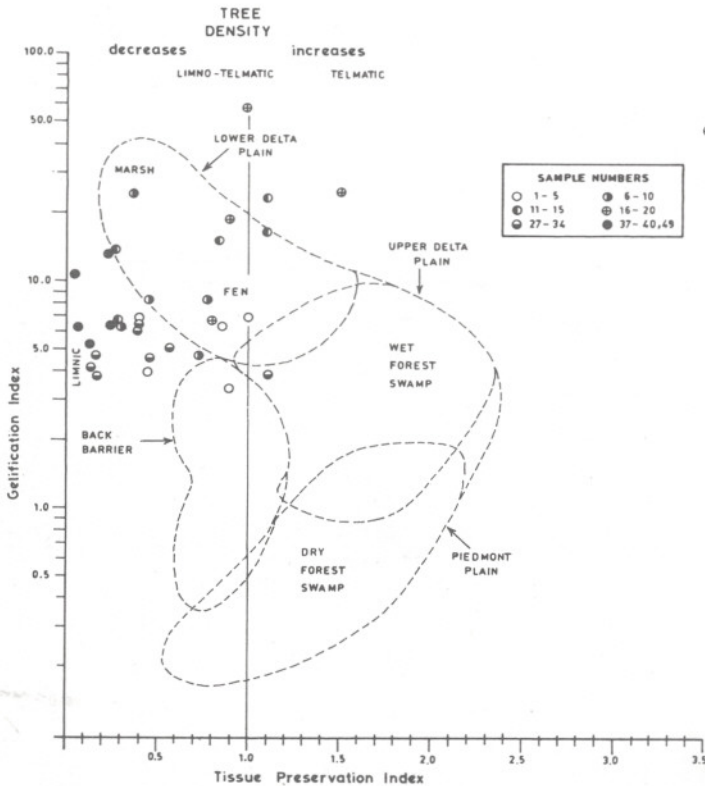
: Tertiary plant megafossils from Kerala Basin

Objective

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

A new taxon *Acronychia* (Rutaceae) has been identified amongst carbonised woods studied from Payangadi clay mine, Kerala. An analysis of the available data on megafossils has revealed that during Middle Miocene-Pliocene luxuriant forest dominated by tropical evergreen elements thrived all along the Kerala Coast. Presence of certain taxa of Malayan distribution, viz., *Dryobalanops*, *Anisoptera*, *Gonystylus*, *Payena*, *Hydnocarpus*, *Canarium*, *Swintonia* and *Leea* indicates prevalence of excessive humid conditions in this region.

N. Awasthi and Rashmi Srivastava



Facies of the Lower Eocene lignite seams and associated carbonaceous sediments from Panandhro Lignite field (Kutch), Gujarat in terms of Gelification Index (GI) and Tissue Preservation Index (TPI) in relation to depositional settings and swamp types (modified from Diessel, 1986).

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

Objective : *Characterization of lignites and quality assessment*

Out of the two lignite seams in the Panandhro Lignite Field, Kutch, the bottom seam has been petrographically found to contain three seams separated by carbonaceous shale, shaly lignite and greyshale bands. The basal two (1st and 2nd) and the top most (4th) seams show high degree of degradational effects (dominated by macerals attrinite-densinite) whereas, the 3rd seam is relatively rich in woody fraction (dominated by macerals textinite-ulminite). Macerals resinite (7-20 m.m.f.) and liptodetrinite (10-28% m.m.f.) are fairly rare. In contrast to lignite samples, shaly lignite, lignitic shale and carbonaceous shale bands above 3rd and 4th seams have relatively more resinite (13-26% m.m.f.) and liptodetrinite (25-50% m.m.f.) contents. Persistent occurrence of primary calcite and framboidal pyrite in all the 50 samples indicates brackish water milieu during lignite deposition in a shallow and gradually sinking basin. The Panandhro lignite appears to be better suited for the extraction of organic chemicals apart from briquetting.

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

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

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

Systematic study of palynofossils recovered from Meenkunnu and Payangadi sections of North Kerala has been completed. 45 genera and 70 species of spores and pollen have been identified. Angiosperm pollen register dominance over pteridophytic spores. The important genera are *Lygodiumsporites*, *Foveotriletes*, *Osmundacidites*, *Polypodiisporites*, *Quilonipollenites*, *Crotomonosulcites*, *Lakiapollis*, *Tribrevicolporites*, *Meliapollis*, *Ctenolophonidites*, *Myrcipites*, *Proteacidites*, *Clavaperiporites*, *Compositoipollenites* and *Malvacearumpollis*. A Miocene age and tropical humid climate with plenty of rainfall have been inferred. A brackish water environment of deposition is indicated by mangrove elements and dinoflagellate cysts.

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*

Study of selected peat/lignite samples rich in grey amorphous organic matter under Scanning Electron Microscope has shown the presence of well-preserved bacterial remains. Presence of grey amorphous organic matter has been related to the formation of hydrotriolite in the Karewa basin. Record of this type of organic matter from completely fresh water sediments is significant. The spectral fluorimetric study of peat and lignite samples has indicated the presence of three

different types of resin bodies in the sediments. These are characterised by the green, greenish yellow and yellow colours, respectively.

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

Plant megafossils comprising mostly leaf-impressions and a few fruits/seeds collected from Bargolai, Ledo (Tirap) and Tipogpani coalfields (Oligocene) were studied. About 40 types have been recognised, e.g., *Calophyllum*, *Kayea*, *Drimycarpus*—*Mangifera*, *Odina*, *Mucuna*, *Dalbergia*, *Terminalia* (*T. catappa*, *T. coriacea*), *Myristica* (*Knema*), *Avicenia* and *Podocarpus*. These indicate tropical climate with prevalence of humid conditions in this region during their deposition. Occurrence of leaves comparable to *Terminalia catappa* and *Avicenia officinalis* suggests near shore deposition of Makum coals.

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

About 150 samples collected from Langpar (Lower Palaeocene), Therria (Middle Palaeocene), Lakadong (Middle-Upper Palaeocene), Umlatodoh (Lower Eocene), Prang (Middle Eocene) and Kopili (Upper Eocene) formations were processed for palynofossils. It was observed that *Dandotiaspora dilata* and *Lycopodiumsporites speciosus* are met with only in the Middle Therria Formation. *Matanomadbiasulcites maximus* and *Spinizonocolpites echinatus* occur in Langpar Formation and continue beyond Lakadong Formation.

R. K. Kar

Samples collected from seam nos. 1 and 2 of Nangwal Bibra area, Garo hills contain more or less similar palynotaxa, e.g., *Dandotiaspora dilata*, *D. telonata*, *Lycopodiumsporites palaeocenicus*, *L. speciosus*, *Neocouperipollis echinatus*, *Matanomadbiasulcites maximus*, *Spinizonocolpites echinatus*, *Kielmeyerapollenites syncolporatus*, *Proxapertites crassimurus*, etc. It seems that both the seams are homotaxial.

K. Ambwani

Striatriletes and *Malayaeaspora* were studied under light microscope and SEM. It was observed, that in *Striatriletes*, costae are discontinuous and are made up of verrucae. In *Malayaeaspora* verrucae are absent on the proximal side though sometimes coalesce on distal side but never form true verrucae. Extant spores of *Ceratopteris* were compared with the fossil ones. It was observed that the spores of *Ceratopteris thalictroides* closely resemble *Striatriletes microverrucosus*.

R. K. Kar and K. Ambwani

Palynological investigations on the Mariani-Mokohchung road exposure, Nagaland was completed. It was observed that the assemblage recovered at 39 km post is rich in polypodiaceous spores while those at 35 km and 35.2 km posts are dominated by *Striatriletes*, *Marginipollis*, *Lakiapollis*, etc. *Tricolporopilites*—a marker fossil for the Middle Eocene in Kutch—is also present in the assemblage. In all probability, the assemblage recovered from Mariani-Mokohchung road is also Middle Eocene in age. Palaeoecological charts were drawn to depict different ecological groups present in the assemblage.

J. Mandal

In the 38 productive samples from Jadukata and Mahadek formations of Khasi Hills, Meghalaya following genera could be identified provisionally: *Araucariacites*, *Densoisporites*, *Cyatbidites*, *Todisporites*, *Dictyophyllidites*, *Lycopodiumsporites*, *Cicatricosisporites*, *Appendicisporites*, *Triporoletes*, *Contignisporites*, *Ariadnaesporites*, *Coptospora*, *Callialasporites* and *Podocarpidites*. Besides, some angiospermous pollen and dinoflagellate cysts were also recovered.

R. S. Singh and A. Rajanikanth

Monocolpate, spinose pollen, viz., *Neocouperipollis* and *Spinizonocolpites* recovered from Jarain and Laitrymbai collieries were studied in SEM. For comparison pollen of *Arenga pinnata*, *A. caudata*, *Mauritia flexuosa*, *Wettinacarpus fascicularis* and *Nypa fruticans* were also studied in SEM.

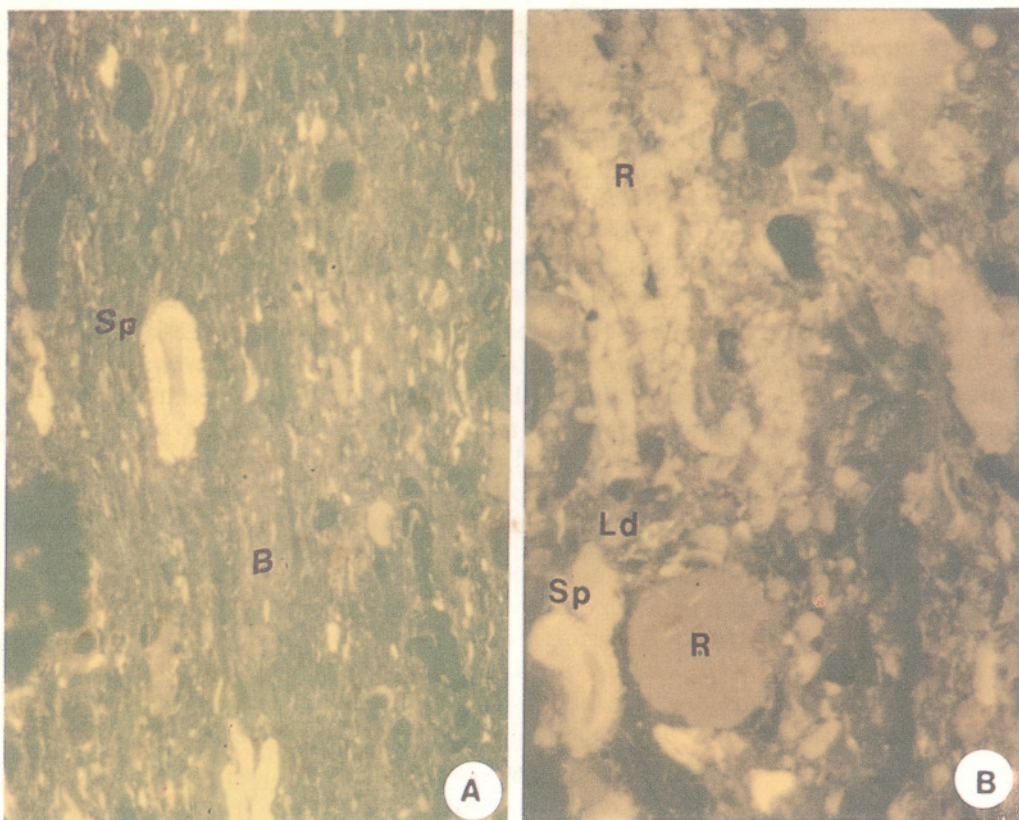
Madhav Kumar

Palynoassemblage from Tikak Colliery consists of 61 genera and 86 species. Some of the important taxa are: *Eximispora tuberculata*, *Biretisporites scabratus*, *Dictyophyllidites trilobiformis*, *Pteridacidites verrucatus*, *Osmundacidites wellmanii*, *Polypodiaceasporites tertiarus*, *Polypodiisporites ornatus*, *Pelliceroipollis langensheimii*, *Marginipollis kutchensis*, *Meyeripollis nabarkotensis*, etc. It is postulated that deposition of sediments took place under fresh-water conditions.

B. D. Mandaokar

Samples of Kopili Formation collected from east bank of Umshoryngkew River section, Therriaghat, Kopili River section, Garampani and Khorungma, Umrangso were studied for palynofossils. The assemblage consists of fungal bodies, spores, and pollen. The dominant taxa are: *Dictyophyllidites cymbatus*, *Todisporites minor*, *Osmundacidites wellmanii*, *Striatriletes susannae*, *S. multicostatus*, *Malayaeaspora costata*, *Polypodiisporites repandus*, *Polypodiaceasporites chatterjeei*, *Podocarpidites kbasiensis*, *Pinuspollenites crestus*, *Retitrescolpites assamicus*, *Margocolporites tsukadae*, *Dermatobrevicolporites dermatus* and *Pelliceroipollis langensheimii*.

G. K. Trivedi



Some of the main hydrocarbon source-macerals in Tertiary coals of north eastern India: **A**, sporinite (Sp) and resinite bodies in bituminite groundmass (B) $\times 288$ under blue light excitation; **B**, Resinite rich (R) liptodetrinite (Ld) with sporinite $\times 288$ under blue light excitation.

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

Objective : Organic matter classification and maturation level

Biopetrographic investigation (under normal white light and blue light excitation) of 18 m and 6 m thick coal seams (27 samples) from Makum Coalfield, Upper Assam shows appreciable amount of hydrogen-rich macerals (79-88% m.m.f.). Both the seams are almost identical in their petrographic composition and are persistently associated with framboidal pyrite and primary calcite. These coal seams probably originated under anaerobic and brackish water conditions in protected shallow basin of a prograding delta complex. The Makum coals have properties for syncrude generation.

Coal seams (49 samples) from Jaintia and Garo Hills of Meghalaya are also very rich in fluorescing or hydrogen-rich macerals (72-91% m.m.f.). However, the Meghalaya coals have higher proportions of liptodetrinite and other liptinites and lower proportion of perhydrous vitrinite in comparison to those of the Makum Coalfield. These coals have been assessed to be useful for liquifaction.

The study on 55 particulate coal pellets from Laitryngew Coalfield, Khasi Hills, Meghalaya shows that the Laitryngew coals, like other Tertiary coals from northeastern India, are quite-rich in fluorescing (hydrogen-rich) macerals.

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

Detailed study of lenticular type of dinoflagellate cysts with an apical and two unequal antapical horns, belonging to *Alterbidinium*, recovered from Trichinopoly Formation, Cauvery Basin revealed an interesting new find that the 2a Intercalary archaeopyles, independently developed on periphragm and endophragm, are



Herendeenia alaskaensis (Stover & Evitt)
Stover & Helby 1987 from Early Cretaceous,
Palar Basin.

dissimilar in shape, the periarchoepyle is 2a steno/isodeltaform, whereas the endoarchoepyle is eury-deltaform. Genus *Alterbidinium* has been emended along with two known species, viz., *A. acutulium* (Type species) and *A. minus*. A new species *A. papillatum* has been proposed.

For precise biostratigraphic interpretation additional samples (cuttings) at closer intervals are analysed throughout the 700 m deep bore hole sequence of Palar Basin. The dinoflagellate cyst assemblage recovered has been photodocumented and the detailed morphological study revealed the presence of following species of stratigraphic significance: *Herendeenia postprojecta*, *Pyxidiella tumida*, *Kaiwaridinium scrutillinum*, *Circulodinium attadalicum*.

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



Leaf-impression of *Ficus glaberrima* Bl. from Mahuadanr Valley, Palamu District, Bihar.

A leaf compression collected from the Neyveli lignite deposit shows resemblance with the leaves of *Garcinia bancana* of Clusiaceae and a carbonised specimen has been provisionally identified as wood of Lecythidaceae.

Anil Agarwal

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

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

Important morphoforms of calcareous algae of Kallakudi Limestone, Cauvery Basin include *Cayeuxia*, *Picnoporidium*, *Halimeda*, *Larvaria*, *Neomeris*, *Acicularia*, *Permocalculus*, *Archaeolithothamnium* and *Lithothamnium*. A comparative assessment of these rock building algae and their ecological implication have been attempted. Compilation of records of Indian calcareous algae for the catalogue of Indian fossil plants has been completed.

A. Rajanikanth

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

Objective : *Vegetational history of the Neogene period*

About one hundred leaf-impressions collected from the Late Cenozoic sediments from Mahuadanr, Palamau District, Bihar were studied and ten new types have been recognised.

M. B. Bande

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

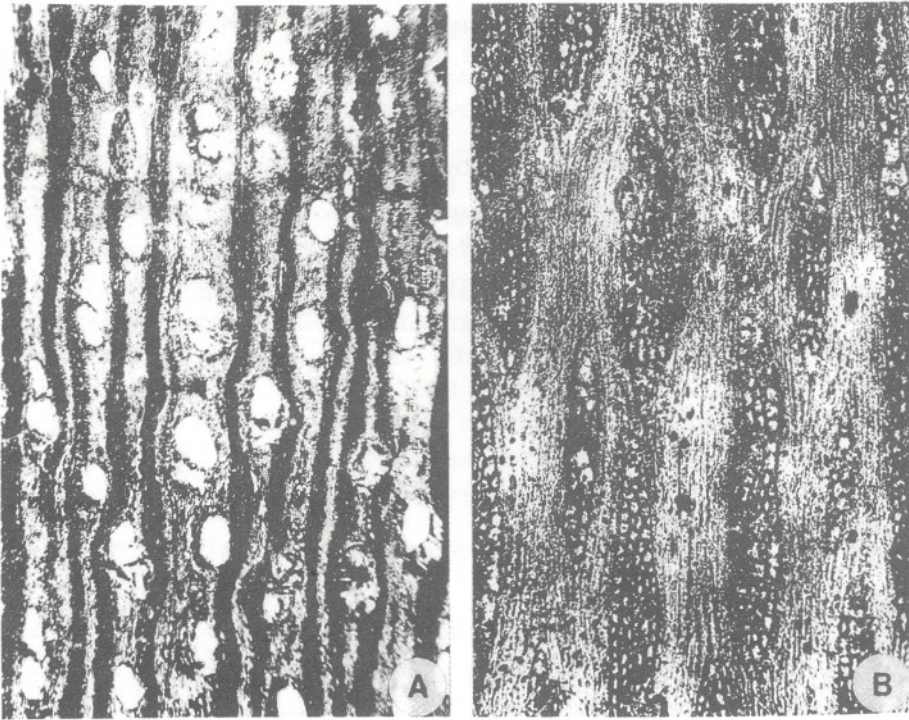
Objective : *Morphotaxonomy, biostratigraphy, palaeogeography and palaeoecology of the Cenozoic diatoms*

Diatoms from North Coast and Champin Jetty sections of Nancowry island have been photodocumented. The assemblage comprises 80 species belonging to 32 genera. Occurrence of *Coscinodiscus lewisianus*, *C. gigas* var. *diorama*, *Caraspepodiscus coscinodiscus* and *Actinocyclus moronensis* in Nancowry assemblage indicates the presence of Neogene Tropical Diatom zones (NTD) 6, 7, 8 and 9, respectively and suggests Middle Miocene age to the studied Nancowry sections. Quantitative analysis revealed the dominance of centric forms over the pennales. *Coscinodiscus* is represented by highest number of species.

Anil Chandra

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

Objective : *Morphology, palynostratigraphy, biozonation and palaeoenvironments*



Fossil wood of *Khaya*, a tropical element of Meliaceae, from the Shumar Formation of Rajasthan: **A**, Transverse section $\times 35$; **B**, Tangential longitudinal section $\times 35$.

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

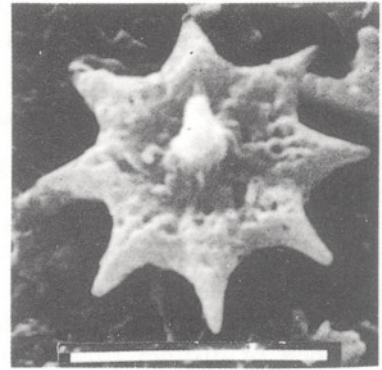
Objective : To build up vegetational history

Anatomical study of about 100 petrified woods from Tertiary sediments of Rajasthan and Bharuch District of Gujarat was carried out. The genera identified from Bikaner are *Dipterocarpus*, *Dialium*, *Ougeinia*, *Anogeissus*, *Terminalia*, *Holoptelea*, *Lagerstroemia* and *Duabanga*. In contrast to present day deserts conditions, the assemblage indicates moist humid conditions in Bikaner during the Neogene. The occurrence of *Dipterocarpus* is of phytogeographic, palaeoclimatic and stratigraphic significance. A fossil wood of tropical African genus *Baphia* has been identified from Jaisalmer. Two fossil woods belonging to the family Lauraceae and Myrtaceae have been identified from Palaeogene of Bharuch District in Gujarat.

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



Discoaster saipanensis Bramlette & Riedel, an important global marker species from late Middle Eocene (Bartonian) of Kutch Basin (Bar = 10 μ m).

A draft manuscript was completed on the discovery of Black shales containing nannoflora at 300 m depth in a bore-well at Habur Village, Jaisalmer Basin. Sparse but datable nannofloral assemblage of Tethyan realm has important bearing on the age of sedimentaries underlying the Habur Formation (Albian age based on Ammonites) which are equivalent to Pariwar Formation (almost barren of marine fossils). The nannofloral assemblage can be assigned to CC7 *Chiastozygus litterarius* Zone of Aptian-Early Albian age, but more precise Late Aptian age is probable due to the presence of *Eprolithus floralis*, *Nannoconus globulus* and *Nannoconus inconspicua*. Other species are *Thoracosphaera* sp., *Watznaueria barnesae*, *Ellipsagelosphaera bratannica*, *Ellipsagelosphaera fossacincta*, *Cyclagelosphaera* cf. *C. mergerelli*, *Cretarhabdus* sp., *Biscutum constans*, *Rbagodiscus splendens*, *Rbagodiscus asper*, *Zeugrhabdotus erectus*, *Diazomatolithus lehmanii*, *Rucinolithus irregularis*, *Polycostella* sp. Three new species, viz., *Zeugrhabdotus ?haburensis*, *Laguncula indica* and *L. angulata* have been proposed.

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*

Palynological study of Ellichpur area, Maharashtra has been finalized.

The palynoassemblage of Nimar Formation exposed near Umrli Village is comparable with the palynoflora of Jabalpur, Umia, Rajmahal and Gangapur formations.

Palynofossils recovered from Dhrangadhra Formation (than plant beds) in Tarnetar and Songad areas, Saurashtra Basin are comparable to those of the Jabalpur Formation assemblage.

Pramod Kumar

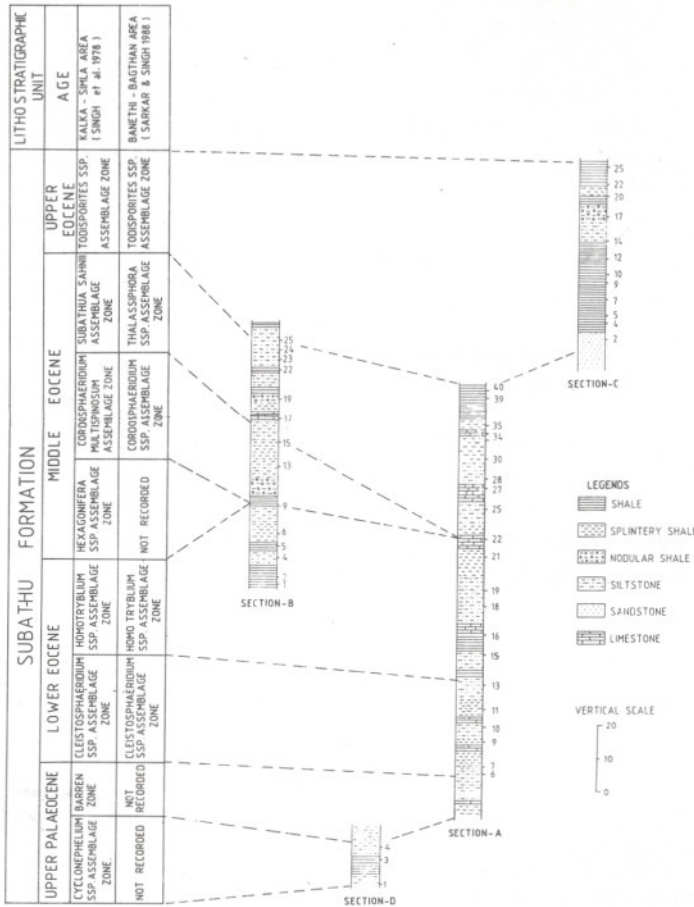
Subproject I.D.6.6 : Palaeocene palynology of Rajasthan—a reconnaissance

Objective : *Morphotaxonomy, biozonation, correlation and palaeoecology*

Morphotaxonomic studies and photodocumentation of palynofossils from 130 cutting samples from MK and MJ wells in Barmer Sandstone, Rajasthan were continued. Palynoflora recovered from this formation shows the dominance of tricolporate pollen having a variety of exine ornamentations. These forms have been assigned to *Lakiapollis* and *Tricolporopollis*. Other forms present in the assemblage are *Proxapertites*, *Palmaepollenites* and *Dandotiaspora*. Studies indicate the presence of distinct Palaeocene and Eocene assemblages in the sequence.

S. K. M. Tripathi

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



Palynostratigraphic correlation of four measured sections of Subathu Formation (Eocene), Garkhal area, Himachal Pradesh.

Objective : Biozonation, age determination and palaeoecological interpretation

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

Objective : Biozonation, age determination and palaeoecological interpretation

Palynostratigraphical and palaeoenvironmental study of Subathu Formation (Eocene) in north-western part of Punjab Basin correlates four measured sections in the Garkhal-Dharampur area of Solan District, Himachal Pradesh. It throws light on species diversity in relation to changing environment and marks trends in the compositional variation of palynofossils in south-eastern and north-western parts of the basin.

Palynoassemblage of Subathu samples from six measured sections around Dasseron and Dugnair on Bilaspur-Simla Highway consists of 30 genera and 47 species belonging to dinoflagellate cysts, pteridophytic spores, fungal spores and ascostromata. Based on the qualitative and quantitative analyses of the assemblage, three palynological zones have been identified and used in the correlation of different sections. Palynological data do not support the concept of intertonguing facies relationship of Subathu sediments in this area as suggested by some earlier workers.

A rich dinoflagellate cysts assemblage has been recorded from Dhondon and its adjoining areas of Himachal Pradesh. Significant constituents of the assemblage are *Homotryblium*, *Cleistosphaeridium*, *Thalassiphora*, *Cordosphaeridium*, etc. Palynofossil yielding horizons have been observed in Kunnihar, Swarghat and Dadahu areas of Himachal Pradesh.

H. P. Singh and Samir Sarkar

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

Objective : Morphotaxonomy, biozonation, correlation and palaeoecology

Studies on sediments exposed near Pasighat, Yinkiyong and Dalbung, Siang District, Arunachal Pradesh have shown the presence of marker Eocene palynotaxa like *Ctenolophonidites*, *Cryptopolyporites*, *Lakiapollis*, *Tricolporopollis*, *Pelliceroipollis*, *Tricolpites* and *Crotonipollis*. Recovery of these palynotaxa provides additional evidence for the occurrence of Lower Tertiary sediments in this area.

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*

Plant fossils were recorded from Gondwana equivalent continental facies outcropping in Kameng District (Arunachal Pradesh), South Sikkim District (Sikkim) and Darjeeling District (West Bengal). The flora comprises equisetalean axes, *Phyllotheca* sp., *Glossopteris stenoneura*, *G. sp. cf. G. leptoneura*, *G. syaldiensis*, *G. formosa* and *Vertebraria indica* and compares with the Late Permian flora of Raniganj Formation in peninsular India.

Usha Bajpai (and Trilochan Singh, WIHG)

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

Objective : *Morphotaxonomy, correlation and dating of sediments*

Recovery of spore/pollen from Permian and Triassic of Niti area in western Himalaya is poor. Photodocumentation of striate and non-striate disaccate types has been done and morphotaxonomic study taken up.

R. S. Tiwari and Vijaya

Project 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 sub-tropical, temperate and alpine belts of Himachal Pradesh and Uttar Pradesh

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

Palynology of a 6 m thick profile from Naukuchia Tal indicates the predominance of mixed oak-chirpine forests around 4,000 years BP. On the basis of vegetational composition, moist and warm climate has been inferred. Chirpine-oak forests are recorded around 1,000 years BP which indicate comparatively drier conditions. At the top of the sequence some biotic interference is exemplified by increased values of grasses, cheno/ams, *Artemesia*, etc. A 1.35 m deep profile from Tarag Tal was pollen analysed which revealed the existence of chirpine-oak forest. At the top of the profile, chirpine declined whereas grasses and culture pollen improved depicting biotic activity.

Studied 12 surface samples from Bhim Tal, Ghodakhal and Chaphi. Chirpine, oaks, *Viburnum*, Poaceae, Oleaceae, etc., are the main constituents of arboreals and compare well with the modern set-up of vegetation. Correlation chart of four

profiles in Sat Tal zone has revealed the existence of chirpine-pak forest since 1000 years BP.

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*

Thirty four samples from a 6.8 m thick profile from Silent Valley have been pollen analysed. The biomass potential of sediments is quite high. Palynologically, the samples are quantitatively and qualitatively rich. Contrary to other profiles from south Indian montanes, the Silent Valley profile has a rich assemblage of arboreal taxa such as *Elaeocarpus*, *Euonymous*, *Symplocos*, *Ilex*, *Palaquium*, etc. Important non-arboreal taxa recorded are *Senecio*, *Impatiens*, *Peperomia*, *Meracleum*, etc. These taxa are closely related to the Shola forest. Two pollen diagrams and two pollen depositional models one each from Silent Valley and Annamalai Hills have been prepared.

H. P. Gupta and S. K. Bera

Study of pollen morphology of 150 species from Silent Valley has been completed and a key is proposed.

H. A. Khan and S. K. Bera

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

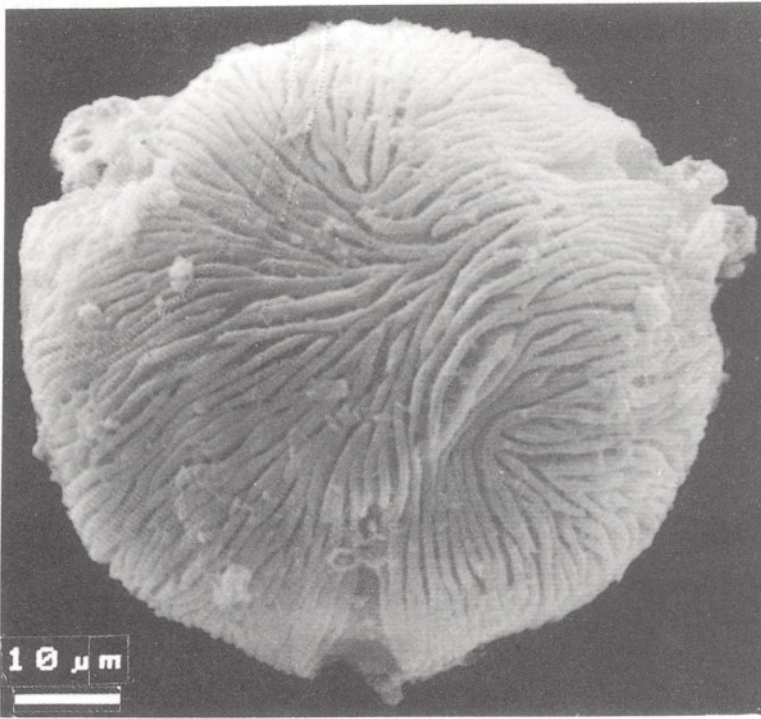
Objective : *Tree ring analysis and decoding climatic data with emphasis on monsoon records*

Cross dating of 20 cores of deodar and 5 cores of blue pine from Kansar, Chakrata, U.P. has been completed. Measurement of tree ring widths of 14 deodar cores from Kansar and 5 cores of *Cedrela toona* from southern India has also been accomplished.

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*



SEM photograph of *Alangium alpinum* pollen showing striate pattern and apertures.

Pollen of 15 taxa belonging to Alangiaceae, Ericaceae and Liliaceae were studied. The study has shown the pollen morphology variations.

Chhaya Sharma and Asha Gupta

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 3.75 m deep profile from Nalabana Island, Chilka Lake, Orissa. Sediments throughout the profile consist of clayey sand except that coarse sand increases downcore. Palynological study has shown overall high values of nonarboreals. Poaceae, Cyperaceae, Chenopodiaceae, Acanthaceae, etc. predominate the ground flora. Arboreals, particularly mangrove and peripheral mangrove taxa, e.g., *Rhizophora*, *Avicennia*, *Sonneratia*, *Excoecaria*, *Ceriops*, *Bruguiera*, *Cerbera*, *Lumnitzera*, etc. are present in highly reduced values. Thus, these evidences suggest deltaic environment in and around Nalabana Island about 1000-2000 years BP.

Data generated as a result of D.O.M. analysis from Balugaon profile have been synthesised. Photography of palyno-debris (LM & SEM) was done to prepare a ready reckoner. Besides, one chart and one ternary diagram showing relative values of all

particulate organic matter have been prepared. The results reveal the preponderance of terrigenous structured and semistructured organic matter.

Eight types of *Pediastrum* coenobia recovered from Balugaon and Nalabana profiles have been photographed. Different types of fungal spores, hyphae and fruiting bodies, seeds and fruits recovered from Balugaon profile have been photographed.

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*

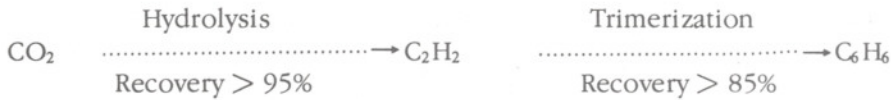
A total of 90 samples were processed for radiocarbon dating by methane and benzene syntheses for gas-proportional (63) and liquid scintillation (27) counting methods. Of these, 63 samples including anthracite background and NBS oxalic acid (contemporary radiocarbon standard) were prepared for methane gas counting. C-14 ages for 45 samples have been calculated. One sample could not be dated due to insufficient carbon content.

Profiles from Takcha section in Lahul and Spiti, H.P., date back to 30,000 years BP. The 80 cm section of calcareous tuff profile is deposited over a period of 4,000 years (from 21,920 years to 17,820 years BP). But the carbonate rock on top of this section with impression of plant material is dated to 32,000 years BP. Other trench profiles and the core sections from the same locality give consistent ages going back to 6,880 years BP. With these age data it is now possible to correlate Quaternary sediments sequence in the area.

Twenty two samples of Kankar deposits from the alluvium near Lucknow are under process for dating the past flooding episodes in the river channel.

Two profiles of peat/peaty clay deposits from Nilgiri Hills (Sandy nallah and upper Bhavani) were dated for correlation with O^{18} and C^{13} variations. The Sandy nallah profile is dated to 8,700 years BP at a depth of 2.4 meter which is at variance with the earlier measurement of 30,000 years for the sample at 1.95 meter collected from marshy area. This may be due to variations in topography and hydrology of undulatory surface and uneven sedimentation in the two sites of collection. Similar results have also been obtained for Konal Ar Basin in Palni Hills. The upper Bhavani profile dates to 3,980 years BP at a depth of 1.5 meters which is in reasonable agreement with earlier measurements. Two calcareous rock specimens (Andaman sea: age 14,400 years and Thiruchendur, near Rameshwaram, Tamil Nadu coast : age 27,000 years) were dated. In addition, profiles of lake sediments of Kumaon and Kodaikanal were dated.

Work on the setting up of the Liquid Scintillation Counting method was continued. Twenty seven syntheses of benzene samples from CO_2 via acetylene were carried out after refabrication of the entire glass system. Consistent yields of $> 95\%$ were achieved with Benzene recoveries $> 83\%$.



Few of these benzene samples were counted in the LKB Rackbeta liquid scintillation counting system and the age results were compared with the ones obtained by gas counting method. The counting parameters of the system need to be optimized to obtain better figures of merit.

G. Rajagopalan

Subproject I.D.11.2 : Fission track dating of rock samples

Objective : To date minerals and rocks by Fission Track method

The volcanic ash check samples from Chopan porcellanite and Ransing Khola, Balubagh bridge, Nepal, Siwalik Himalaya have been processed. Zircon grains were separated by hand picking after mineral separation by both magnetic and density separation methods. An assembly for zircon grains mounting has been designed and tested for various temperatures. The mounting of the zircon grains was tried using teflon pieces. It was found that these pieces did not soften even at 300°C and hence proper mounting could not be achieved.

A glauconitic sandstone check-sample (3T/5) collected from the Vindhyan deposits at Ahu bridge, Jhalwar, Rajasthan was processed. The glauconitic grains are not well evolved and could be separated only after using high value of magnetic current, i.e., 1.2 Amp. F-T dating of this sample is in progress.

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

Glauconite separation from 4 samples collected from several Vindhyan locations was carried out. Calibrations on various parameters of system components were done. Several changes were made in the set-up of K-Ar dating, e.g., new inlet system, (38) Ar spike, separate pumping line for extraction bottle, etc.

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 mudbank and to develop a profile of palynological studies in marginal areas*

Investigations on the sedimentary facies, spore-pollen and palynodebris of mudbank and Vembanad Lake, Kerala have shown that the bottom sediments of Alleppey profile are dominated by silty clay whereas, in Quilandy, clay is the dominant unit. In Vembanad Lake, the finer particles are concentrated in the middle part of the lake. Spores and pollen are more common near the shore and dinoflagellate cysts dominate in sea-ward direction. Spores are mostly represented by *Ceratopteris* and *Pteris* type while pollen, structured terrestrial, biodegraded terrestrial organic matter and foraminifera are also frequently met with. The structured terrestrial and biodegraded organic matter is common along the shore and the foraminifera in offshore region.

B. S. Venkatachala, 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*

Specimens of *Faunipollenites*, *Parasaccites*, *Crucisaccites* and *Callumispora* have been further studied and photographed to highlight specific characters. The prominence of *Callumispora* in Lower Karharbari and of *Crucisaccites* in Upper Karharbari identifies these horizons. *Parasaccites* qualifies the Talchir and Karharbari formations while *Faunipollenites* diversifies in Barakar, Kulti and Raniganj formations.

Evolutionary trends in saccate pollen through Gondwana Sequence are being studied.

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 morphography of taxa and palynostratigraphy*

Updating of the data bank on palynology of Indian Gondwana sediments and related aspects has been done. About 600 references have been stored in the floppy

diskette for specific retrieval.

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*

About one hundred samples of oil well cuttings, ranging from Campanian to Oligocene in age of the bore hole CM 5 from Senegal and 50 samples (Miocene) from the bore hole Pemba 5, Tanzania were chemically processed. Important palynotaxa have been identified and photographed from some of these samples.

B. S. Venkatachala, R. K. Kar and A. Rajanikanth
(in collaboration with C. Caratini and C. Tissot,
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*

Work on the Early Tertiary vegetational reconstructions around Nagpur-Chhindwara and Mandla, central India was completed.

M. B. Bande and Shaila Chandra

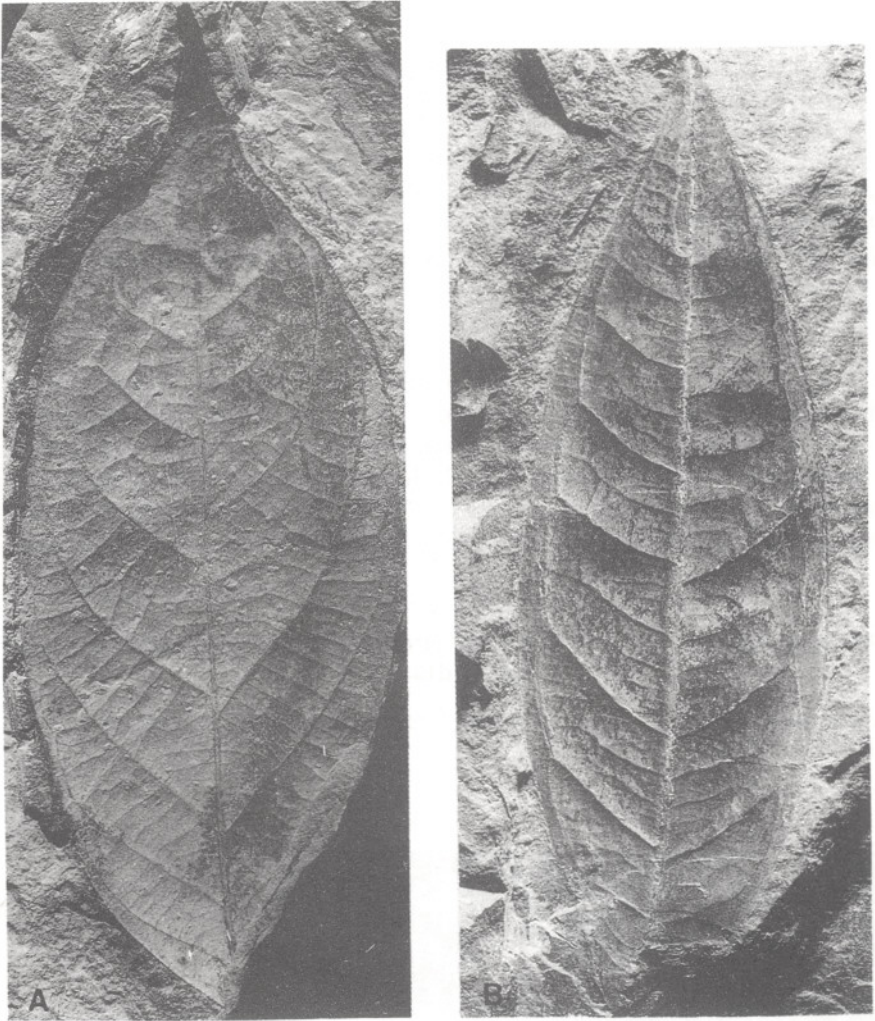
Project I.D.15 : Siwalik flora and its stratigraphical implications

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

Subproject I.D.15.1 : Siwalik plant megafossils

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

A part of the collection of leaf-impressions from a complete sequence of the Siwaliks exposed in Surai Khola area, Nepal was identified in terms of extant species. It includes mostly tropical evergreen elements, among them the most important are *Polyalthia*, *Dipterocarpus*, *Calophyllum*, *Mangifera*, *Swintonia*, *Cynometra* and *Myristica* and a few moist deciduous and dry deciduous ones. Palaeoclimate during Lower Siwalik was warm and humid which continued to prevail during Middle Siwalik. However, towards the close of the Middle Siwalik and the beginning of Upper Siwalik considerable change in the floral composition occurred. Most of the evergreen elements were replaced by the moist deciduous and dry deciduous ones. This obviously reflects change in climatic conditions all along the Himalayan foot-



Leaf-impressions of evergreen elements from the Siwalik sediments, Arjun Khola, Nepal: **A**, *Combretum flagrocarpum*; **B**, *Syzygium jambosa*.

hills which was caused by the northward movement of the Indian Plate and the uplift of Himalaya.

N. Awasthi and Mahesh Prasad

Thirty five taxa comprising leaf-impressions and a few fruits and seeds from the Siwalik sediments near Oodlabari, North Bengal have been identified.

N. Awasthi and J. S. Antal

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

Objective : Systematic palynology, biozonation and palaeoecology

Palynological assemblage recovered from the Siwalik sediments of Surai Khola area of western Nepal contains a total of 33 genera and 45 species. Pteridophytic spores and gymnospermous pollen predominate the assemblage followed by algal remains and angiospermous pollen. *Pinus* pollen hitherto not known in this sequence have been recorded from the middle part of the Surai Khola succession. Palynofossil evidences depict the existence of freshwater swamps in the lower part and the prevalence of tropical to sub-tropical climate during the deposition of Siwalik sediments.

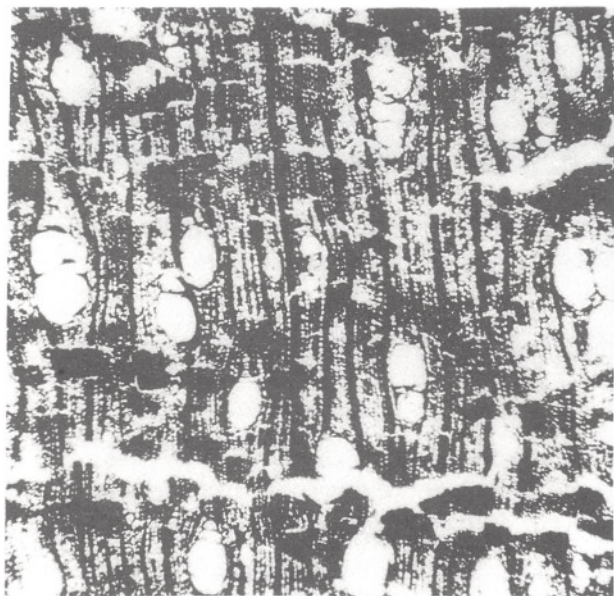
Samir Sarkar

On the basis of palynological study, a Late Miocene vegetational scenario from the Lower Siwalik sediments exposed in Nalagarh region of Himachal Pradesh has been envisioned. The floral elements mainly pertain to broad leaf forest communities typical of sub-tropical climate. The presence of *Dipterocarpus*—*Pinus* plant association has been recorded. The occurrence of *Pediastrum* and *Cosmarium* proves beyond doubt that the environment of deposition was fresh water.

Samir Sarkar and H. P. Singh

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

Objective : Plant economy of ancient India



Transverse section of charcoal wood of *Prosopis spicigera* ($\times 70$) from Rohira, Punjab. It is an indicator of arid conditions in Harappan times.

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

Two hundred thirty wood charcoal pieces were studied from pre-Harappan and mature Harappan deposits at Rohira, district Sangrur, Punjab. The pre-Harappan timber taxa (ca. 2,300-2,000 B.C.) belong to *Acacia* and *Tamarix*. In the succeeding mature Harappan Period (ca. 2,000-1,700 B.C.), predominance of *Prosopis spicigera* and *Ziziphus* species was noticed. The study reflects maximum exploitation of *Acacia* sp., *Tamarix* sp., *Capparis aphylla*, *Ziziphus* sp. and *Prosopis spicigera* by the ancient settlers. The evidence suggests that an arid and dry climate prevailed in this region of Punjab during the period of Harappan settlement.

Sixteen wood charcoal samples recovered from northern Black-Polished ware period (ca. 600-200 B.C.) at Khairadih, district Ballia, Uttar Pradesh were studied. They belong to *Madhuca indica*, *Acacia* sp., *Mangifera indica*, *Flacourtia indica*, *Shorea robusta*, *Azadirachta indica*, *Tectona grandis*, *Dalbergia sissoo*, *Butea monosperma*, *Ailanthus excelsa*, *Diospyros montana*, *Tamarindus indica*, *Holoptelia integrifolia*, *Alangium salvifolium*, *Aegle marmelos* and species of Bamboo. As these taxa still grow around the site of ancient settlement, no major change in the vegetation of the area is indicated during the last 2,600 years.

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

A study has been completed on crop remains and associated weeds and wild taxa from Hulaskhera, district Lucknow (C. 800 B.C.-500 A.D.).

Archaeobotanical samples collected from Nagwada, Harappan site in Gujarat (ca. 2600-2300 B.C.) were examined. Only a few carbonised seeds of some wild taxa were found mixed with sizable quantity of small bits of wood charcoal remains.

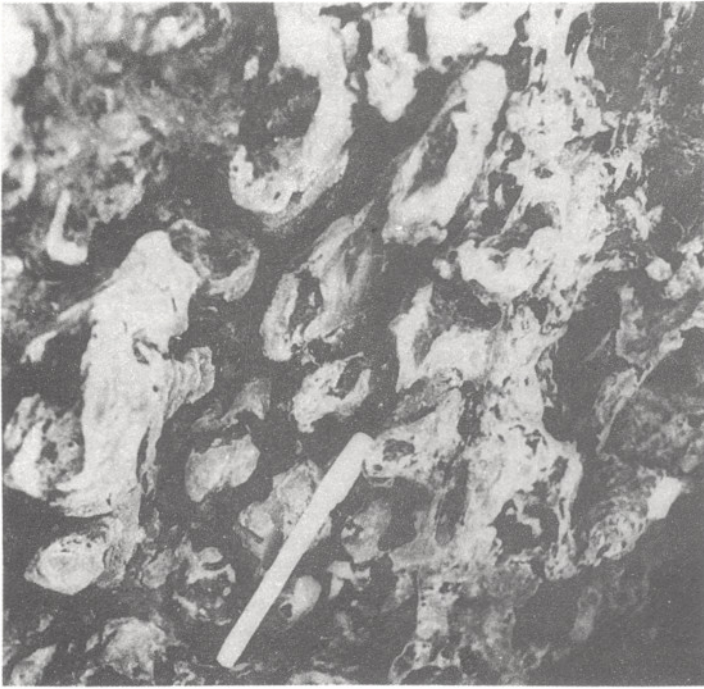
Twelve samples containing about one hundred pieces of wood charcoal from Harappan Shikarpur (ca. 2200 B.C.) in the Rann of Kutch, Gujarat were studied. Most of the charcoals belong to *Prosopis spicigera* which is a typical indicator of arid conditions which prevailed in the area of study.

Chanchala

Sponsored Projects

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

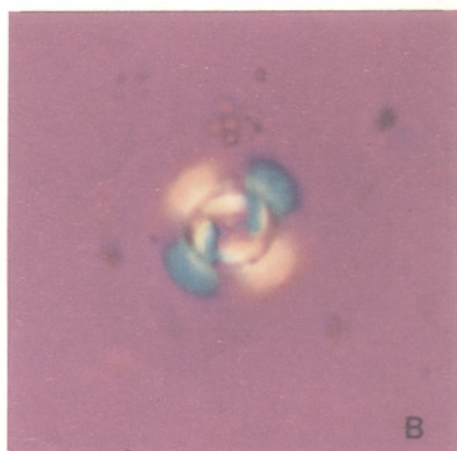
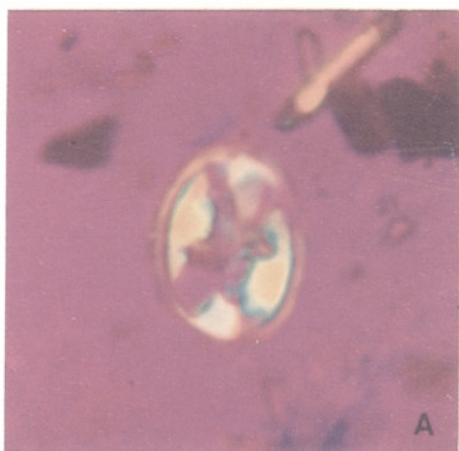


Bowl-shaped stromatolites from Bhimasamudra tank locality in Chitradurga Schist Belt, Dharwar Craton, which are indicative of supratidal conditions.

A study of the stromatolites of Chitradurga Schist Belt has shown the cyclicity of stromatolite forms in the chert-dolomite member of the Vanivilas Formation. This formation has predominant limestone lithology, however, stromatolites are represented in dolomite only. Some of the stromatolitic form reported earlier are supposed to be better representative for supratidal organosedimentary structures. The general succession of stromatolites observed in the Bhimasamudra, Dodguni and Marikanve localities shows the prevalence of stratiform stromatolites at the base followed by *Domal* forms, columnar stromatolites with wall structures, digitate type stromatolites, laminite type stromatolites and finally naked stromatolites on the top of the dolomitic belts. Bowl-shaped stromatolites have been noticed in patches near Bhimasamudra and Kumsi localities as well. These bowl-shaped stromatolites are indicative of supratidal conditions.

Study of the Banded Iron Formation from Donimalai, Bhimangundi and Timmapranguddi area has suggested their biological origin. Besides the typical spheroids found in the BIF world, these cherts and Iron Formation consist of algal mat like structures suggesting a biological origin.

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



Late Cretaceous-Palaeogene species of calcareous nannofossils—**A**, *Eiffellithus turriseiffeli* (Deflandre) Reinhardt; **B**, *Cribrocentrum reticulatum* (Gartner & Smith) Perch-Nielsen from Nayagarh Mud-Volcano, Baratang, Andaman Nicobar Islands.

Project Sp. 2 : **Nannoplankton biostratigraphy and palaeo-environmental 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 palaeo-environment*

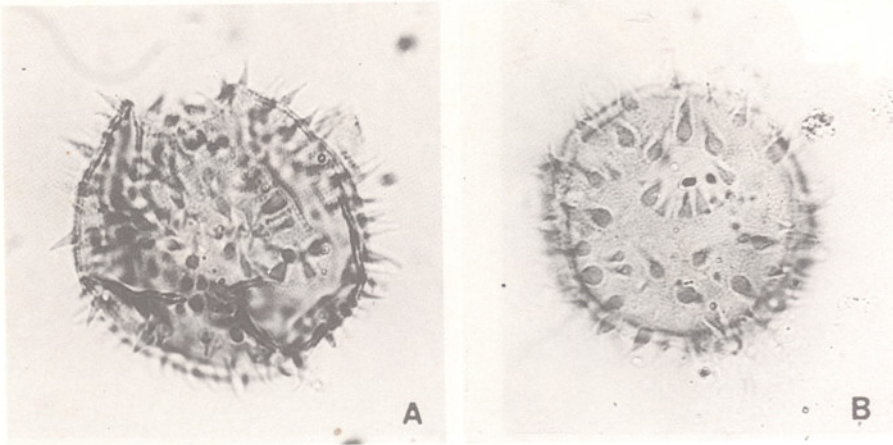
Detailed examination of silty material exuded from the mud-volcano of Nayagarh, Baratang Island, yielded over 120 species of coccoliths and discoasters, suggesting Early Campanian through Periabonian age of sedimentaries in the subsurface of Baratang Island. Additional discovery of mud-volcano sites namely, viz., Pudumadurai in northern and Born-in-yol in southern part of Middle Andaman, yielded similar nannoflora but with different frequency of Cretaceous and Palaeogene elements.

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

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*

A lithostratigraphic study of the Ratnagiri beds developed in a number of well, outcrop, mine and cliff sections in the Ratnagiri and Sindhudurg districts of



A, B. *Ecbimonoporopollis* gen. nov. from the Neyveli Formation of Jayamkondacholapuram area, Tamil Nadu.

Maharashtra has been done to build up a generalised sequence of various litho units of the Ratnagiri sequence. Due to their distinctiveness and lateral persistence over a large area, these beds may be ranked as formation—a formal lithostratigraphic unit. Besides, a rich palynoflora and some plant megafossils have also been recorded which have been utilized in inferring palaeoclimate and depositional environment prevalent at the time of deposition of the Ratnagiri beds.

R. K. Saxena, N. K. Misra and Sanjay Khare

A rich palynoassemblage, dominated by angiospermous pollen, has been recovered from the Ratnagiri beds of the Redi mines area in Sindhudurg District, Maharashtra. The assemblage is broadly identical to the palynoflora known from the Warkalli beds of Kerala.

R. K. Saxena and N. K. Misra

Detailed morphotaxonomic study of the palynoflora from the Neyveli Formation of Jayamkondacholapuram area has been completed. The assemblage contains 70 genera and 128 species of fungal remains, pteridophytic spores and angiospermous pollen. Quantitative analysis of the palynoflora shows the dominance of angiospermous pollen. Based on palynofossils, a tropical climate with plenty of rainfall and a coastal swampy environment of deposition have been inferred. The Neyveli Formation has been divided into 3 palynozones and has been correlated with Palaeocene-Eocene sediments of various parts of India. Palynostratigraphic study of this formation in Neyveli mine-I is being done.

R. K. Saxena and Sanjay Khare

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 coalbearing subsurface strata in these areas, and to determine their age

Fourteen samples of bore-hole DNJ-13 were processed. Photodocumentation of important taxa and quantitative estimation of the assemblage have been carried out.

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 palaeo-biogeographic interpretations

Morphological study and photodocumentation of Late Cretaceous-Palaeocene dinocysts from Dawki, Khleirhiat, Therriaghat and Cherrapunji areas has been carried out. In Therriaghat section, rare occurrence of marker Danian dinoflagellate cyst, *Carpatella cornuta*, is recorded. Global stratigraphic distribution of dinocysts across Cretaceous-Tertiary boundary in important key sections from different parts of the world is compiled. Upper Palaeocene age to Lakadong Sandstone Member of Sylhet Formation exposed around Cherrapunji and Khleirhiat areas of Khasi and Jaintia Hills has been suggested on the basis of marker *Apectodinium* species.

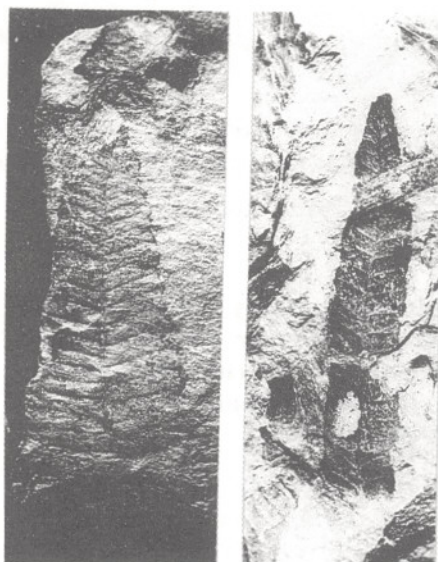
K. P. Jain and Rahul Garg

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

Pollen morphology of *Salvia*, *Alangium*, *Polygonum* and *Rhododendron* distributed in Sikkim Himalaya was carried out. Aeropalinological studies in Darjeeling and Sikkim areas were carried out. The pollen spectra reveal the dominance of *Alnus*, *Syzygium*, *Rhus*, Poaceae, Cheno/Ams in the aerospora of Gangtok, and of *Alnus*, Poaceae, Cheno/Ams, *Artemisia* and Asteraceae in Darjeeling area. *Alternaria*, *Helminthosporium*, *Curvularia*, *Tetraploa*, etc. are common fungal spores recovered from both the sites.

Chhaya Sharma



Fern fronds of *Goniopteris prolifera* from the Siwalik sediments of Kathgodam, Uttar Pradesh.

Project Sp. 7

: Vegetational history of the Siwalik Group in the Himalayan foot-hills of Uttar Pradesh, India (D.S.T. no. SP/SY/038/87)

Objective

: Comparative study of plant megafossils with the extant plants and to reconstruct the palaeofloristics, phytogeography and palaeoecology of the Himalayan foothills in Uttar Pradesh

About 200 fossil woods and 1,500 leaf-impressions collected from the Siwalik sediments of Haridwar, Kalagarh, Kathgodam and Koilabas (Nepal) near Jarva in the Himalayan foot-hills of Uttar Pradesh were studied. Of these, about 100 well-preserved leaf-impressions were selected and photographed. Some of the important taxa identified are *Uvaria*, *Garcinia*, *Kayea*, *Mesua*, *Bombax*, *Sterculia*, *Dipterocarpus*, *Ficus*, *Shorea*, *Hopea*, *Mangifera*, *Zizyphus*, *Canarium*, *Albizia*, *Dialium*, *Cynometra*, *Millettia*, *Parinari*, *Terminalia*, *Lagerstroemia*, *Artocarpus* and a fern—*Goniopteris prolifera*. These indicate prevalence of warm and humid conditions in Siwalik sediments.

Mahesh Prasad

Collaborative Project

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

Study of the fossil wood slides belonging to the Plio-Pleistocene of Sahabi, Hadar, Omo and Semliki, Africa was taken up. Descriptions of about 50 angiospermous woods were completed. Some of the genera so far described in this assemblage are *Acacia*, *Aglaea*, *Airyantia*, *Albizia*, *Anthoantha*, *Antidesma*, *Aphania*, *Aptandra*, *Baphia*, *Borassus*, *Brachylaena*, *Brachystegia*, *Bridelia*, *Byrsocarpus*, *Cantium*, *Carapa*, *Cassipourea*, *Cathormion*, *Catophractes*, *Celtis*, *Chrysophyllum*, *Cola* and *Combretum*.

M. B. Bande (and R. Dechamps, Belgium)

Work other than Inter-Departmental Projects

A dinoflagellate cyst assemblage reported from Rataria bore hole, southern Kutch by Kar and Saxena (1981) has been revised and its Middle Eocene age has been confirmed in the light of taxonomic revision.

Based on re-examination of the holotype and figured slides, *Membranilarnacia donaensis* Saxena & Rao 1984 is considered to be a junior synonym of *Tuberculodinium vancampoe* (Rossignol 1962) Wall 1967.

K. P. Jain and Rahul Garg

Surface sediment samples (shelf) from 113 stations in Chukchi and Bering seas were selected for determining the oceanographic and ecological significance of diatoms. Diatoms from twenty samples have been photodocumented and a minimum of 300 diatom frustules were counted in each sample. The diatom assemblage is represented by various species of *Actinocyclus*, *Actinoptychus*, *Asteromphalus*, *Azpeitia*, *Bacteriosira*, *Chaetoceras*, *Conscinodiscus*, *Delphineis*, *Denticulopsis*, *Nitzschia*, *Odontella*, *Paralia*, *Porosira*, *Rhaphoneis*, *Rhizosolenia*, *Stephanopyxis*, *Thalassionema*, *Thalassiosira*, *Thalassiothrix*, *Navicula*, *Diploneis*, *Pleurosigma*, *Gyrosigma*, *Rouxia*, etc.

Anil Chandra

Manuscripts are under preparation on BSIP internal collaboration work comprising palynological aspect of Flysch sediments from middle Andamans, discovery of fossil wood from Baratang Island and genesis and petrography of thin coal pockets interbedded with deep sea Flysch sediments.

N. Awasthi, S. A. Jafar, B. K. Misra and S. K. M. Tripathi

Terminology of spores/pollen was critically assessed and redefined wherever necessary.

R. K. Saxena and K. Ambwani

Evaluated taxonomic status of 38 Indian Tertiary tricolpate pollen taxa. Selected palynofossils were photographed and redescribed.

J. P. Mandal and M. R. Rao

Taxonomical and nomenclatural status of polycolpate and polycolporate pollen from the Indian Tertiary sediments was assessed. Valid taxa were photographed/

R. S. Singh and B. D. Mandaokar

Monocolpate and tricolpate pollen genera from the Indian Tertiary sediments were re-investigated. Some were studied under SEM and photographed.

S. K. M. Tripathi and Madhav Kumar

Critical morphotaxonomic analysis was carried out on inaperturate and porate pollen grains already published from the Indian Tertiary sediments.

Samir Sarkar

International Geological Correlation Programmes

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

Global Sedimentary Geology Programme (IUGS)

Cretaceous Resources/Events and Rhythms (CRER)

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

Doctoral Degrees Awarded

Name	University	Title of Thesis
S. K. Pera	Lucknow	Pollen productivity, dispersal and sedimentation in deciduous Sal forest, Sidhi, M.P., India
Khowaja-Ateequzaman	Kanpur	Study of Cretaceous dinoflagellate cysts and acritarchs from East Coast of India: Their application in biostratigraphy, palaeogeography and palaeoecology
S. R. Manik	Kanpur	Contributions to the Triassic flora of South Rewa Gondwana Basin, India
Neeru Pandya	Lucknow	Contribution to the Mesozoic flora of India
Jyotsana Rai	Lucknow	Calcareous nannoplankton from Eocene of Kutch, western India
Alpana Singh	Kanpur	Palynology and maturation studies of the Neyveli Lignite, south India
G. P. Srivastava	Gorakhpur	Studies on the Cenozoic plants of West Bengal and Bihar

Doctoral Thesis Submitted

Name	University	Title of Thesis
N. K. Sharma	Gorakhpur	Studies at Narhan, District Gorakhpur, U.P. (ca. 1,000 B.C.—400 A.D.)

Papers Submitted

- Agarwal, Anil**—Occurrence of *Altingia* and *Baubinia* in the Neyveli lignite deposits, India. *Phytomorphology*.
- Anand-Prakash & Saxena, R.**—Palynology of Raniganj sediments from bore-holes GRT-OV/79 and DMM-OV/79 and SS-OV/79, Raniganj Coalfield, West Bengal, India. *Geophytology*.
- Awasthi, N. & Srivastava, Rashmi**—Some new carbonised woods from Neogene of Kerala coast and their bearing on palaeoclimate. *Palaeobotanist*.
- Bande, M. B. & Chandra, Shaila**—Early Tertiary vegetational reconstructions around Nagpur-Chhindwara and Mandla, central India. *Palaeobotanist*.
- Bera, S. K.**—Palynology of *Shorea robusta* Gaertn. (Dipterocarpaceae) in relation to pollen production and dispersal. *Grana*.
- Bera, S. K. & Khandelwal, Asha**—Air catches at Chhota Shigri Glacier, Himachal Pradesh, India. *Indian J. Aerobiol.*
- Bhattacharyya, A.**—Ethnobotanical observations in Ladakh region of northern Jammu and Kashmir, India. *Econ. Botany*.
- Bhattacharyya, A.**—Studies of modern pollen vegetation relationships from Ladakh and Lahul Spiti area, alpine region of the north west Himalaya. *Arctic Alpine Res., USA*.
- Bhattacharyya, A. & Yadav, R. R.**—Tree ring and its role in the reconstruction of drought in India. *Proc. Ann. Archaeol. Conf., 1988*.
- Bhattacharyya, A. & Yadava, R. R.**—Tree ring analysis of *Cedrela toona* from Kappa, Karnataka, India. *Curr. Sci.*
- Caratini, C., Kar, R. K., Sarr, R., Tissot, C. & Venkatachala, B. S.**—Palaeocene palynoflora from Walalane bore hole, Senegal. *Palaeoecol. Africa*.
- Chandra, Shaila, Srivastava, A. K. & Singh, K. J.**—Lower Permian plant fossils from India and early developmental history of the Glossopteris flora. *Acta Palaeobot.*
- Chandra, Shaila, Srivastava, A. K. & Singh, K. J.**—Palaeobotany and climate around Marhwas area, Sidhi District, South Rewa Gondwana Basin during Permian. *Palaeobotanist*.
- Chauhan, M. S. & Bera, S. K.**—Pollen morphological studies of some important plant species of tropical deciduous Sal forest in district Sidhi, M.P. *Geophytology*.
- Chauhan, M. S. & Bhattacharyya, A.**—Contribution to the ethnobotany of Pokhari Block, Chamoli, Garhwal, U.P. Himalaya, *J. Eco. Tax. Bot. Jodhpur*.
- Chauhan, M. S. & Sharma, Chhaya**—Modern pollen/spore rain in Kumaon Himalaya, India. *Proc. Int. Conf. Biod., Cult. Prop. NRLC, Lucknow*.

- Ghate, S., Raghavan, H. & Rajagopalan, G.**—Petrology and problems of dating Karal rocks. *J. Geol. Soc. India*.
- Guleria, J. S.**—On the occurrence of carbonised woods resembling *Terminalia* and *Sonneratia* in the Palaeogene deposits of Gujarat, western India. *Palaeobotanist*.
- Guleria, J. S. & Bande, M. B.**—Antiquity of some common plants in India. *Curr. Sci*.
- Gupta, Asha & Sharma, Chhaya**—Polymorphism in *Salvia leucantha* Cav. (Lamiaceae). *Grana*.
- Jana, B. N.**—Palynology of Athgarh Formation exposed near Talbast, Orissa. *Palaeobotanist*.
- Kar, R. K. & Ambwani, K.**—Light microscopy and SEM studies of *Striatriletes* and *Malayaeaspora* from India and Malayasia. *Pollen Spores*.
- Khan, H. A.**—Vegetational history of Dam Site, Valia Parthode, Silent Valley, Kerala. *J. Palynol.*
- Khandelwal, Asha**—Pollen and spore rain in Lucknow city during 1983-86. *Proc. Int. Conf. Biod. Cult., Prop., NRLC, Lucknow*.
- Khowaja-Ateequzzaman, Garg, R. & Jain, K. P.**—Some observations on dinoflagellate cyst genus *Alterbidinium* Lentin & Williams 1985. *Palaeobotanist*.
- Khowaja-Ateequzzaman & Jain, K. P.**—*Cauveridinium* gen. nov. and related GV type dinocyst taxa: A discussion. *Palaeobotanist*.
- Kumar, P.**—Reassessment of Pipli palynoassemblage of Dhrangadhra Formation from Saurashtra Basin, Surendranagar District, Gujarat State. *Geophytology*.
- Kumar, P.**—Palynology of the Mesozoic rocks exposed near Ellichpur, Maharashtra State. *Geophytology*.
- Maheshwari, H. K. & Bajpai, Usha**—Ginkgophyte leaves from the Permian Gondwana of Rajmahal Basin, India. *Palaeontographica*.
- Maheshwari, H. K. & Tewari, Rajni**—Epidermal morphology of some Indian species of the genus *Glossopteris* Brongniart. *Palaeontographica*.
- Maithy, P. K.**—Evidence of Proterozoic Metaphytes and Metazoans from India. *Origin of Life*.
- Maithy, P. K., Meena, K. L. & Babu, Rupendra**—First report of Ediacaran biota from the Upper Bhandar of Vindhyan Supergroup, north-east Rajasthan, India. *Curr. Sci*.
- Mandaokar, B. D.**—Palynology of Miocene rocks around Maibong, Assam. *Geophytology*.
- Mehrotra, R. C.**—Further observations on some fossil woods from the Deccan Intertrappean beds of central India. *Phytomorphology*.
- Misra, B. K.**—Spectral fluorescence analyses of some liptinite macerals from Panandhro lignite (Kutch), Gujarat, India. *Int. J. Coal Geol.*

- Misra, B. K.**—Optical properties of some Tertiary coals from northern India: Their depositional environment and hydrocarbon potential. *Int. J. Coal Geol.*
- Misra, B. K. & Singh, Alpana**—Observations on trilatiporate pollen from Indian Tertiary sequence. *Pollen Spores.*
- Pandya, Neeru, Srivastava, V. B. & Sukh-Dev**—A new conifer fossil from Vemavaram (Early Cretaceous), Andhra Pradesh, India. *Geophytology.*
- Pandya, Neeru & Sukh-Dev**—Fossil flora of Gollapalli Formation. *Palaeobotanist.*
- Pocock, S. A. J., Vasanthi, G. & Venkatachala, B. S.**—Production, sedimentation and diagenesis of palynodebris. *Sedimentation of organic debris.* A. Traverse (Ed.), Cambridge Univ. Press.
- Pocock, S. A. J., Vasanthi, G. & Venkatachala, B. S.**—Pollen of *Circumpollis*—An enigma or morphotrends showing evolutionary adaptation. *Rev. Palaeobot. Palynol.*
- Prasad, Mahesh**—Occurrence of a lauraceous wood in the Siwalik sediments, India. *Geophytology.*
- Sarkar, Samir & Singh, H. P.**—The Lower Siwalik palynoflora (Late Miocene) and its palaeoecology from Nalagarh, Himachal Pradesh, India. *Rev. Palaeobot. Palynol.*
- Saxena, R. & Anand-Prakash**—Indian Gondwana coals of cold climate. *Int. Symp. coals cold climate, Australia.*
- Saxena, R., Navale, G. K. B., Chandra, D. & Prasad, Y. V. S.**—Spontaneous combustion of some Permian coal seams of India: An explanation based on microscopic and physiochemical properties. *Palaeobotanist.*
- Saxena, R., Navale, G. K. B. & Chandra, D.**—Coal fire—An enigma. *Nature.*
- Saxena, R. K., Misra, N. K. & Khare, S.**—Ratnagiri beds of Maharashtra—lithostratigraphy, flora, palaeoclimate and environment of deposition. *Indian J. Earth Sci.*
- Shukla, M. & Sharma, M.**—Palaeobiology of Suket shale: Vindhyan Supergroup—age implications. *Proc. Workshop Precam. central India.*
- Singh, A. & Misra, B. K.**—Revision of some Tertiary pollen genera and species. *Rev. Palaeobot. Palynol.*
- Singh, Alpana & Misra, B. K.**—A new spinose monosulcate genus *Spinomonosulcites* and an emendation of spinose porate *Acanthotricolpites*. *Rev. Palaeobot. Palynol.*
- Singh, Alpana & Singh, B. D.**—Rank evaluation of the Neyveli Tertiary brown coal of south India on the basis of reflectance parameter. *J. Min. Metall. Fuels.*
- Singh, H. P. & Sarkar, Samir**—Palynostratigraphy and palaeoenvironment of Subathu Formation (Eocene) in north-western part of Punjab Basin, H.P., India. *Rev. Micropalaeont.*

- Singh, H. P., Saxena, R. K. & Rao, M. R.**—Recycled Permian and Cretaceous palynofossils from the Barail and Surma groups (Oligocene-Early Miocene) in Jaintia Hills (Meghalaya) and Cachar (Assam). *Geophytology*.
- Singh, R. S., Pandya, Neeru & Sukh-Dev**—*Equisetites seboraeensis* sp. nov. from Jabalpur Formation, Madhya Pradesh. *Geophytology*.
- Singh, Trilochan & Bajpai, Usha**—On some plant fossils from Gondwana equivalent sediments of eastern Himalaya. *Palaeobotanist*.
- Srivastava, A. P. & Rajagopalan, G.**—Glaucyony ages of Vindhyan sediments in Rajasthan. *Indian J. Phys.*
- Srivastava, A. P., Rajagopalan, G. & Bande, M. B.**—Fission Track ages of fossil woods from Deorikhund, Keria and Mohgaonkalan. *Indian J. Phys.*
- Srivastava, Shyam C. & Manik, S. R.**—*Rostrumaspermum venkatachalaee*, an archegoniate seed from Triassic of Nidpur, India. *Palaeobotanist*.
- Srivastava, Suresh C. & Bhattacharyya, A. P.**—Permian palynofossils from Namchee, Sikkim. *J. geol. Soc. India*.
- Stephan, T., Jessberger, E. K., Lochmann, D. & Nautiyal, C. M.**—Ar-Ar Altersbestimmung des Pataz-Batholith/Peru. *Jahresbericht MPI-Kernphysik*.
- Tiwari, R. S. & Ram-Awatar**—Palynodating of Nidpur plant beds, Son Graben, Madhya Pradesh. *Palaeobotanist*.
- Tripathi, S. K. M. & Singh, Trilochan**—Record of marker Eocene palynotaxa from Siang District, Arunachal Pradesh, India. *Palaeobotanist*.
- Trivedi, G. K.**—Reworked Gondwana palynomorphs from the Kopili Formation (Upper Eocene), Meghalaya, India. *Geophytology*.
- Vasanthi, G., Venkatachala, B. S. & Pocock, S. A. J.**—The evolution of Angiospermid pollen characteristics, conjectures and queries. *Palaeobotanist*.
- Venkatachala, B. S., Naqvi, S. M., Chadha, M. S., Shukla, M., Srinivasan, R., Balesh, Kumar, Mathur, R., Balaram, V., Natarajan, R., Sharma, M., Udai Raj, B., Subba Rao, D. V., Manikyamba, C., Krishnamurthy, B. S. S. & Bansal, R.**—Geology, geochemistry and palaeobiology of the Precambrian stromatolites and associated sedimentary rocks from the Dharwar Craton, constraints on Archaean biogenic processes. *Indo-Soviet Symp. stromatolite and stromatolitic deposits, WIHG, Himalayan Geology, Dehradun*.
- Venkatachala, B. S. & Maheshwari, H. K.**—Palaeobotany, in Johri B. M. (Ed.). *History of botany in India: Modern period*.
- Venkatachala, B. S., Shukla, M., Bansal, R. & Acharyya, S. K.**—Upper Proterozoic microfossils from the Infra-Krol sediments. Nainital Synform, Kumaon Himalaya, India. *Palaeobotanist*.
- Vijaya**—Evolutionary pattern of striations in Indian Gondwana saccate pollen. *Palaeobotanist*.

Abstracts Submitted

Guleria, J. S.—African elements in the Upper Tertiary flora of Rajasthan, western India. *IWA Bull.*

Venkatachala, B. S., Kar, R. K., Suchindan, G. K., Ramachandran, K. K. & Kumar, Madhav—Study on the sedimentary facies, spore-pollen, palynodebris of mud banks and Vembanad Lake, Kerala. *Proc. 77th Indian Sci. Congr., Cochin.*

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- Acharyya, S. K., Raha, P. K., Das, D. P., Moitra, A. K., Shukla, Manoj & Bansal, Rajendra (1989).** Late Proterozoic microbiota from the Infra-Krol rocks from Nainital Synform, U.P. Himalaya, India. *Indian J. Geol.*, **61**(3) : 137-147.
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- Ambwani, K. & Kar, R. K. (1989).** Light microscopy and SEM studies of *Dandotiaspora* and *Proxapertites* from Palaeocene sediments of India. *Pollen Spores*, **30**(2) : 223-230.
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- Awasthi, N. & Srivastava, Rashmi (1989).** *Canarium palaeoluzonicum*, a new fossil wood from the Neogene of Kerala with remarks on the nomenclature of fossil woods of Burseraceae. *Palaeobotanist*, **37**(2) : 173-179.
- Bande, M. B. & Srivastava, G. P. (1990).** Late Cenozoic plant-impressions from Mahuadanr Valley, Palamau District, Bihar. *Palaeobotanist*, **37**(3) : 331-366.
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- Bhattacharyya, A. (1989).** Vegetation and climate during the last 30,000 years in Ladakh. *Palaeogeogr. Palaeoclimatol. Palaeoecol.*, **73** : 25-38.
- Bhattacharyya, A. (1989).** Modern pollen spectra from Bara Sigri Glacier, Great Himalayan Range, Lahul Spiti District, Himachal Pradesh. *Sci. Cult.*, **55**(7) : 246-248.
- Bhattacharyya, A. (1989).** Vegetation and climate during postglacial period in the vicinity of Rohtang Pass—Great Himalayan range. *Pollen Spores*, **30**(3-4) : 417-427.
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- Chandra, A. & Singh, K. J. (1989).** *Handapaphyllum*—a new leaf type from the Upper Permian of Orissa, India. *Palaeobotanist*, **37**(2) : 143-146.
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Venkatachala, B. S., Caratini, C., Tissot, C. & Kar, R. K. (1989). Palaeocene-Eocene marker pollen from India and tropical Africa. *Palaeobotanist*, **37** (1) : 1-25.

Abstracts Published

Maithy, P. K. (1989). Evidence of Proterozoic Metaphytes and Metazoan from India. *Origin of Life*, **19** (3-5) : 452-453.

Nautiyal, C. M. (1989). Noble gas structures in planetary materials. Vol. II-10, National Seminar on role of young scientists in national development, Modinagar : 21.

Nautiyal, C. M. & Rajagopalan, G. (1989). An ultra high vacuum argon extraction and purification system for K-Ar dating and possible application to natural resource-exploration. Vol. II-7, National Seminar on role of young scientists in national development, Modinagar : 18.

Shukla, Manoj, Venkatachala, B. S. & Sharma, Mukund (1989). Interaction of lithosphere and biosphere: Some evidences from early metazoan and metaphytes from India. *XX Lunar Planetary Sci. Conference, Houston*, Part III : 1012-1013.

Venkatachala, B. S.; Shukla, Manoj, Sharma, Mukund, Naqvi, S. M., Srinivasan, R. & Udai Raj, B. (1989). Palaeobiologic activity in the Archaean Dharwar Craton, India. 6th ISSOL Meeting and IX International Conference on Origin of life, Prague, Czechoslovakia: 237-238. *In: Origin of life* **19** (3-5) : 448-449.

Field Excursions

Ambwani, K.

Palynological samples from Simsangiri, Garo Hills, Meghalaya were collected.

Chanchala

Collection of botanical remains was done in the second season excavation work at Shikarpur, in the Runn of Kutch, Gujarat.

Chauhan, M. S.

Collected surface samples, air catches and plant specimens from Bhim Tal, Kumaon.

Gupta, H. P. and Bera, S. K.

Collected surface samples and deep profiles from Bombay shola forest and Berijam Lake, Kodaikanal, Palni Hills, southern India.

Gupta, H. P. and Khandelwal, Asha

Collected deep profile from Chilka and Rambha lakes, two deep profiles one each from Birds' Island and Breakfast Island. In addition, surface and water samples were also collected from sea confluence and Bhargavi River confluence to Chilka Lake.

Jafar, S. A. and Singh, O. P.

Systematic collection of field data and palynological samples from key sections in Baratang and Middle Andamans, Andaman-Nicobar Islands.

Jain, K. P. and Garg, Rahul

Collection of geological data and rock samples from the measured sections around Cherrapunji and Lumshnong areas, south Shillong Plateau, Meghalaya.

Kar, R. K. and Mandal, J. P.

Collection of palynological samples from Disang Formation exposed in north Cachar Hills and Cachar districts, Assam were made.

Khan, H. A.

Collected 430 and 210 polleniferous materials of the Silent Valley from the herbarium sheets of B.S.I., Coimbatore and Institute of Forest Genetics and Tree Breeding, Coimbatore, respectively.

Kumar, Madhav

A field excursion was undertaken to collect Disang rocks from Mahur, Assam.

Maheshwari, H. K., Srivastava, A. K., Bajpai, Usha and Tewari, Rajni

Plant fossils were collected from Hura, Jharia and Koel basins.

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

Collected samples for microbiota and stromatolites from the Vindhyan sediments near Balwan, Lakheri and Katauli and Gwalior Supergroup at Ranthambore.

Mandaokar, B. D.

Collection of palynological samples from Dilli-Jayapore Colliery, Dibrugarh, Assam was made.

Meena, Kalyan L. and Babu, Rupendra

Visited the Vindhyan sequence exposed around Satna and Maihar and collected samples for macrobiota, stromatolites and catagraphia study.

Prasad, Mahesh

Collection of plant fossils was made from Siwalik of Kathgodam, Kalagarh, Haridwar, Mohand, Uttar Pradesh and Koilabas, Nepal.

Prasad, Mahesh and Sarkar, Samir

Systematic collection of plant fossils and palynological samples was made from Siwalik sediments of Arjun Khola, Nepal.

Rajagopalan, G. and Srivastava, A. P.

Field trip to Shahpura in Mandla district: Vindhyan localities in Sidhi District, M.P. and Newari area, Mirzapur District has been made to collect petrified wood and glauconitic sandstone samples.

Ram-Awatar

Outcrop samples were collected from Parsora Formation, South Rewa Basin.

Rao, M. R.

A field trip was undertaken to visit Padappakkara, Varkala, Kundra clay mine and Kundra-Kannanaur road, South Kerala and collected clay and lignite samples.

Saraswat, K. S.

Collected archaeobotanical samples from an ancient mound at Sanghol, district Ludhiana, Punjab.

Sarkar, Samir

Stratigraphically located samples were collected from the Lower Tertiary strata, Bilaspur area of Himachal Pradesh. Six different measured sections were studied geologically to verify the concept of intertonguing facies relationship in this area.

A field trip was undertaken in Arjun Khola area of Nepal to collect Siwalik samples. Samples from eleven profiles were collected.

Sharma, C., Chauhan, M. S. and Gupta, Asha

Collected subsurface, surface samples and air catches and plant specimens from Darjeeling and Sikkim Himalaya.

Singh, K. J.

An excursion was undertaken and plant fossils were collected from Talchir, Karharbari, Barakar and Kamthi formations, Talchir Coalfield, Orissa.

Singh, R. S.

More than 200 palynological samples were collected from Garo Hills, Meghalaya.

Srivastava, Shyam C., Banerji, J., Pandya, N. and Manik, S. R.

Plant fossil collection was made from seven localities in Rajmahal Hills, Bihar.

Tiwari, R. S., Tripathi, A., Jana, B. N. and Pal, Chandra

Palynological samples were collected from Panagarh, Birbhum, Rajmahal, Talchir, Athgarh and South Rewa Basin.

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

Systematic sampling, collection of field data and preparation of lithologs from Chitradurga and Sandur Schist belts were done.

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

A field trip was made to collect recent and subrecent samples from Kumbalam, Alleppy, Quilandy and neighbourhood in Kerala.

Yadav, R. R. and Bhattacharyya, A.

Collected tree cores and disc samples of conifers from Kanasar and Deoban, U.P. Himalaya.

Papers presented at Symposia/Conferences/Meetings

- Bhattacharya, A.**—*Tree ring analysis and the assessment of forest disturbances.* Symposium: Indian Forest Problems and Prospectives, Hissar.
- Jafar, S. A., Mainali, U. C. & Singh, O. P.**—*Late Cretaceous-Palaeogene coccolith-cocktail exuded from the Mud Volcano of Baratang Island, Andaman-Nicobar Islands, India.* International Nannoplankton Association Conference, Florence, Italy.
- Jafar, S. A., Mainali, U. C. & Singh, O. P.**—*First report on Palaeogene Discoasters of Andaman Islands, India.* International Nannoplankton Association Conference, Florence, Italy.
- Maithy, P. K.**—*Evidence of Proterozoic Metaphyte and Metazoan from India.* 6th ISSOL Meeting and 9th International Conference on Origin of life, Prague, Czechoslovakia.
- Naqvi, S. M., Srinivasan, R., Shukla, M., Venkatachala, B. S., Udairaj, B. & Sharma, M.**—*Archaean stromatolites and microbiota from the Dbarwar Schist belts, India.* International Geological Congress, Washington, U.S.A.
- Nautiyal, C. M.**—*Noble gas structures in Planetary material.* National Seminar on Role of young scientists in national development, Modinagar.
- Nautiyal, C. M.**—*An ultra high vacuum argon-extraction and purification system for K-Ar dating and possible application to natural resource-exploration.* National Seminar on Role of young scientists in national development, Modinagar.
- Saraswat, K. S.**—*An evidence of American plant introduction in India.* Annual Conference of Indian Archaeological Society, Indian Society for Pre-historic and Quaternary studies and Indian History and Culture Society, Nagarjuna University, Guntur, Andhra Pradesh.
- Shukla, M. & Tewari, V. C.**—*Palaeobiology of the Late Proterozoic Deoban Limestone from Lesser Himalaya, India.* 6th ISSOL Meeting and 9th International Conference on Origin of Life, Prague, Czechoslovakia.
- Srivastava, Shyam C.**—*Indian seed-compressions from Triassic of Nidpur—an evolutionary perspective.* II European Palaeobotanical Conference, Madrid, Spain.
- Srivastava, Suresh C. & Bhattacharyya, A. P.**—*Permian palynofossils from Namchee, Sikkim.* Seminar on Basic and Applied Sciences in Botany, Silver Jubilee Celebration, Department of Botany, University of Burdwan, Burdwan.
- Venkatachala, B. S., Kar, R. K., Suchindan, G. K., Ramchandran, K. K. & Kumar, Madhav**—*Study on the sedimentary facies, spore-pollen and palynodebris of mudbank and Vembanad Lake, Kerala.* 77th Indian Science Congress, Cochin.

Venkatachala, B. S., Naqvi, S. M., Shukla, M., Srinivasan, R., Sharma, M., Udairaj, B., Natrajan, R. & Balram, V.—*Early biogenic processes: Some evidences from Dharwar Craton, India.* National Space Science Symposium, 1990, ISRO, Nagpur.

Venkatachala, B. S., Shukla, M., Sharma, M., Naqvi, S. M., Srinivasan, R. & Udairaj, B.—*Palaeobiological activity in Archaean Dharwar Craton, India.* 6th ISSOL Meeting and 9th International Conference on Origin of Life, Prague, Czechoslovakia.

Lectures delivered

- Chandra, Anil**—*Geology of Andaman and Nicobar Islands with special reference to the known fossil diatoms.* Geology Department, University of Bergen, Norway.
- Maithy, P. K.**—*Indian Precambrian life.* Geologische-Palaontologische Institut, Giessen, West Germany.
- Nautiyal, C. M.**—*Noble gas mass spectrometry and dating based approach to the study of planetary bodies.* Max Planck Institut fur Kernphysik, Heidelberg, West Germany.
- Nautiyal, C. M.**—*Noble gas mass spectrometric approach to the early stages of solar system bodies.* Universitat Koln, West Germany.
- Nautiyal, C. M.**—*SEP-Neon composition and implications for gas-rich meteorites.* Physikalisches Institut, Universitat Bern, Switzerland.
- Rajagopalan, G.**—*Dating methods.* Two lectures to trainees of XII—UNESCO sponsored training course at NRLC, Lucknow.
- Saxena, R. K.**—*Neogene palynofloras of India and their stratigraphic utility.* Department of Palaeobotany, Institute of Botany, Krakow, Poland.
- Saxena, R. K.**—*Palynostratigraphic studies on the Early Palaeogene sediments of India.* Department of Palaeobotany, Institute of Botany, Krakow, Poland.
- Saxena, R. K.**—*Palynostratigraphic studies on the Neogene sediments of India.* Institute of Palaeontology, Warsaw University, Poland.
- Saxena, R. K.**—*Stratigraphy and palynology of Indian Neogene sediments.* Institute of Geology, Wroclaw University, Wroclaw, Poland.
- Saxena, R. K.**—*Palynological investigation of the lignite deposits of south India.* Department of Palaeobotany, Institute of Botany, Krakow, Poland.
- Saxena, R. K.**—*Early Palaeogene palynostratigraphy of India and its relevance with the age of Neyveli lignite of south India.* Department of Palaeobotany and Palynology, P. et M. Curie University, Paris, France.
- R. S. Tiwari**—*Procedure and prospects of Gondwana palynology.* Geological Survey of India, Calcutta.
- Venkatachala, B. S.**—*Annual Day Address.* N.B.R.I., Lucknow.
- Venkatachala, B. S.**—*Greening of the Earth.* The Palaeobotanical Society, Lucknow.
- Venkatachala, B. S.**—*Greening of the Earth.* National Museum of Natural History, Barakhamba Road, New Delhi.
- Venkatachala, B. S.**—*Impact of plant fossil research on evolutionary botany—some thoughts.* Group Monitoring Workshop in the area of plant science, Trivandrum.
- Venkatachala, B. S.**—*Impact of Plant Fossil Research on Indian Geology.* 77th Science Congress, Cochin.

- Venkatachala, B. S.**—*Evolution—a holistic approach*. Kerala Sastra Sahitya Parishad, Trivandrum.
- Venkatachala, B. S.**—*Origin, diversification and spread of angiosperms*. Tropical Botanic Garden and Research Institute, Palode, Trivandrum.
- Venkatachala, B. S.**—*Earliest biosphere evidences from India*. National Space Science Symposium, Nagpur.
- Venkatachala, B. S.**—*Botanizing in rocks*. Institute of Sciences, Nagpur University, Nagpur.
- Venkatachala, B. S.**—*Impact of recent Palaeobotanical findings on Indian Stratigraphy*. Kumaon University, Nainital.
- Venkatachala, B. S.**—*Plant life through ages*. Kumaon University, Nainital.
- Venkatachala, B. S.**—*Perspectives in Indian Palaeobotany & Gondwana Super-group*. Sheffield University, Sheffield.
- Venkatachala, B. S.**—*Perspectives in Indian Palaeobotany & Gondwana Super-group*. Institute for Geologie, Gottingen, Federal Republic of Germany.
- Vijaya**—*Significance of spore-pollen species in stratigraphy*. Department of Botany, Calcutta University, Calcutta.

Technical Assistance rendered to other Agencies

Training provided to outsiders

- A. A. Moiz and K. V. Rama Rao, Kothagudem Post Graduate Centre, Osmania University in palynological techniques and morphotaxonomy of Gondwana palynomorphs.
- G. Lakshminarayana and M. Rama Rao, Geological Survey of India, Hyderabad in palynological techniques, morphotaxonomy and Gondwana palynostratigraphy.
- A. K. Singh, Department of Geology, SNSRKS College, Saharsa, Bihar, in palynological techniques and morphotaxonomy of Lower Gondwana palynomorphs.
- N. C. Mehrotra, Oil & Natural Gas Commission, Calcutta in morphotaxonomy and identification of Permian-Triassic *sporae dispersae*.
- Rakesh Harsh, Department of Botany, University of Jodhpur on wood anatomy.
- R. K. Mazhari, Wadia Institute of Himalayan Geology, on leaf anatomy.
- Azhar Syed, Department of Geology, Panjab University, Chandigarh, on leaf morphology.
- Tanu Prakash, Department of Geology, Panjab University, Chandigarh, on palynological technique and identification of palynomorphs.
- Tirth Raj, Wadia Institute of Himalayan Geology, Dehradun, photography techniques.

Technical Assistance to Agencies/Universities/Institutes

Radiocarbon dating of samples for :

- French Institute, Pondicherry
- National Institute of Oceanography, Goa
- Physical Research Laboratory, Ahmedabad
- Wadia Institute of Himalayan Geology, Dehradun
- Department of Geology, Banaras Hindu University, Varanasi

S. E. M. Facility

- University of Lucknow, Lucknow
- University of Delhi, Delhi
- French Institute, Pondicherry

Others

Kothagudem, P. G. Centre, Osmania University

Coal Wing, Geological Survey of India, Calcutta

Operation M.P., Geological Survey of India, Bhopal

Govt. Model Science College, Rewa, M.P.

Deputation/Training/Study Abroad

Anil Chandra

Visited Department of Geology, University of Bergen, Norway, during April-June, 1989. Participated in a scientific cruise abroad, the R/S Hakon Mosby to the Norwegian-Iceland Seas.

S. A. Jafar

Participated in International Nannoplankton Association Conference, Florence, Italy during September, 1989. Also visited Geological Survey of Austria and Natural History Museum, Vienna.

P. K. Maithy

Participated in the 6th ISSOL Meeting and the 9th International Conference on the Origins of Life, Czechoslovakia, during July, 1989. Visited Prof. H. D. Pflug, Geologische-Palaontologische Institute, Giessen and Prof. F. Schaarschmidt, Senckenberg Museum, Frankfurt am Main, West Germany.

C. M. Nautiyal

Visited Federal Republic of Germany under INSA-DFG exchange programme during October, 1989 to January, 1990. Visited Universitat zu Koln, Universitat Heidelberg, Universitat Munster in addition to Max Planck Institut fur Kernphysik, Heidelberg and Max Planck Institute fur Chemie, Mainz. Also visited Universitat Bern and SFIT, Zurich (Switzerland).

R. K. Saxena

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

Manoj Shukla

Participated in the 6th ISSOL Meeting and the 9th International Conference on the Origins of Life, Czechoslovakia, during July, 1989. Visited Prof. H. D. Pflug, Geologische-Palaontologische Institut, Giessen and Prof. F. Schaarschmidt, Senckenberg Museum, Frankfurt am Main, West Germany.

Shyam C. Srivastava

Participated in II European Palaeobotanical Conference, Madrid, Spain, during September, 1989.

B. S. Venkatachala

Participated in the 6th ISSOL Meeting and the 9th International Conference on the Origins of Life, Czechoslovakia, July, 1989. Visited West Germany, France, Netherlands and Britain, during July-August, 1989.

Courses/Lectures in the Institute by outside scientists

Professor Oscar Rösler
Departamento de Geologia
Universidade Federal Do
Ceara

: *Evolution of South American floras*
February, 1990

Dr Otto Appert
Hochweid
Switzerland

: *Permian and Upper Jurassic floras of
Madagascar*
March, 1990

Deputation to Conferences/Symposia/Seminars/ Workshops

- A. Bhattacharya . Symposium on *Indian Forest Problems and Prospectives*, Hissar, December, 1989
- A. P. Bhattacharyya . Seminar on *Basic and Applied Sciences in Botany*, Silver Jubilee Celebration, Department of Botany, University of Burdwan, Burdwan, December, 1989
- C. M. Nautiyal . National Seminar on *Role of Young Scientists in National Development*, Modinagar, September, 1989
- K. S. Saraswat . Annual Conference of Indian Archaeological Society, Indian Society for Pre-historic and Quaternary Studies and Indian History and Culture Society, Nagarjuna University, Guntur, December, 1989
- Chhaya Sharma . First National Seminar on *Thrust areas in atmospheric sciences*, Pune, August, 1989
- Mukund Sharma . Indo-Soviet Symposium on *Rifted Basins and Aulacogens: related sedimentation, crustal evolution and mineralisation*, Aligarh Muslim University, Aligarh, July, 1989
- G. P. Srivastava . Short term course in *Museology*, National Museum, New Delhi
- R. S. Tiwari & Vijaya . Colloquium (Geology Section) of the Humboldt Foundation, Tagung, New Delhi, November, 1989
- B. S. Venkatachala
R. S. Tiwari & Vijaya . National Seminar on *Computer Aided Education at School of Education Technology*, Jadavpur University, Calcutta, December, 1989
- B. S. Venkatachala . *Group Monitoring Workshop in the area of plant science*, Trivandrum, January, 1990
- B. S. Venkatachala
R. S. Tiwari & N. Awasthi . 77th Session of Indian Science Congress Association, Cochin University of Science and Technology, Cochin, February, 1990
- B. S. Venkatachala
Manoj Shukla & Mukund Sharma . *National Space Science Symposium-1990*, ISRO, Nagpur, March, 1990

Representation in Committees/Boards

- | | |
|-----------------------------|---|
| J. S. Antal | . Editor, Geophytology |
| Nilamber Awasthi | . Chief Editor, Geophytology |
| Anand-Prakash | . Treasurer, Indian Association of Palynostratigraphers |
| M. B. Bande | . Member, Executive Council, The Palaeobotanical Society |
| Anil Chandra | . Member, Executive Council, Indian Society of Geoscientists |
| Shaila Chandra | . Vice-President, Indian Society of Geoscientists |
| Rahul Garg | . Member, Managing Council, Indian Association of Palynostratigraphers |
| H. P. Gupta | . Business Manager, Indian Association of Palynostratigraphers |
| K. P. Jain | . Secretary, Indian Association of Palynostratigraphers |
| Asha Khandelwal | . Joint Secretary, The Palaeobotanical Society |
| Khawaja-Ateequzzaman | . Member, Managing Council, Indian Association of Palynostratigraphers |
| Hari K. Maheshwari | . Member, Committee for Fossil Plants, International Association for Plant Taxonomy
. Editor, Indian Association of Palynostratigraphers
. Editor, The Palaeobotanist
. Co-editor, Asian Journal of Plant Science |
| P. K. Maithy | . Member, Editorial Board, Geoviews |
| B. K. Misra | . Joint Secretary, Indian Society of Geoscientists |
| G. K. B. Navale | . Member, International Committee of Coal Petrology
. Member, International Commission of Coal Nomenclature and Analysis
. Member, Editorial Board, Coal Geology
. Member, Indian Standards Institution (Coal)
. Vice-President, Coal Petrological Society of India |

- G. Rajagopalan**
- . Chief Editor, Indian Society of Geoscientists
 - . Member, Advisory Committee, Regional Sophisticated Instrumentation Centre (Central Drug Research Institute), Lucknow
 - . Member, Academic Committee of School of Archaeological Dating, Jadavpur University, Calcutta
 - . Member, National Organising Committee, Nuclear Track Society of India, Calcutta
- Rakesh Saxena**
- . Associate Member, International Committee of Coal Petrology
- R. K. Saxena**
- . Secretary, Indian Society of Geoscientists
 - . Member, Editorial Board, Bulletin Indian Society of Geoscientists
- Manoj Shukla**
- . Editor, Geophytology
- Shyam C. Srivastava**
- . Secretary, Birbal Savitri Sahni Foundation
- H. P. Singh**
- . Treasurer, The Palaeobotanical Society
 - . Editor, The Palaeobotanist
 - . Member, Editorial Board, Geophytology
- A. K. Srivastava**
- . Treasurer, Indian Society of Geoscientists
- Suresh C. Srivastava**
- . Secretary, The Palaeobotanical Society
 - . Member, Managing Council, Indian Association of Palynostratigraphers
 - . Member, Editorial Board, Geophytology
- R. S. Tiwari**
- . Editor, The Palaeobotanist
 - . Member, Executive Council, The Palaeontological Society of India
 - . Member, Executive Council, Indian Society of Geoscientists
 - . Co-editor, Asian Journal of Plant Science
- S. K. M. Tripathi**
- . Member, Executive Council, The Palaeobotanical Society
- B. S. Venkatachala**
- . Member, Committee for Fossil Plants, International Association for Plant Taxonomy
 - . Vice-President, International Federation of Palynological Societies
 - . President, The Palaeobotanical Society

- . Chairman, Expert Committee for Centre for Palaeoclimatic and Environmental Research (PERCA)
- . Chairman, Programme Advisory & Monitoring Committee of the Palaeoclimate and Palaeo-environmental Research
- . Chief Editor, The Palaeobotanist
- . Member, Editorial Board, Acta Palynologica, Montpellier, France
- . Member, Research Advisory Committee, Wadia Institute of Himalayan Geology, Dehradun
- . Expert Member, Board of studies in Botany, Garhwal University, Srinagar

Honours and Awards

- N. Awasthi** . Elected, Fellow of *The Palaeobotanical Society*, 1989
- K. P. Jain** . Elected, Fellow of *The Palaeobotanical Society*, 1989
- Rakesh Saxena** . Elected, Associated Member of the *International Committee of Coal Petrology*, 1990
- B. S. Venkatachala,
Manoj Shukla and
Mukund Sharma** . Special Prize for the best Poster and paper presentation at *National Space Science Symposium, Nagpur, 1990*
- Vijaya** . Fellow of the *Linnean Society of London*, 1989

Publications of the Institute

The Palaeobotanist

Volume 37, Number 1, 2 and 3 of the journal were published. Manuscripts of next Volume 38, a volume on the Proceedings of the Symposium on "Vistas in Indian Palaeobotany", were also processed and sent to Press.

Birbal Sahni Memorial Lecture

Nineteenth Birbal Sahni Memorial Lecture "Rates of floral turn over and diversity change in the fossil record" by Norman Frederiksen, United States Geological Survey was processed for publication.

Sir Albert Charles Seward Memorial Lecture

The manuscript of 35th Seward Memorial Lecture entitled "Floristic composition and distribution of evergreen forests in the Western Ghats, India" by Dr J. P. Pascal, Director French Institute of Pondicherry, Pondicherry was processed for publication.

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. 1,76,061.45, out of which about Rs. 85, 217.00 were earned in foreign exchange approximately equivalent to U.S. \$ 4,877.00 plus £ 85.00.

Library

The holdings of the Library are :

Particulars	Additions during 1989-1990	Total
Books	95	4,329
Journals	387	9,156
Reprints	499	32,914
Microfilms/Fisches	—	290
Theses	8	79
Reports	—	46
Maps & Atlases	1	55
Reference Books	4	180

The services of the library were also made available to scientists of other organisations and universities. The total number of registered borrowers is 122. Seventy five periodicals were procured on exchange basis. Sixty five current periodicals are being subscribed by the library.

Reprints Section

(i) Reprints of research papers purchased	43
(ii) Reprints sent out in exchange	2,875
(iii) Institutions on exchange list	65
(iv) Individuals on exchange list	403

Library facility provided to:

Centre of Advanced Studies in Geology, Panjab University, Chandigarh
Government S.G.S. College, Sidhi

Department of Library & Information Science, Lucknow University, Lucknow
Government Model Science College, Rewa

University of Jodhpur, Jodhpur

Banaras Hindu University, Varanasi

Forest Research Institute, Dehradun

Oil & Natural Gas Commission, Calcutta

Allahabad University, Allahabad

Computerisation of References

A programme has been developed for data retrieval. References of all the papers published in the journals, viz., Palaeontology, Journal of Palaeontology, Lethaia, Alcheringa, Journal of Palaeontological Society of India, Journal of Geological Society of India and Australian Journal of Earth Science have been loaded on to the computer.

Herbarium

The holdings of the Herbarium materials are :

Particulars	Addition during 1989-90	Total
Herbarium		
Herbarium sheets of plant specimens	300	11,908
Herbarium sheets of leaf specimens	30	250
Xylarium		
Wood blocks	205	3,935
Wood discs	5	29
Wood core samples	159	187
Wood slides	93	4,705
Sporothek		
Polleniferous materials	300	450
Pollen slides	—	11,384
Carpothek		
Fruits/Seeds	25	2,071
Photonegatives	5	5

About 300 plant specimens have been collected from Lucknow and Gorakhpur.

Plant materials received from :

	Number of Specimens
Department of Quaternary Biogeography & Archaeobotany	300 Plant specimens
Department of Cenophytic Evolutionary Botany	a) 50 leaf specimens b) 2 wood blocks c) 5 wood slides

Exchange Programme

Materials received from :

Rijksh Herbarium Schelpnkade-6 2300 RA-Leiden, The Netherlands	201 wood blocks
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Herbarium facility provided to :

Veena Chandra
Forest Research Institute
Dehradun

S. K. Singh
Department of Botany
Gorakhpur University, Gorakhpur

Suresh Singh
National Botanical Research Institute
Lucknow

Museum

Preparation of inventory work of Type and Figured specimens was continued. Besides, a computer print out of inventory part-I has been prepared which includes data on papers published till 1970, and related specimens/slides available in our repository.

As part of Nehru Centenary celebrations, a photographic exhibition was arranged in the Museum, from June 26-30, 1989, at the Institute depicting Pt. Jawaharlal Nehru's association with the Sahnii Institute. Visitors from all walks of life attended the exhibition in large numbers. A programme on Pt. Nehru and Science was prepared which was televised by Lucknow Doordarshan on June 29, 1989.

The National Science Day was celebrated on February 28, 1990. An open house was observed. Students of local schools/colleges and others evinced keen interest in the exhibits.

To popularize Palaeobotany, plant fossils collected from different parts of the country representing different geological horizons were gifted to seven educational Institutions. Video cassettes covering various aspects of ecology and evolution were procured.

Type and Figured specimens/slides/negatives

Type and figured specimens of thirty one research papers were deposited in the Institute repository.

Teachers and students of fourteen colleges/universities visited the museum of the Institute.

A number of scholars from United Kingdom, Phillipines, Malayasia, Nigeria, Japan, United States of America, East Germany, Nepal, West Germany, Madagascar, and Brazil visited the museum of the Institute.

	Additions during the year	Total
Type and figured specimens	228	4,698
Type and figured slides	149	10,013
Negatives of the above	443	12,710

New Collections

As a result of field excursion by the Institute staff specimens/samples belonging to two hundred fourty seven localities were submitted to the Museum as detailed below:

Departments	Specimens / Samples
Non-vascular plants	— 38

Palaeophytic Evolutionary Botany	928	28
Cenophytic Evolutionary Botany	832	—
Quaternary Biogeography and Archaeobotany	—	528
Pre-Gondwana & Gondwana Palynostratigraphy	—	699
Post-Gondwana Palynostratigraphy of Peninsular India	—	919
Post-Gondwana Palynostratigraphy of Extra-Peninsular India	—	489
Planktonology	—	60
Radiometric Dating	—	14

Specimens/samples received for investigation

1. Geological Survey of India, O.M.E. & M.C. Wing, Coastal Geotectonics Division, Calcutta	1
2. Department of Geology, University of Dakar, Senegal	105
3. Geological Survey of India, Coal Division, Calcutta	12

Exchange of fossil specimens

A set of plant fossils of our country was sent in exchange to the following :

Professor Luka Pesie
 Director Rudarsko Geoloski, Faktet Beograd
 Oour grupa Za Regionalnu, Geologijee
 Palenotologijei, Beograd
 Yugoslavia

Presentation of fossil specimens within the country

Fossil specimens/slides were gifted to the following educational Institutions during the period of this year.

1. P. G. College, Department of Botany, M.A. College, Motihari, Bihar
2. Department of Botany, Payyanur College, Kerala
3. Department of Botany, Christ Church College, Kanpur, U.P.
4. Department of Botany, Gujarat University, Ahmedabad, Gujarat
5. Department of Botany, M.S. Gour Vishwavidyalaya, Sagar, M.P.
6. Department of Geology, Government G.M. Science College, Jammu
7. Department of Botany, Jai Hind College of Arts, Science and Commerce, Deopur, Dhule, Maharashtra

Visitors during the year

Educational Institutions

Students of Calcutta University
Calcutta, West Bengal

M. M. Bhandari and research scholars
University of Jodhpur, Rajasthan

Students of St. Francis College
Lucknow, Uttar Pradesh

Students of P. G. Department of Botany, L.N. Mithila University,
Darbhanga, Bihar

Students of Sibsagar College
Joysagar, Assam

Students of M.Sc., P.G. College
Satna, Madhya Pradesh

Students of Department of Botany, C.M.D. College
Kanpur, Uttar Pradesh

Students of B.Sc., Christ Church College
Kanpur, Uttar Pradesh

Students of Department of Botany, Tribhuvan University
Kirtipur, Nepal

Students of P.G. Department of Botany
T.P. College, Nadhepur, Bihar

Students of A.N.N.D. College
Kanpur, Uttar Pradesh

Trainees of Balaghat Forest Rangers College
Madhya Pradesh

A team of journalists, Centre for Media Studies, Delhi

Students of Department of Botany, B.B.P.G. College
Jhansi, Uttar Pradesh

Distinguished Visitors

Cuttuine Owmmoral Meggerion
Custte Swol Scotland, U.K.

Jocely D. George
National Museum of Philippines, Philippines

Vanin Ahman, National Museum
Kualalaumpur, Malayasia

Robin F. Lojiwin
Department of Sabah Museum
Kota Kimabalu, Sabah, East Malayasia

- W. T. Odofin
Federal Ministry of Science & Technology
Lages, Nigeria
- Takao Tokuoka
Department of Geology
Faculty of Science, Shimane University, Japan
- Shubha & T. A. Parthasarathy
Dayton, Ohio, U.S.A.
- Diefricly Wall
Academy of Sciences of G.D.R.
- Otto Appert
Manja, Medagascar
- H. P. Chaubey
General Secretary, Indian Academy of Social Sciences
New Delhi
- P. V. Sharma
P. G. Institute of Indian Medicines
Banaras Hindu University, Varanasi
- A. K. Chatterji
Regional Chief Conservator of Forest
Western Region, Bhopal
- Y. N. Saxena, I.P.S.
I.G. Police, C.I.D., U.P.
- Baldev Singh, Nehru Fellow
Teen Murthy House, New Delhi
- V. K. S. Vardhan, Ex. D. G.,
G.S.I., Bangalore
- D. Peppenfuss
Alexander von Humboldt Foundation, Bonn, F.R.G.
- Hoffman
Alexander von Humboldt Foundation, Bonn, F.R.G.
- J. P. Pascal, Director
French Institute of Pondicherry, Pondicherry
- Norman O. Frederiksen
U.S. Geological Survey, U.S.A.
- D. N. Awasthi
Member, O.N.G.C., Dehradun
- Oscar Rosler
University of Sao Paulo, Brazil
- Hari Narayan
Former Director, National Geophysical Research Institute, Hyderabad

Republic Day Celebrations—1990

The Republic Day Celebration, on January 26, 1990 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 games and 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 prize distribution was done by two retiring members of the staff. Dr Sukh-Dev (A.D. Spl. Grade) and Mr N. K. Khasnavis (S.O.). The National Song "Vande Mataram" concluded the cultural programme.

Founder's Day Celebrations—1989

Founders Day was celebrated on 14th November, 1989. In the morning floral tributes (PUSHPANJALI) were offered on the Samadhi of Professor Birbal Sahni. As the day coincided with the concluding day of Pandit Jawaharlal Nehru's birth centenary celebrations, a "SHILALEKH" (a stone memorial) with inscribed words of



Shri Y. N. Saxena, Inspector General of Police, Uttar Pradesh unveiling the *Shilalekh* with inscribed words of Pt. Nehru's speech.



Dr Norman Frederiksen delivering the 19th Birbal Sahni Memorial Lecture.

Pt. Nehru's speech delivered on the occasion of Foundation Day in 1949 was unveiled in the Institute's premises by Sri Y. N. Saxena, IPS, Inspector General of Police (CID) U.P., Lucknow. Rich tributes were paid to Pandit Jawaharlal Nehru and Prof. Sahni. An exhibition of photographs and sayings of Pandit Jawaharlal Nehru and Professor Sahni was also organised which was viewed by several visitors. In the evening two memorial lectures were organised. Welcoming the distinguished gathering, Dr B. S. Venkatachala, Director, Birbal Sahni Institute of Palaeobotany recalled the ideals of Professor Sahni and stressed his dedication and service to science. He further talked on the scientific information explosion and the need to channelize the data bank to narrow the gap between information gathering and wisdom.

Dr Norman Frederiksen, United States Geological Survey delivered the 19th Prof. Birbal Sahni Memorial Lecture on "*Rates of floral turnover and diversity change in the fossil records.*" He highlighted the significance of plant fossils to discern evolutionary patterns.

Dr Jean Pierre Pascal, Director, French Institute Pondicherry delivered the 35th Sir Albert Charles Seward Memorial Lecture on "*Floristic and distribution of evergreen forests in the Western Ghats, India*". He stressed on preserving rich evergreen forests and on the ecological factors influencing the composition of the flora; understanding of climax evergreen forests, variations in their structure and floristic composition and its interaction with gradual changes in the climate. The



Dr Jean P. Pascal delivering the 35th Sir Albert Charles Seward Memorial Lecture.

celebrations concluded with a vote of thanks by Dr H. P. Singh, Deputy Director, Birbal Sahni Institute of Palaeobotany, Lucknow.

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.Pb.S., F.I.A.P., F.P.S.

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

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

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

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

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

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

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

Assistant Directors

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

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

Mohan B. Bande, Ph.D.

Jayasri Banerji, Ph.D.

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

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

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

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

Kripa S. Saraswat, Ph.D.

Chhaya Sharma, Ph.D.

Shyam C. Srivastava, Ph.D.

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

Senior Scientific Officers

Krishna Ambwani, Ph.D.

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

Jaswant S. Guleria, Ph.D.

Hafiz A. Khan, Ph.D.

Pramod Kumar, Ph.D.

Jagannath P. Mandal, Ph.D.

Chandra M. Nautiyal, Ph.D.

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

Manoj Shukla, Ph.D.

Ashwini K. Srivastava, Ph.D.

Gajendra P. Srivastava, Ph.D.
Archana Tripathi, Ph.D., F.P.S.
Vijaya, Ph.D., F.L.S., F.P.S.

Junior Scientific Officers

Anil Agarwal, Ph.D.
Usha Bajpai, Ph.D.
Samir K. Bera, Ph.D.
Amalava Bhattacharyya, Ph.D.
Chanchala, Ph.D.
Brijendra N. Jana, Ph.D.
Neerja Jha, Ph.D.
Asha Khandelwal, Ph.D.
Khowaja-Ateequzzaman, Ph.D.
Madhav Kumar, 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.
Ram-Awatar, D.Phil.
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.
Abhay P. Srivastava, Ph.D.
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.
Asha Gupta, Ph.D.
Surendra R. Manik, Ph.D.
Kindu L. Meena, Ph.D.
Neeru Pandya, Ph.D.
Jyotsana Rai, Ph.D.
Alpana Singh, Ph.D.
Bhagwan D. Singh, Ph.D.

Rashmi Srivastava, Ph.D.
Gyanendra K. Trivedi, Ph.D., F.P.S.

**Junior Research Fellows
(Sponsored Projects)**

Rajendra Bansal, M.Sc.	
Debu K. Chowdhury, M.Sc.	(upto 15.9.1989)
Sanjay Khare, M.Sc.	
Umesh C. Mainali, M.Sc.	(upto 16.8.1989)
Narendra K. Misra, M.Sc.	
Naveen C. Pant, M.Sc.	
Om Prakash Singh, M.Sc.	(upto 14.8.1989)

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. (S.T.A.—Library)

Kavita Kumar, B.Sc., B.Lib.Sc. (Librarian)

Museum

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

Prem Prakash, B.Sc. (S.T.A.—Museum)

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

Herbarium

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

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

Laboratory Services

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

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

Kamla Amarlal, B.Sc. (S.T.A.)

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

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

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.)

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

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

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

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

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

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

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

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

Technical Services

Madhukar Arvind, B.Sc. (Console 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, B.F.A. (Artist)
Pradeep Mohan, B.F.A. (Dark Room Assistant)

Administration

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

Accounts Section

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

Stores

Nirmal K. Khasnavis, B.Sc., LL.B. (S.O.—S.&P.)
Inder J. Mehra, B.A. (Senior Assistant)
Inder J. S. Bedi (Assistant)
Ruchita Chatterji, M.A. (Store Keeper)
Kunwar P. Singh (L.D.C.)

Sponsored Projects

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

Drivers

Nafees Ahmed
Lallan
Hanuman Prasad
Balbir Singh

General Help

Mohd. Shakil (Binder)
Bipat (Mali-skilled)
Rameshwar Prasad Pal (Mali)
K. C. Chandola (Attendant)
Prem Chandra (Attendant)
Sunder Lal (Attendant)
Raja Ram (Attendant)
Satrughan (Attendant)
Rajendra Kumar (Attendant)
Haradhan Mahanti (Attendant)
Kailash Nath (Peon)
Sri Ram (Peon)
Bam Singh (Peon)
Ram Singh (Attendant)
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)
Maya Devi (Safaiwali)
Ram Kishan (Safaiwala)
Chhange Lal (Attendant)
Mewa Lal (Safaiwala)
Munni (Safaiwali)

Promotions and Appointments

Promotions

- Sukh-Dev, A.D. promoted as A.D. (Spl. Grade) w.e.f. 01.4.1989
P. K. Maithy, A. D. promoted as A.D. (Spl. Grade) w.e.f. 01.4.1989
R. K. Kar, A.D. promoted as A.D. (Spl. Grade) w.e.f. 01.4.1989
Chhaya Sharma, S.S.O. promoted as A.D. w.e.f. 01.4.1989
M. B. Bande, S.S.O. promoted as A.D. w.e.f. 01.4.1989
Jayasri Banerji, S.S.O. promoted as A.D. w.e.f. 01.4.1989
K. S. Saraswat, S. S. O. promoted as A.D. w.e.f. 01.4.1989
J. P. Mandal, J.S.O. promoted as S.S.O. w.e.f. 01.4.1989
H. N. Boral, J.T.O. promoted as Technical Officer w.e.f. 01.4.1989
P. C. Roy promoted as S.T.A. (Photography) w.e.f. 01.4.1989
D. Pradhan promoted as S.T.A. (Herbarium) w.e.f. 01.4.1989
A. K. S. Rathore promoted as S.T.A. (Library) w.e.f. 01.4.1989
Chandra Bali promoted as Section Cutter (Grade II) w.e.f. 01.4.1989
S. R. Yadav promoted as fossil Cataloguer (Grade II) w.e.f. 01.4.1989

Appointments

- Mohammad Shakil was appointed as Binder w.e.f. 01.1.1990

Retirements

Sukh Dev, A.D. (SG)

— 28.02.1990

N. K. Khasnavis

— 28.02.1990



On the eve of the retirement of Dr Sukh Dev and Mr N. K. Khasnavis.

Organisational Structure

Governing Body

Chairman

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

Members

Sri B. K. Chaturvedi,
Joint Secretary & Financial Adviser,
Department of Science and Technology, Technology 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,
Former Director, Wadia Institute of Himalayan Geology,
Vikashpuram,
Dehradun 248 001

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

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

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

Secretary

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

Assistant Secretary (Non-member)

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

Finance and Building Committee

Chairman

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

Members

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

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

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

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

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

Secretary

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

Research Advisory Council

Chairman

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

Members

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

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

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

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

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

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

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

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

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

Special Invitee

Deputy Director-General,
Geological Survey of India, Northern Region,
Lucknow 226 020

Convener

Dr H. P. Singh,
Deputy 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

Research Programming Committee

B. S. Venkatachala —Convener
H. P. Singh
G. K. B. Navale
H. K. Maheshwari

Excursion Committee

P. K. Maithy —Convener
N. Awasthi
H. P. Gupta

Computer Committee

G. Rajagopalan —Convener
R. S. Tiwari

Instrument Maintenance Committee

K. P. Jain —Convener
Anil Chandra

Quality Control Committee

Suresh C. Srivastava —Convener
Bhagwan Singh
B. K. Jain

Purchase Committee

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

Maceration Committee

R. K. Kar —Convener
R. K. Saxena
Vijaya

Scientific Display Committee

Shaila Chandra —Convener
S. A. Jafar
Asha Khandelwal
P. K. Bajpai

Building Construction and Maintenance Committee

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

Vehicle Maintenance Committee

Anand-Prakash —Convener
 Registrar
 R. K. Takru —Vehicle Incharge

Garden Maintenance Committee

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

Canteen Committee

Sukh Dev —Convener
 P. K. Bajpai —Secretary
 K. Manik Chhabra —Treasurer
 N. C. Saxena
 H. S. Srivastava

Faculty Consultative Committee

H. K. Maheshwari —Chairman
 Anil Chandra —Secretary
 S. A. Jafar
 J. S. Guleria/R. K. Saxena
 B. N. Jana/O. S. Sarate

Joint Consultative Committee

Diwakar Pradhan —Chairman
 V. Nirmala —Secretary
 B. Sekar
 N. K. Khasnavis
 Prem Prakash
 P. S. Saluja
 A. K. Srivastava
 Usha Chandra
 Kedar Nath Yadav
 Keshav Ram
 Ram Kishan

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

We have audited the annexed Balance Sheet of Birbal Sahni Institute of Palaeobotany, Lucknow as at 31st March, 1990 and its relative Income & Expenditure Account and Receipts & Payment Account for the year then ended with the records produced before us.

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

- i) in the case of Balance Sheet of the state of affairs of the Institute as at 31st March, 1990;
- 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 : 02.08.1990

Annexure—I

**Comments on Accounts of
Birbal Sahni Institute of Palaeobotany, Lucknow
as at 31st March, 1990**

1. Accounts have been maintained on cash system except for adjustment for unsettled advances.
2. Fixed assets are at cost and no depreciation has been provided.
3. Balances of various projects and seminars have not been incorporated in the Balance Sheet and Income and Expenditure Account.
4. Advances have directly been charged to the final head of expenditure in the Receipt and Payments Account, instead of debiting the advance. However, the unsettled advances have been adjusted in the Income and Expenditure Account and taken to advances in Balance Sheet.
5. Advances include Rs. 3.02 lacs remaining unsettled for want of submission of adjustment Bills by the parties, that has resulted in understating the expenditure and overstating the advances.
6. Deposit includes advances of Rs. 20,47,337 to C.P.W.D., Lucknow under Plan Capital which remained unadjusted resulting in under stating the Works and Building expenditure and over stating the Deposits.
7. Completion certificates for various works transferred to Works and Building, wherever required, still remain to be obtained.
8. The final bill of the Multi-Storeyed Building contractor is under dispute and no adjustment has been made in account for his claim pending decision of Hon'le court.
9. Nineteen (19) bags of Cements valued at Rs. 1,107.70 p. issued for maintenance and consumed, continue to be included under Building and Material, for want of adjustment, resulting in over stating the Building Material and under stating the Revenue Expenditure to that extent.
10. The figures have been recasted and regrouped wherever deemed necessary.

*For KISHORE & KISHORE
Chartered Accountants*

(R. K. MATHUR)
Partner

*Place : Lucknow
Date : 02.08.1990*

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

<i>Liabilities</i>	<i>Last Year 1988-89</i>	<i>During the Year 1989-90</i>
Capital	3,06,33,837.82	3,46,33,837.82
Excess of Income over Expenditure	28,21,461.90	34,83,304.17
Donations/Gifts	4,12,943.65	4,25,741.20
G.P.F. Deposits	50,55,717.67	61,04,515.06
Deposits under security & Earnest money	52,756.14	1,42,291.79
Total Rs.	3,89,76,717.18	4,47,89,690.04

Sd.
(J. C. Singh)
Accounts Officer

PALAEOBOTANY, LUCKNOW**31st March, 1990**

<i>Assets</i>	<i>Last Year 1988-89</i>	<i>During the Year 1989-90</i>
Land & Buildings	49,94,466.50	49,94,466.50
Apparatus & Equipments	1,62,28,014.07	1,82,39,169.69
Vehicles	6,51,398.57	6,51,398.57
Furniture & Fixtures	18,11,943.54	18,83,773.69
Books & Journals etc.	14,37,046.26	15,74,716.60
Founder's Fossil collections	50,000.00	50,000.00
Investments	97,687.50	98,600.00
Unesco coupons	793.02	793.02
Advances	13,63,711.43	17,43,013.53
Deposits with CPWD	13,95,559.00	20,89,885.00
Security money	3,000.00	3,000.00
Loans to Employees	21,65,435.57	23,42,066.77
GPF Accumulations	50,55,717.67	61,04,515.06
Closing stock	13,234.10	9,502.90
Sundry Debtors	—	3,498.00
Closing Cash Balances		
i) In hand	276.35	226.80
ii) In Bank	37,08,433.60	50,01,063.91
Total Rs.	3,89,76,717.18	4,47,89,690.04

Sd.
(S. B. Verma)
Registrar

Sd.
(B. S. Venkatachala)
Director

