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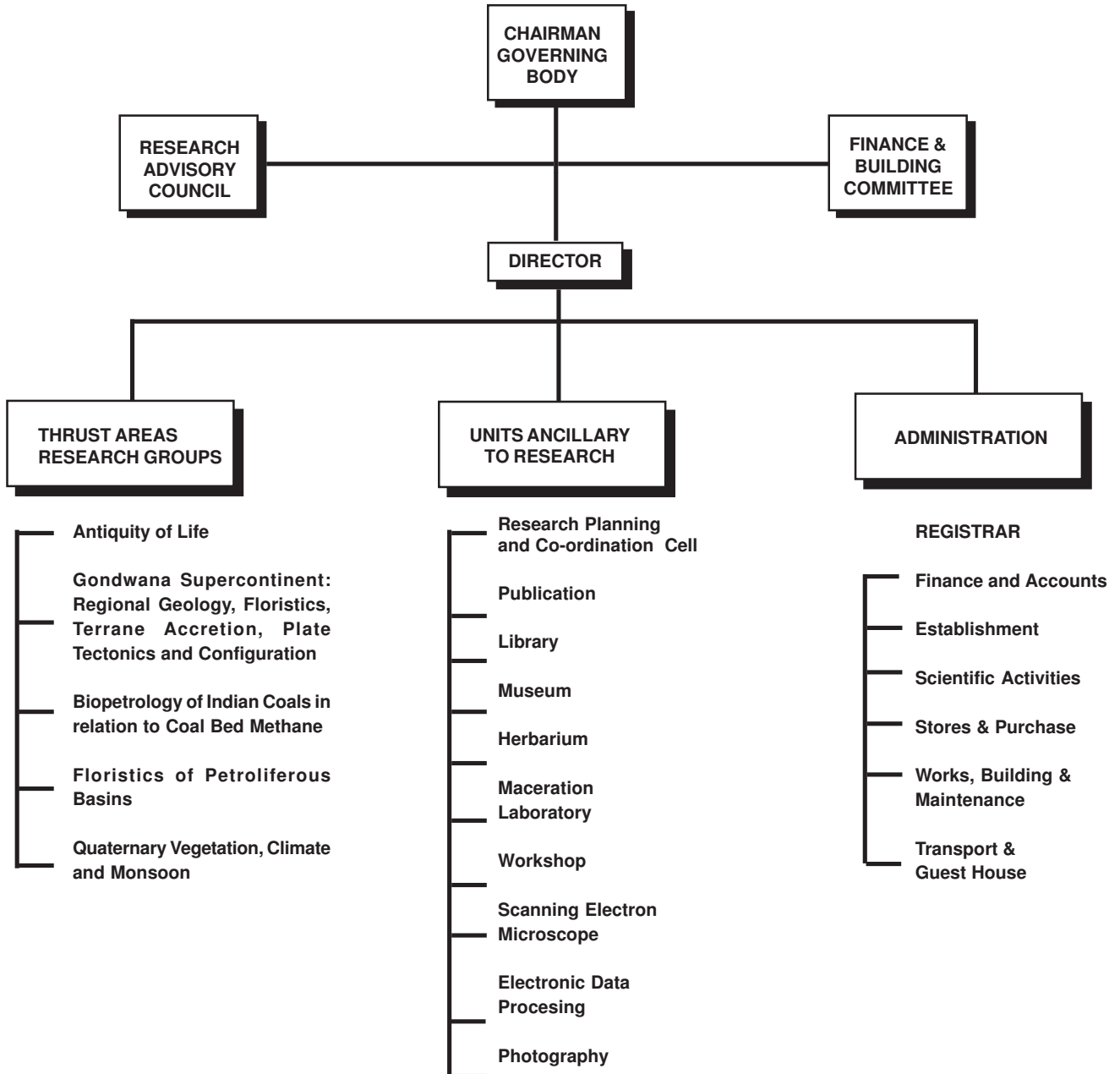
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ORGANISATIONAL SET-UP



Research

Thrust Area: Antiquity of Life

Project 1: Palaeobiology and biostratigraphy of Precambrian Basin

Component 2: Morphotaxonomical studies of biological remains of both micro- and mega-fossils from the Meso/Neoproterozoic sediments of the Kurnool and Chhattisgarh

Studied macrofossils comprising *Longfengshania* and *Tawuia* from the Owk Shale Formation exposed at Ankireddipalle village and also recovered more thallophytic algae from the chert bed in Koilkuntala Limestone Formation, Kurnool Group exposed near Nandikotkur in Kurnool district, Andhra Pradesh. Fresh collection of ichnofossils/dubiofossils from the Panium Quartzite Formation has also been studied. The forms present are broadly grouped into three categories: i) Medusoid like forms, ii) Spindle shaped forms, and iii) Algal mat texture.

M. Shukla & M. Sharma

Studied diversified organic-walled microfossils (OWM) in macerated residue and thin sections of materials from the Charmuria Limestone and Gunderdehi Shale formations, Raipur Group, Chhattisgarh Supergroup. Assemblage comprised of acritarchs and cyanobacteria from the interbedded dark gray shales and cherts in Charmuria Limestone Formation exposed around Katgi and Basin villages. The acritarchs belong to sphaeromorphida group and a few forms are comparable with earlier reported forms, viz. *Margominuscula simplex*, *M. rugosa*,

Granomarginata prima and *Baltisphaeridium dubium*. Colonies of sphaeroidal cells and trichomes represent cyanobacteria. OWM comprising large sized acritarch of sphaeromorphida group and rarely cyanobacteria have been recovered in Gunderdehi Shale Formation exposed around Bilaigarh village. These forms are comparable with known forms of acritarchs, viz. *Leiosphaeridia pellucida*, *Favosphaera conglobata*, *Granomarginata minuta*, *Lophosphaeridium truncatum* and Cyanobacteria, viz. *Myxococcoides ramapuraensis* and *Eomycetopsis rugosa*. An assessment analysis indicates that the sizes of dominating acritarchs of sphaeromorphida group increase from older Charmuria Limestone Formation to younger Gunderdehi Shale Formation. The acritarch of sphaeromorphida group are dominant in the recovered assemblage of Gunderdehi Shale Formation. Cyanophycean algal remains are mostly preserved in cherts of the Charmuria Limestone Formation. The OWM assemblage suggests early Neoproterozoic age and calm depositional environment for the lower part of the Raipur Group.

R. Babu

Thrust Area: Gondwana Supercontinent: Regional Geology, Floristics, Terrane Accretion, Plate Tectonics and Configuration

Project 2: Floristics and biostratigraphy of Palaeozoic and Mesozoic of Himalayas

Component 1: Floristics and stratigraphy of the Late Palaeozoic and Mesozoic sediments of the Tethyan Himalaya and their regional relationship

Rock samples (30) from Laptal Chojan La section of Spiti Shale Formation, Malla Johar area have been worked out for their spore-pollen. The characteristic taxa, viz. *Callialasporites* spp, *Murospora florida*, *Cicatricatisporites australiensis*, *Aequitriradites spinulosus*, *Appendicisporites* sp., etc. evidence the

Oxfordian to Berriasian age correlation for the formation. The palynozones identified have been compared with the known Ammonite zones to develop an integrated biostratigraphy of Spiti Shale unit in the Tethyan Mesozoic sequence.

Vijaya

Component 2: Permian plant fossils from North-Eastern Himalayas

Observation, description, morphotaxonomy and photodocumentation of Permian plant fossils from Tindharia, Pankhabari, Kalijhore nala sections of Darjeeling and Rohtak Khola section of South Sikkim district have been carried out in detail. The assemblages are represented by following species: *Gangamopteris cyclopterioides*, *G. major*, *G. clarkeana*, *Gangamopteris* sp., *Glossopteris communis*, *Gl. indica*, *Gl. stenoneura*, *Gl. varia*, *Gl. vulgaris*, *Noeggerathiopsis hislopilii*, equisetalian axes and vertically and horizontally preserved *Vertebraria* axes. The compilation of floristic data and stratigraphical significance of the flora are under progress. Carbonaceous shale samples from different sections of Tindharia, Baman Pukharia, Pankhabari and Rohtak nala were chemically processed. Although the samples are devoid of megaspores,

seeds and cuticles, but presence of *Botryococcus*-algal colony in almost all the samples are significant. The palaeoecological significance of the algae is being studied.

R. Tewari & A.K. Srivastava

Chemically processed coal and carbonaceous shale samples from Kalijhora, Rakti Khola and Bamon Pokhari areas of Darjeeling district (WB) for palynological analysis. Carbonaceous shale samples from Kalijhora nala section have yielded palynofossils, represented by *Scheuringipollenites maximus*, *Alisporites* sp., *Distriatites* sp., *Faunipollenites varius*, *Striatopodocarpites* and *Microfoveolatispora*. A number of *Botryococcus* algal colonies have also been found.

A.K. Srivastava & A.P. Bhattacharyya

Project 4: Floristics, biostratigraphy and palaeoenvironment of Gondwana sediments

Component 1: Morphotaxonomy, floristics, evolution, biostratigraphy and palaeo-environmental studies of Son-Mahanadi, Damodar, Panagarh and Birbhum basins

Completed identification of 350 impression and compression specimens from eight localities of Mand–Raigarh coalfield, Chattisgarh, viz. Kantasar nala section near Dokripari village, Mand river section near Ambetikra temple, Kasaia nala section near Kasaia village, Gersaghat section near Gersa village, Saria nala section, and Barod, Jindal and Mand open cast projects. The plant fossils indicate Early to Late Permian age (Karharbari, Barakar and Kamthi formations) for the various beds. Photography of important taxa is also completed. Singh again visited the coalfield area and collected above 250

megafossil specimens belonging to *Glossopteris* flora from Barakar and Kamthi formations exposed in different nala sections and collieries.

S. Chandra & K.J. Singh

Traced the marker spore-pollen species from the coal-bearing and Kamthi sediments of Talcher coalfield (Orissa). The Permo-Triassic palynofloral transition has been recorded in the subsurface material. The change of palynoflora is gradual. The variation in the pattern of change over the distribution of nonstriate and taeniate bisaccate pollen is more

significant than the cingulate spores at the P/Tr transition in coalfield as compared to the pattern observed in Damodar basin. A paper on the study has been finalised. Additional samples were collected from five bore-holes drilled in the coalfield area for further palynological studies.

A. Tripathi

Carried out microscopic observation to search spore-pollen species in 500 m thick Gondwana sediments in bore-hole DPD-6 from Deocha-Pachami area, West Bengal. Further study is in progress for precise dating of the three stratigraphic units—Barakar, Dubrajpur and Rajmahal formations.

Vijaya

Recorded the palynofossils, such as *Callialasporites trilobatus*, *Cyathidites australis*, *Callispora foveolata*, *Cicatricosisporites ludbrookii* and *Aequitriradites spinosus* from Parsora Formation (Ghorari and Kamari nala sections) indicating Late Jurassic/Early Cretaceous age of the sediments. Three palynoassemblages have been identified in bore-hole SKM-6, Sohagpur coalfield (MP). The palynoassemblage-I (depth 254.00-163.40 m) of late Early Permian age reveal the prominence of *Scheuringipollenites* and *Faunipollenites* in association with *Barakarites*, *Ibisporites*, *Rhizomaspora* and rarely *Parasaccites*. The palynoassemblage-II (157.40-139.50 m) of Late Permian age contains high percentage of *Faunipollenites*, *Striatopodocarpites* and

Crescentipollenites. The youngest palynoassemblage-III (137.15-77.90 m) exhibits similar palynotaxa as in palynoassemblage-II, but with additional records of *Falcisporites*, *Goubinispota*, *Satsangisaccites*, *Densoisporites*, *Playfordiaspora*, *Klausipollenites* and *Nidipollenites* and assigned Late Permian/Early Triassic age. Permo-Triassic transitional palynofossils have been recorded in this coalfield for the first time. Also collected samples of bore-hole cores and outcrops in Sohagpur and Mand-Raigarh coalfields. Chemical processing of samples from bore-holes ROP-8 and MJB-1 of Mand-Raigarh has been completed. Quantitative analysis of the productive samples is in progress.

Ram-Awatar

Processing of sub-surface samples from bore-hole TKE-2 of Talcher Coalfield (Orissa) has been carried out. Completed the chemical processing of surface samples from the Baki Bihar area (Chaturdhara nala section) and from the Basundhra nala section. Prepared slides, scanned and photographed important palynotaxa from Ib-River coalfield (Orissa). Finalised a manuscript on palynofossils from bore-holes IBT-4, 5 and 6. Recovered two palynoassemblages belonging to Late Permian (Raniganj age) and upper Barakar palynoflora in the samples collected from the north of Gopalpur village, Basundhra nala section. Also finalised a manuscript on palynoflora recovered from bore-holes IBT-2, 3 and 7.

K.L. Meena

Component 2: Morphotaxonomy, floristics, evolution, biostratigraphy and palaeoenvironmental studies of Satpura and Wardha-Godavari basins

Investigated plant fossils from Thisgora and Mathani areas of Pench valley coalfield. The flora is represented by the species of *Gangamopteris*, *Glossopteris*, *Euryphyllum*, *Palaeovittaria*, sterile and fertile foliage shoots of *Buriadia*. Systematic description and specific delineation of the flora on the basis of external morphological features and cuticular structures are being carried out. *Noeggerathiopsis* leaves recovered from Rawanwara

area have yielded well-preserved cuticles. Externally all the leaves are similar to *N. hislopii*. Three distinct types of leaf cuticles have been observed. Cuticular preparation, description and photodocumentation of the specimens and cuticles are complete. The taxonomic significance of cuticular features *vis-a-vis* morphological characters in the generic and specific circumscription of *Noeggerathiopsis* leaves are under progress.

Bulk maceration of samples from Rawanwara Khas, East Pench and Sethia collieries has yielded a variety of megaspores. Each megaspore is being studied under dry and wet conditions under incident light. They are further treated with nitric acid and alkali for the recovery of inner body. Some of the well-preserved megaspores have been examined under SEM, and have been assigned to genera—*Talchirella*, *Duosporites*, *Barakarella*, *Jhariatrilletes*, *Ancorisporites* and *Singraulispota*. A new gulate megaspore *Satpuraspora* showing characteristic furcate exine ornamentation has been identified. A manuscript dealing with structural features of gulate megaspores under LM and SEM has been finalised.

A.K. Srivastava & R. Tewari

Processed and analysed samples (50) from bore-hole MAB-1 of Bottapagudem area, Chintalpudi sub-basin. Two palynoassemblages have been identified in 220 m thick sedimentary sequence. Palynoassemblage-I occurring at the depth of 173 m is characterized by the dominance of *Striatopodocarpites* and *Faunipollenites* along with stratigraphically significant taxa, viz. *Klausipollenites*, *Guttulapollenites*, *Vitreisporites*, *Strotersporites*, *Osmundacidites*, *Crescentipollenites*, *Corisaccites* and *Chordasporites*. Palynoassemblage-II (144-120 m) shows dominance of striate disaccates, chiefly *Striatopodocarpites* and *Faunipollenites* and sub dominance of *Densipollenites* along with stratigraphically significant taxa, viz. *Lunatisporites*, *Klausipollenites*, *Falcisporites*, *Guttulapollenites*,

Playfordiaspora, *Vitresporites*, *Lundbladispota* and *Strotersporites*. These palynoassemblages belong to Raniganj palynoflora and have been dated as Late Permian in age. Fossilized animal remains identified as insect abdomen, cutin and antennae parts have also been recorded in Permian sediments of Godavari Graben.

N. Jha

Described two palynoassemblages from bore-hole WM-14 drilled in Mahadoli area, Chandrapur district (Maharashtra): i) *Scheuringipollenites* dominant assemblage which represent lower Barakar mioflora and ii) *Parasaccites*–*Densipollenites* dominated assemblage along with *Falcisporites* and *Satsangisaccites*. The later is comparable to lower Triassic palynoflora due to presence of younger elements. Presence of *Parasaccites* suggests a cooler climatic condition at the time of deposition. The lower Barakar palynoflora suggests a positive evidence for Lower Gondwana coal in the area. Samples from another bore-hole (BR-134, Baranj Block) have also been chemically processed. *Gondisporites* assemblage zone has been recovered. A field work was undertaken in Wardha valley coalfield around Chandrapur, Yeotmal and Wardha districts of Maharashtra and coal, shale and carbonaceous shale samples were collected from different bore-hole cores and open cast mines. Megafossils from Nand nala section in Umrer coalfield have also been collected.

A.P. Bhattacharyya

Component 3: Ultrastructure of fossil cuticles and megaspores and comparative studies on selected modern taxa

Completed transmission electron microscopic (TEM) studies of the cuticular membrane (CM) of peltaspermaceous taxon of Mesozoic pteridosperms *Lepidopteris* sp. and compared it with three other taxa of Mesozoic pteridosperms. It was found that the structural configuration of CM varies for each taxon. Two taxa of living cycads (*Zamia fischeri* and *Z. furfuracea*) have also been investigated under TEM. The CM in all the four species—*Cycas circinalis*, *C. revoluta*, *Zamia fischeri* and *Z. furfuracea* shows a polylamellate outermost zone, though faintly so in

Z. furfuracea. Dispersed cuticles from the sediments were also studied for ultrastructure under TEM. These show well-preserved structures. SEM studies on the sporoderm of megaspores recovered from Barakar shales of a coal mine near Hahajore, Hura Basin, Rajmahal Hills have been done. A variety of megaspores have been sorted out from the bulk maceration sample. Light microscopic studies have been completed. Inner body in all the megaspore taxa is absent.

U. Bajpai

Project 5: Floristics, biostratigraphy and palaeoenvironment of Mesozoic sediments

Component 1: Morphotaxonomy, floristics, evolution, biostratigraphy and palaeoenvironmental studies of Triassic-Cretaceous flora of East-Coast Gondwana, Rajmahal and Gujarat basins

Carried out anatomical study of petrified female araucarian cones and anatomical features of each part of the cone have been critically assessed. On the basis of character analysis, these cones classified under *Araucaria mirabilis* (Spegazzini) Windhausen section-Bunya of the family Araucariaceae. In addition to female cones, two male coniferous cones (probably Araucarian) are also recovered from the Sonajori locality but due to lack of sufficient data and incomplete preservation, identification remains incomplete. Also studied a fossil wood from the same locality, identified as *Araucarioxylon* sp. Section cutting of Sonajori and Nipania cherts is continued for identifications of various plant remains.

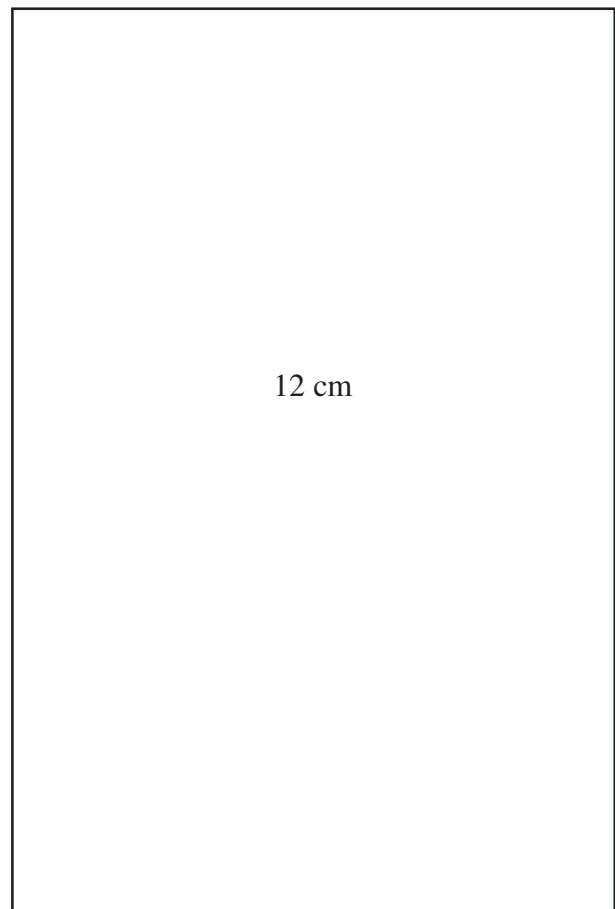
J. Banerji & B.N. Jana

Studied the megafloral assemblage from *Isoetites*-rich beds near Than locality. In spite of repeated collection from the same locality no fertile specimen of *Isoetites* could be recovered so far. In morphological appearance *Isoetites* sp. from the area apparently resembles *Isoetes janaianus* known from Kachchh in the nature of lobed corm and entire margin of sporophylls. The species has been found abundantly towards the peripheral region of a shaly bed which is overlain by a huge sandstone sequence. It is assumed that *Isoetites* sp. was growing towards the margin of a pond and was deposited *in situ* condition in shale sequence.

B.N. Jana

Evaluated the recently identified Late Triassic-Early Jurassic palynological assemblages from the Dubrajpur sediments (bore-hole RJNE-32) of Rajmahal Basin in terms of dominance/sub-dominance, overall composition and First Appearance Datums of specific biomarker genera,

viz. *Stereisporites*, *Foveosporites*, *Enzonalasporites*, *Playfordiaspora*, *Arcuatipollenites*, *Infernopollenites*, *Classopollis*, *Araucariacites* and *Callialasporites*, etc. On the basis of changing pattern of palynological characteristics, seven palynoevents have been identified in the strata. Besides, the palynofloras from the Rajmahal Formation were analysed for the specific composition. Undertook field work in Rajmahal and Birbhum areas and collected subsurface



12 cm

Conifer strobilus from the Lameta Formation, Nand-Dongargaon Sub-Basin. X 2

samples from south of Brahmini Coalfield. Also visited Geological Survey of India, Kolkata to discuss the palynological reports and future plan for sampling.

A. Tripathi

Carried out studies on the plant megafossils of the Gangapur Formation, Pranhita-Godavari Graben. Association of cycadophytes, conifers and pteridophytes within the plant assemblage indicate gymnosperm dominant vegetation during the time of deposition. Studied equisetalean stem impressions of variable morphology. Plant megafossil impressions of pteridophytes and conifers from the Kota Formation were also studied. They are invariably small in size. Also studied conifer strobilus and stem impressions from the Lameta Formation, Nand-Dongargaon sub-basin. Robust nature of conifers facilitated their preservation. Undertook field work in the Wardha-Pranhita-Godavari and collected a number

of plant fossils from Kota, Gangapur and Lameta formations. A number of associated animal fossils were also noticed.

A. Rajanikanth

Investigated megafossils from Eddala-Gattu locality of Raghavapuram. The recorded genera are *Cladophlebis indica*, *Sphenopteris* sp., *Baiera* sp., *Taeniopteris spatulata*, *Ptilophyllum cutchense*, *P. acutifolium*, *P. sahnii* and *Elatocladus jabalpurensis*. In general, cycadophytes and conifers dominate the assemblage, whereas pteridophytes are comparatively less. The palaeofloral assemblage is contemporaneous to Vemavaram and Gollapalle floral assemblages of East Coast and Sehora floral assemblage of Jabalpur Formation (MP). The floral assemblage is assigned Early Cretaceous age.

N. Prakash

Component 2: Morphotaxonomy, floristics, evolution, biostratigraphy and palaeoenvironmental studies of Triassic-Cretaceous of South Rewa-Satpura basins

Study of detached fertile organs has been completed. Two new taxa *Townrowea* and *Douglasea* have been identified. Their morphographic and cutinized structure are quite different from each other. These forms appear to be similar to the conifers of northern and southern hemispheres, but because of their detachment from the main organ and having no fertile unit definitively attached, they could be attributed to any of the known genera, viz. *Voltzia*, *Voltziostrobus* and *Voltziopsis*. *Townrowea* has been isolated in attached condition as well, but fertile units have shed off due to fully mature fructification.

S.C. Srivastava & N. Prakash

Recovered diverse and abundant leaf impressions from Chui Hill, Jabalpur Formation, Satpura Basin. Excellently preserved leaves in reddish-pink clay show dominance of conifers (*Elatocladus* sp., *E. jabalpurensis*, *Brachyphyllum jabalpurensis* sp. nov., *Pagiophyllum chawadensis*, *Araucarites minutus*, *Satpuria sehoraensis*) followed by bennettitales (*Anomozamites* sp., *Ptilophyllum cutchense*, *P. acutifolium*) and pteridophytes. Cycadales is represented by *Taeniopteris spatulata*. The floral assemblage is compared with floral assemblages of Satpura and South Rewa basins and found to be younger than Chaugan and older than Bansa floral assemblages and belongs to Early Cretaceous age.

N. Prakash

Project 14: Accretionary evolution and tectonics of Terranes in Ladakh-Karakoram Sector

Compiled geological information on subduction and accretion tectonics of Himalayan and Karakoram terranes and their palaeogeographic configuration and Himalayan mountain building and plate tectonics. It has been established that Himalayan mountain building is the product of a collision between the Indian and Eurasian plates along the Indus-Tsangpo Suture Zone (ITSZ), which began during the Eocene epoch. The 2,500-km long suture has been recognised as one of the best examples of continent to continent collisional suture zone. It has come into existence as a result of subduction followed by soft continental collision (55-60 Ma). Rocks of the Shyok Suture Zone (SSZ) form adjacent to the ITSZ in the northern part of the Ladakh magmatic arc, an important tectonised zone. The rocks of SSZ are represented by distinct set of highly compressed tectonic slices. These slices have been transiently displayed by the active Karakoram fault. Thrusting and crustal thickening probably began in the northern Himalayas during the Late Eocene-Oligocene epochs, perhaps owing to restacking of the thinned crust of the north Indian continental margin followed by a major uplift of the Himalayas beginning in the Early Miocene. It is now a generally accepted argument that the broader area of the Himalayan Mountains with the Tibetan Plateau is made up of a series of microplates accreted to Asia before the India-Asia collision. The ophiolitic bodies' abduction and some pre-collisional thrusting occurred, too, before syn- and post-collisional

structural complication and tectonics. Successive neotectonic phenomena led to the uplift and grandeur of the Himalayan mountain chain embracing the loftiest peak on our globe- the Everest.

The Karakoram Mountain ranges occupying a significant tectonic unit in the north of Himalayan syntaxial belt and Indus Suture Subduction zone of Indian and Asian plates. The synthesis of data confirms that the accretionary and collision processes in the Karakoram region had been initiated prior to the Indo-Eurasian collision. This result is a pointer and suggests that SSZ was active subduction related feature earlier to the activities along the ITSZ. The successive magmatic activities have acted as stitching plutons leading to the accretion to Karakoram terrane with the Asian plate. Discovery of Permian plant fossils provides crucial clue regarding the palaeogeographic reconstruction of the Karakoram-Himalayan block; which indicates that during Early Permian time the Karakoram microcontinent was located not far from the Salt Range (presently in Pakistan) of Indian sub-continent. It is suggested that Karakoram terrane was welded to Asia some time during Late Jurassic or Early Cretaceous. In the light of new data emerging from inaccessible Karakoram mountain terrane, it is advisable to collect more data from adjoining area to make final conclusion.

A.K. Sinha

Thrust Area : Biopetrology of Indian Coals in relation to Coal Bed Methane

Project 6: Coalification processes and depositional environment of coal and associated sediments

Component 1: Organic matter characterization from plant fossils and DOM in Cenozoic sediments

Pyrite framboids occurring on degraded leaf cuticles were observed under SEM and EDAX systems (with **U. Bajpai**). The investigations from Late Tertiary sediments of Mahuadanr valley, Palamu indicate that framboidal pyrites are formed in the cavities and cell lumens of degraded leaves and other plant entities under reducing conditions and are the result of the activity of mainly sulphate reducing bacteria. Pyrite framboids occur in clusters and as solitary spherules. The elemental analysis and organic matter substrate of framboids indicate that the C, Fe and S are the main constituents. However, N and O are also present in sufficient quantity. The morphological characters of bacterial colonies are generally retained during mineral uptake to form framboids. **Srivastava** and **Shukla** visited Neyveli lignite field, Cuddalore district, Tamil Nadu and collected lignite samples, leaf compressions, lignified woods and resin lumps from different mines.

Microbial action on dispersed and compressed leaf cuticles from clay, shale and carbonaceous shale of various geological periods (Early Carboniferous-Kotshu Hills, J&K; Permian- Lohapity, Jharia coalfield; Late Triassic-Janar and Haral villages, South Rewa Basin; Early Cretaceous- Sehora,

Jabalpur, and Naicolam, Trichurapalli; Tertiary-Bihpuria well #1, Upper Assam; Miocene-Amberiwadi, Maharashtra; Pliocene to Pleistocene-Mahuadanr valley, Palamu, Bihar) have been studied under LM, SEM and TEM (with **U. Bajpai** and **N. Prakash**). It has been observed that most of the leaves or leaf fragments start undergoing various degradational processes, as soon as they are detached from the parent plant body. The pathogen (fungi and bacteria) enters the leaf tissue through stomata, pore or cracks and first degrades non-lignified components present between cuticular layers and then the other parts. These fungi and bacteria rapidly colonize the plant fragments including leaf litter when buried under the sediments. The observations under SEM and TEM shows three characteristic stages of degradation of leaf cuticles affected by fungal attack— hyphal invasion, penetration and dissolution of tissues. In case of bacteria infestation, corrosion, cavity formation and tunneling represent various degradational phases. These processes ultimately contribute towards the formation of amorphous organic matter types.

Anand-Prakash, G.P. Srivastava, M. Shukla & M. Kumar

Component 2: Biopetrographic evaluation, genesis and depositional history of Indian coals

(I) Organic petrological evaluation of Karanpura coal deposit (Damodar Basin) in relation to carbonization properties, genesis and depositional history

Studied microconstituents (macerals and microlithotypes) of coals from Kargali Seam of Kathara colliery to assess the nature and composition of coals. The coals belong to Early Permian Barakar Formation of East Bokaro coalfield. In general, these coals are found to be rich in vitrinite group (38-74%, vitric and fusovitric coal types) followed by inertinite and liptinite groups. Likewise, their vitrite, clarite, vitrinertite and duroclarite microlithotypes are high. The rank values ($R_{o\ max}$ 0.82 - 0.94%) determined

through reflectance measurements on maceral vitrinite indicate that the coals have attained high-volatile bituminous A stage. On the basis of coal types, it appears that the Kargali Seam originated dominantly from woody vegetation under anaerobic (wet-reducing) condition with occasional aerobic (dry-oxidative) conditions. The rank and composition of coals indicate that these coals are within the threshold of methane (thermogenic) generation.

B.K. Misra & B.D. Singh

(II) Biopetrology of Wardha-Godavari Valley coals

The biopetrological investigations on coals representing Kosar (bore-hole KDR-43), Dongargaon (BH KDR-38) and Mahadoli (BH WM-16) areas of the Wardha valley coalfield has revealed that the coals contain remarkably low (14-20%) mineral matter association. The ternary and binary (m.m.f.) plottings have suggested that the middle seam in Dongargaon and Kosar areas of the Yeotmal district contain mixed type of coal. However, the top seam in Dongargaon area contains vitric type of coal and the middle seam in Mahadoli area (Chandrapur district) is represented by fusic coal type. The vitrinite reflectance study of

the coals from Mahadoli area has indicated a gradual increase in the values ($R_{o\max}$ 0.53-0.62%) from the bottom to the top part of the seam. The top and the middle seams of the Dongargaon area possess similar reflectance values (0.59-0.62%) as recorded from the top part of the seam in Mahadoli area. However, the top seam near Kosar village contains low reflectance values (0.53-0.54%) The coals in all the three areas have attained high volatile bituminous C stage of the rank.

O.S. Sarate

(III) Biopetrographic evaluation of coals from Satpura Gondwana Basin with an emphasis on depositional pattern and utilization potential

Finalised a paper entitled "Petrology of Kanhan coals, Satpura Gondwana Basin (India) vis-à-vis coal bed methane". Estimated macerals of Early Permian Barakar coals from Eklehra and Mathani mines of PENCH area under fluorescence mode. The sub-bituminous A to high-volatile bituminous C stage mixed types (vitrinite: 13-59%, inertinite: 22-60%) coals have low amount of liptinite (6-15%). However, under fluorescence mode hydrogen-rich liptinite macerals show manifold increase (11-38%). The liptinites are found to be chiefly constituted by sporinite (spores-pollen) and liptodetrinite (detritus). On the basis of coal types, the seam of studied area appears to have formed chiefly from woody and

herbaceous vegetation with frequent spells of oxidative (aerobic) conditions affecting the organic matter. A field work was undertaken in Kanhan valley coalfields and collected coal/shale samples from Mohan (Maori Incline), Ambara (Shastri and Bhawani), Ghorawari (Jharna) and Rakhikol (Bansi Incline) underground mines. The channel samples representative of top, middle and bottom sections of Seam I (MECL III Top) belonging to Early Permian Barakar Formation were collected. The coals are generally of bright banded in nature, and the seam is expected to have potential for coal bed methane generation.

A. Singh & B.D. Singh

(IV) Organic petrographic evaluation of coal seams from Talcher Coalfield

Coals studied from Belanda and Kalinga areas show the dominance of inertinite, vitrinite and exinite group of macerals. Telocollinite and desmocollinite form the characteristic sub maceral of vitrinite group, while the semifusinite, fusinite and inertodetrinite constitute inertinite components. Sporinite, resinite, cutinite form exinite group of maceral. Maceral pattern of these coals on triangular and two axial

diagrams suggest that most of the coals lie in fusovitrinite-vitrofuscite groups. However, fusic and vitric groups were also recorded. It suggests that fluctuating oxidative and reducing conditions prevailed during the genesis of Talcher coals.

R. Saxena & J. Rai

Component 3: Sedimentary organic matter characterization of Indian lignites

Twenty selective resinites from lignite beds of H.D. Patel block of Panandhro, Bhuri Devi areas of Rajpardeeh, Kharsalia and Ghogha areas of Bhavnagar were processed for Fourier Transform Infrared studies. The characteristic pattern of FTIR peaks of the chronostratigraphically different resins indicate the similar plant source. Variations in the aromatic and aliphatic peak pattern were noticed in

fresh and oxidized resin. Three papers on the intra- and inter-seam characterization have been finalised. Further work is in progress. A field work was carried out to collect fresh materials at Panandhro, Jara dome, Jhura dome, Rajpardeeh, Vastan, Ghalla nala, Surat in Gujarat; Akli and Sindri areas of Barmer and Kuldhar nala of Jaisalmer, Rajasthan.

R. Saxena & J. Rai

Component 4: Biopetrography and geochemistry of coals, oil shales and organic matter in Late Palaeocene-Oligocene sediments from northeastern India

Petrographic investigation on coal and non-coal samples from 18 m (Main seam: 60 Feet Seam) and A (A1-A3: 4 m – 2 m thick) group of seams respectively from Tikak Parbat colliery of Makum coalfield and 5D Incline of Dilli-Jeypore coalfield was completed. Under normal incident mode, the coals exhibit high vitrinite macerals (48-72%), mainly the telocollinite and desmocollinite. Mainly resinite and subordinate amounts of sporinite, cutinite and suberinite macerals form the liptinite macerals (up to 15%). Maceral exsudatinites are present sporadically. The macerals of inertinite group are generally low to moderate in amount (9-16%) constituted mainly by semifusinite, fusinite and very commonly present fungal spores, sclerotia and hyphae. Pyrite, clastics and calcite are the main associated mineral matter (7-18%) of the coals. Pyrite

is usually the dominant mineral occurring both in primary (framboids, euhedra and granules) and secondary (encrustations and in-fillings) forms. Under fluorescence mode, the coals appear to be rich in perhydrous vitrinite, liptodetrinite and resinite macerals with low quantities of sporinite, cutinite and suberinite. Fluorinite and exsudatinites macerals are sporadic to common. Rank of the coals varies between high volatile bituminous C to B stages ($R_{o\max}$ 0.66-0.72%). However, the coals from Dilli-Jeypore are of relatively lower rank than those of the Makum. The coals from Makum and Dilli-Jeypore coalfields appear to have originated from autochthonous woody tropical vegetation predominantly under mildly alkaline anoxic milieu.

B.K. Misra

Thrust Area : Floristics of Petroliferous Basins

Project 7: Morphotaxonomy, floristics, biostratigraphy and sedimentological studies of Tertiary sediments of Lesser Himalayas

Component 1: Floristics and biostratigraphy of Pre-Siwalik sediments

Finalised a paper dealing with leaf-impressions of *Arthromeris* and *Syzygium* from the Kasauli sediments of Himachal Pradesh. In addition a draft manuscript of a paper describing leaf-impressions belonging to six taxa has also been prepared.

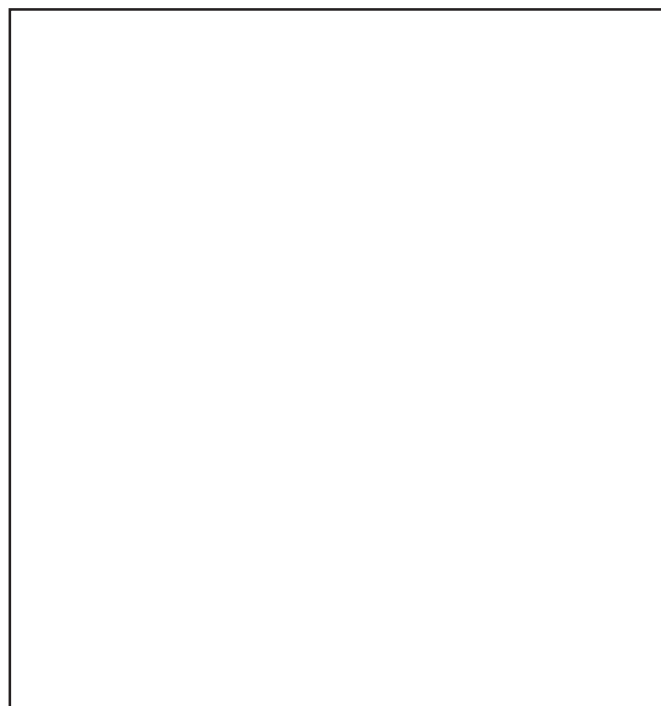
J.S. Guleria & R. Srivastava

Carried out palynological investigations of the Subathu Formation in the Lesser Himalayas. The Subathu Formation (Late Thanetian-Middle Lutetian) from Himachal Pradesh and Haryana contains distinct reworked Permian and Cretaceous palynofossils along with characteristic Late Ypresian and Early Lutetian palynofloras. The pollen assemblage consists of 17 genera and 22 species of pteridophytic spores, gymnospermous pollen and dinoflagellate cysts. Of these, 10 genera and 13 species belong to Permian, whereas others are of Cretaceous in age. The Permian palynotaxa are well preserved, while the Cretaceous forms are generally broken and highly oxidised. The palaeogeographic significance of these reworked palynofossils in the Subathu Formation has been interpreted. The basal part of the Subathu Formation (Late Thanetian–Early Ypresian), exposed at Nilkanth (Uttaranchal) and its adjoining areas were studied for palaeoenvironmental interpretations. Total carbonate and organic matter content of cyanobacteria-rich sediments were estimated. SEM studies were performed to locate biogenic carbonate particles associated with the cyanobacterial filaments. Decreased clastic supply and climate induced fluctuating environmental conditions of intertidal–supratidal zones provided ideal conditions for the establishment and rapid proliferation of cyanobacterial mats in the area.

Palynological study of the stratotype section (Kuthar Nala) of the Subathu Formation indicates that this succession span the Late Ypresian and part of the Early Lutetian time interval. Several characteristic biostratigraphical markers are identified. Based on dinocyst distribution a new palynological zonation scheme has been proposed for this formation. Palynofloral assemblages recovered from two sections (Chamla and Kharak) have also been evaluated to throw light on the role of reducing environmental conditions on the development of

black facies during sedimentation of Early Eocene rocks in the Morni Hill. Morphological study of various species of the algal genus *Pediastrum* has been carried out. Critical analysis of various morphotypes reveals that there are intraspecific morphological variations in shape, size and structure. The stratigraphic distribution of this species has been found to be restricted to Late Ypresian–Early Lutetian transitional part of the Subathu Formation. Palaeoenvironmental significance of fresh water *Pediastrum* in marine sediments of the Subathu sediments is now being worked out. A field work was also undertaken along with Professor I. B. Singh (Lucknow Univ.) for systematic collection of palynological samples as well as field sedimentological studies of lower horizons of the Subathu Formation of Nilkanth and its adjoining areas of Uttaranchal. Cyanobacteria rich bands were identified in the basal part of Subathu Formation of Nilkanth and Tal valley sections. Reconnaissance survey was also carried out at several localities to find out their lateral extensions on regional scale.

S. Sarkar & V. Prasad



Odontochitina operculata (Wetzel) Deflandre & Cookson, 1955, a reworked Cretaceous palynofossil from the Subathu Formation

Component 2: Floristics, biostratigraphy and sedimentological studies of Siwalik sediments

Carried out chemical processing of the samples from the lower-middle Siwalik sediments of Dhangar area (Bilaspur district) and Jwalamukhi-Ranital-Kangra Road section (Kangra district) of Himachal Pradesh and Morni hills, Haryana. Scanning and photodocumentation of selected taxa have been completed. *Striatriletes*, *Lycopodiumsporites*, *Inaperturopollenites*, *Pinjoriapollis* and *Pinuspollenites* mainly represent the assemblage recovered from the Dhangar area. In this assemblage, gymnosperm pollen are dominant over angiosperm pollen followed by pteridophytic spores. The palynoflora recorded from Jwalamukhi-Ranital-Kangra Road section is represented by pteridophytic spores— *Pteridacidites* (*Pteris*) and *Striatriletes* (*Ceratopteris*), gymnospermous pollen— *Pinuspollenites* (*Pinus*) and *Abiespollenites* (*Abies*), angiospermous pollen— *Pinjoriapollis* (*Magnolia*), *Inaperturopollenites* and *Graminidites*. The recovery of palynofossils from Morni hills is poor and mainly represented by *Striatriletes*, *Pinuspollenites* and *Pinjoriapollis*. A field work was undertaken to study various Siwalik sediments exposed at Nadah area, Gaggar River section in Panchkula and adjoining areas; Khetpurali section, Haryana; Markanda River

section (middle Siwalik); Saketi (lower Siwalik); Bilaspur-Mandi Road section and Haritalyangar and adjoining areas, Bilaspur district and 180 samples were collected for palynological study.

M.R. Rao

Finalised the results of palynological and sedimentological studies carried out on middle Siwalik sediments exposed along Nandni-Nagrota Road on Jammu-Srinagar Highway. The sequence (about 1600 m thick) is represented by couplets of medium- to coarse-grained, gravely, multistoried sandstone complexes and silty-muddy fine-grained horizons. The fine-grained muddy horizons are divisible into two facies associations— floodplain and interfluvial associations. The floodplain facies association is related to channel processes and is the product of sedimentation on flood plains mainly by vertical accretion. In contrast, the interfluvial association characterised by silt; mud and fine sand units are completely mottled, laterally persistent, highly oxidised and are unrelated to channel processes. Such fine-grained horizons imply sedimentation on Doab areas (interfluvial) lying between the major rivers, and acting as independent domain of sedimentation where deposition took place in higher sloping surfaces, ponds, lakes, low-lying areas and minor channels, creeks and abandoned linear valleys. These fine-grain horizons yielded palynofossils.

Pteridophytic spores, gymnosperm and angiosperm pollen dominate the palynoflora. Spores of the families Cyatheaceae, Schizaeaceae, Parkeriaceae and Polypodiaceae represent pteridophytes.



A view of Gaggar River section (Top of Pinjor Formation) Panchkula, Haryana

Gymnosperm pollen of the family Pinaceae are profusely recorded. Angiosperm pollen though less in number belong to the families Magnoliaceae, Asteraceae and Ctenolophonaceae. Samples representing the older sediments of the studied section are characterised by presence of little *in situ* organic matter (cuticle and woody elements), profuse bisaccate pollen derived from gymnosperm plants growing at higher reaches and also the organic matter. Presence of pollen of plants inhabiting the high elevations and the absence of spore/pollen assemblages representing the local flora coupled with increased thickness of channelised sand bodies may also imply incision of the rivers into their valleys. As a result of this, the flood plains were probably very narrow, regularly flooded and did not allow the growth of local flora. Occurrence of higher and lower elevation pollen elements in same samples indicates that the areas lying at different elevations acted as the provenance for the middle Siwalik sediments. It may also indicate that the Himalayan orogeny was episodic and different lithotectonic units gained heights at different times. The characteristic presence of *Ctenolophon* in the upper level of Middle Siwalik succession (at 1,080 m level) is indicative of a drastic change in the climate, which became more humid during the later phases of sedimentation. This inference is corroborated by the increased thickness of the sand bodies (40-60m) and the frequent occurrence of the gravely horizons in the upper levels of the Middle Siwalik succession implying increased energy in the system.

S.K.M. Tripathi

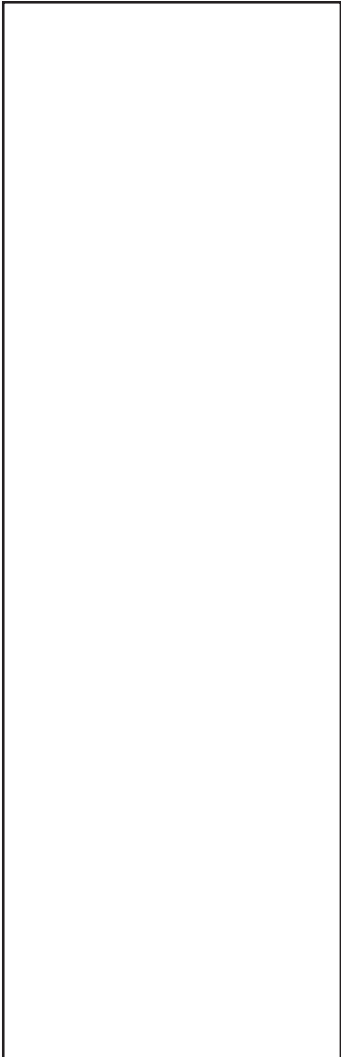
Carried out morphotaxonomical study of the plant fossils from Siwalik sediments of India, Nepal and Bhutan. Photodocumentation of the leaf-impressions collected from Siwalik sequence of Suraikhola (Nepal) has been completed. Leaf fossils belong to extant taxa—*Dipterocarpus alatus*, *Shorea stellata*, *Lagunaria patersonii*, *Ochna integrifolia*, *Sterculia montana*, *S. eusifolia*, *Xylosma japonica*, *Xerospermum glabrata*, *Rouria rugosa* and *Cynometra simplicifolia*. A manuscript about the flora of lower Siwalik sediments of Bilaspur (HP) has been prepared. The plant assemblage consists of 10 taxa

belonging to tropical angiosperm families—Anonaceae, Flacourtiaceae, Clusiaceae, Meliaceae, Dipterocarpaceae, Sabiaceae, Fabaceae, Moraceae and Palmae. Based on habit, habitat and physiognomic characters of the fossils, palaeoclimate of the area has been discussed. A paper on the plant fossils from Siwaliks of Tanakpur (UP) area is also being prepared. Visited Central National Herbarium, Howrah for the identification of plant fossils (leaf, fruit and seed impressions) collected from Siwalik sediments of India and Nepal. About 35 leaf-impressions and two fruits have been identified with extant taxa. The details of herbarium sheets of

the identified species have been noted and photographed. Also collected a variety of plant megafossils from measured outcrop sections of Siwalik sequence of Suraikhola, western Nepal.

M. Prasad

Processed samples from Subansiri Formation of the Likabali-Along Road section (West Siang district) and Kimin Formation of Itanagar-Naharlagun Road section (Papumpare district) of Arunachal Pradesh for palynological study. The assemblage is dominated by reworked Palaeozoic Gondwana palynomorphs, like *Crescentipollenites* sp., *Indotriradites* sp., *Parasaccites* sp., *Platysaccus* sp., *Primuspollenites*



A fossil leaf cf. *Millettia pachycarpa* (Fabaceae) - an evergreen element from Lower Siwalik sediments of Bilaspur area H.P. x 1

sp., *Rhizomaospora* sp., etc. with few Tertiary forms, like *Striatriletes susannae*, *Polypodiaceasporites* sp., *Pinuspollenites* sp., *Abiespollenites* sp., besides some fungal forms, mainly *Frasnacritetrus* sp. The distribution of the families in the assemblage indicates a tropical to subtropical climate during the deposition of the sediments. Presence of reworked Permian palynofossils indicates that the Lower Gondwana sediments were extensively developed in the region and were the source rocks for these younger Tertiary

sediments. Presently, the Permian sediments are well exposed to the north of the studied localities. Field work was undertaken to collect palynological samples from Itanagar-Naharlagun Road section and Likabali-Garu-Along Road section. About 114 rock samples and about 36 fossil woods were collected from in and around Likabali, West Siang district.

G.K. Trivedi

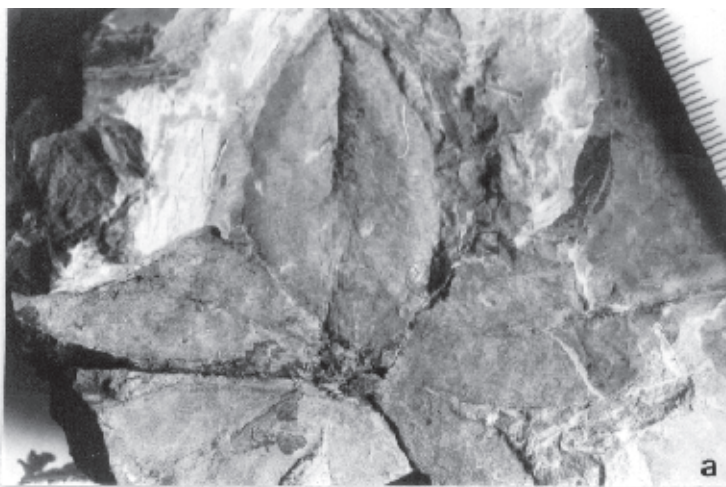
Project 8: Tertiary floristics of peninsular India

Component 1: Tertiary floral diversity in North-East India

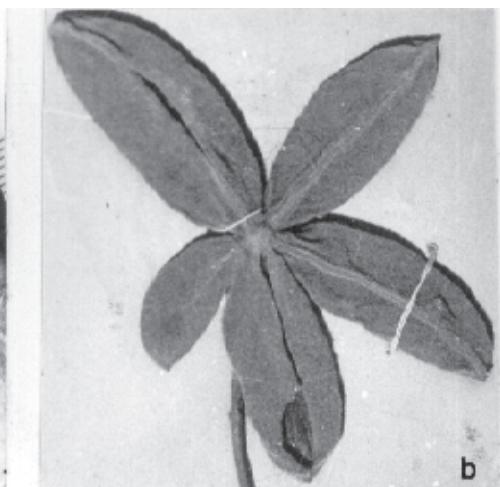
Recorded rich palynofloral assemblages from the Siju and Rewak formations (Middle-Late Eocene) exposed in a stream section at Jenggitchakgre and along Tura-Dalu Road in West Garo Hills (Meghalaya). Dinoflagellate cysts and acritarchs dominate the Siju palynoflora, whereas the Rewak palynoflora is mainly represented by spores-pollen followed by fungal remains and dinoflagellate cysts. Predominant palynotaxa of the assemblage are *Achomosphaera alcicornu*, *A. ramulifera*, *Homotryblium floripes*, *H. tenuispinosum*, *Operculodinium centrocarpum*, *O. major*, *Cordosphaeridium fibrospinosum*, etc. The palynoflora indicates prevalence of tropical (warm-humid) climate and presence of mangrove elements

along the shore. It has been interpreted that the Siju Formation was laid down over the unstable shelf in a shallow sea. The dominance of terrestrial elements and decrease of dinocysts indicates a regressive phase during the sedimentation of the Rewak Formation. The palynoflora have been compared with the Eocene assemblages recorded from various sedimentary basins of India. Representation of *Areoligera undulata*, *Areosphaeridium arcuatum*, *Homotryblium floripes*, *Distatodinium ellipticum*, etc. suggests a Middle Eocene age for the Siju Formation. The overlying Rewak Formation is dated as late Eocene on the basis of palynofossils. Chemical processing of the samples from the Boldamgiri/ Baghmara Formation has also been taken up.

R.K. Saxena & S. Sarkar



Fossil fruit of *Sterculia villosa* from Oligocene sediments of Makum Coalfield, Assam X 1



Modern fruit of *Sterculia villosa* X 1

Studied in detail two fossil fruits collected from the Oligocene sediments of Makum Coalfield (Assam). They belong to *Sterculia* of Sterculiaceae and *Barringtonia* of Lecythidaceae. The plant remains from the Oligocene sediments of Mizoram were also studied and further study is in progress. Study of fossil woods from other Tertiary localities of Assam and Tripura are in progress. Also collected fossil material from the Barail sediments of the Makum Coalfield.

R.C. Mehrotra

Studied various types of dispersed organic matters (DOM) recovered from Bihpuria #1 well (depth 4,494–1,915 m) from North Lakhimpur district (Assam). The biodegraded and amorphous OM contains rich inorganic and organic pyrite framboids at various depth levels. The behaviour and frequency of OM as well as morphology of pyrites (under SEM) are analysed and illustrated. Palynological rock samples were collected from Karim Ganj and Margherita districts, Assam. Macerated about 50 rock samples collected from pit and mine sections of Tirap and Ledo collieries, Makum Coalfield to study palynofossils, DOM and genesis of pyrite framboids over biodegraded plant tissues. The palynoassemblage contains varied Tertiary pollen and rich recycled Permian pollen grains. The pyrite framboids occurred on biodegraded or amorphous OM are densely packed 'raspberry like' aggregates of equigranular micron sized spherules. The selected samples were analysed (with **U. Bajpai & V.K. Singh**) in EDAX analyzer system to determine content of mineral elements (S, Fe, C, O, P, Mg, Mn, Ca, Cu, etc.) in formation of pyrite. The genesis of pyrite exhibit prevalence of euxenic condition during the deposition of the strata of Ledo coal seams.

M. Kumar

Utilised palynological data from Mizoram to analyse deposits of the Miocene age. Keifang sediments are cyclic alternation of light and dark grey



Clusters of pyrite framboids, a biodegraded plant tissue from carbonaceous shale of Tirap Coalfield (Late Oligocene), Margherita District, Assam

shale with interbedded siltstone, sandstone package and minor mudstone. Cyclicity was probably driven by high frequency sea level changes. Light-grey layer containing shallow-water bioclasts was formed when Keifang exported material, whereas the dark grey layers are dominantly pelagic. High stand deposits contain shallow-water components, such as pteridophytes, angiosperms, gymnosperms and epiphytic fungal remains. Whereas, the low stand turbidites are dominated by abraded bioclastics detritus. Palynofloral assemblage consists of 42 genera and 45 species. The qualitative analysis of the assemblage reveals that Polypodiaceae, Lycopodiaceae, Cyathiaceae, Gleicheniaceae, Podocarpaceae, Pinaceae, Palmae, Oleaceae, Malvaceae and Compositae represent warm and humid climate. The common occurrence of diverse types of palynoassemblage in Keifang Formation indicates coastal tropical moist vegetation during Early Miocene. Field work was done in Tertiary localities around Lunglei, Saiha, Aizawl, Tlabung, Kolasib, Lawngtlai, Tuipang and adjacent regions and collected 350 samples for palynological studies.

B.D. Mandaokar

Component 2: Tertiary floristics of peninsular India

Studied and identified a number of woods from the Intertrappeans and Neogene sediments of Gujarat. The woods belong to various genera, viz. *Afzelia-Intsia*, *Bauhinia*, *Cynometra*, *Ficus*, *Sterculia*, etc. Identified some dicot and palm leaf-remains from Eocene of Rajasthan. Also finalised a paper on the Intertrappean woods of Kachchh (with **R. Srivastava**).

J.S. Guleria

Collected and processed lignite samples from exposed section (6-27 m) of mine II of Neyveli lignite field. The palynological assemblage recovered from the samples belongs to 33 genera and 40 species, out of which 23 genera belong to angiosperms, 5 genera (8 species) to pteridophytes and 5 genera belong to fungi. The recorded assemblage attributes Miocene age for the lignite deposits and indicates that the lignite was deposited in a moist tropical forest along with inland elements. Carried out study to understand evolution, palaeogeographic distribution and extinction of the genus *Trilatiporites* (= *Sclerosperma*) with context to Indian sub-continent.

K. Ambwani

Studied rock succession in two sections from Fulra nala (Fulra Limestone Formation, Late-Middle Eocene) of Kachchh Basin. One section has yielded palynofossils. The assemblage mainly contains *Aplanosporites* and dinocysts besides few *Margocolporites*, *Tricolporopilites* and pteridophytic spores. A few palynotaxa comparable to *Tasmanites* and *Tetraploa* have also been recovered. Section of Khari Nadi Formation (Early Miocene) near Kunri village has yielded *Striatriletes*, *Khariasporites*, *Palaeomalvaceapollis*, *Hibisceapollenites*, *Meliapollis* and *Pinuspollenites*. The palynoassemblage compares well with *Striatriletes susannae* zone (Kar, 1985) except dinocysts which are meagre in the present assemblage. A few *Bombacacidites* pollen of smaller size have been recovered from Naredi Formation (Early Eocene). A paper has been finalised highlighting their phytogeographical significance and discussing the

stratigraphic antiquity of the fossil Bombacaceae pollen in India.

J.P. Mandal

Completed the morphotaxonomy and identification of spore-pollen recovered from Parachuri and Vidyamandir well sections, Ratnagiri district (Maharashtra). The palynological assemblages consist of fungal remains (*Phragmothyrites*, *Notothyrites*, *Parmathyrites*, *Kutchiathyrites*, *Ratnagiriathyrites*, *Lirasporis*, *Dicellaesporites*, *Dyadosporonites*, *Multicellaesporites*, *Pluricellaesporites* & *Staphalosporonites*), pteridophytic spores (*Lygodiumsporites*, *Striatriletes*, *Pteridacidites*, *Osmundacidites*, *Cyathidites* and *Polypodiaceasporites*) and angiospermous pollen (*Quilonipollenites*, *Plumbaginacipites*, *Dipterocarpuspollenites*, *Retitrescolpites*, *Lakiapollis*, *Ctenolophonidites*, *Verrutripurites*, *Clavaperiporites* and *Malvacearumpollis*). The palynoflora suggests a warm and humid climate (tropical-subtropical) with plenty of rainfall during the deposition of sediments. The environment of deposition has been interpreted as nearshore with sufficient fresh water or freshwater swamp near by. The *Heliospermopsis* represents the salt glands of mangrove plants.

M.R. Rao

Continued the morphotaxonomic study of palynofossils recovered from Akli Formation, Giral lignite mine, Barmer district (Rajasthan). Dinoflagellate cysts, fungal remains, pteridophytic spores and angiosperm pollen constitutes the assemblage. The flora is distinctly dominated by monosulcate pollen appearing to be related to the family Arecaceae (Palmae). Based on qualitative and quantitative analyses two zones were identified in the studied sequence. The lower zone is characterised by high frequency of dinoflagellate cysts along with low number of pteridophytic spores suggesting the deposition of this part of sediments under shallow marine environment. The upper zone is distinctly dominated by angiosperm pollen having affinity with coastal elements and the palms. Most of the

palynotaxa present in the assemblage shows affinity with plants confined to tropical to subtropical regions. Palynofloral comparison of the present assemblage with those recorded from other Tertiary sediments of Rajasthan, Kutch and Meghalaya indicates Late Palaeocene age.

S.K.M. Tripathi

Analysed Tertiary sediments (Quilon and Warkalli formations) of Kerala for palynomorphs. Angiosperm pollen (48 genera with 68 species) dominates the assemblages followed by pteridophytic spores (27 genera with 32 species). Fungal remains are present in all the assemblages. An analysis of ecological grouping based on their affinities with extant plant shows that fresh water swampy and water edge plant communities dominate over montane, mangrove and other vegetation types. The behaviour of plant communities through rock succession shows that the deposition of sediments took place under transgressive and regressive phases. Following taxa are common to all the assemblages: *Polypodiisporites*, *Lycopodiumsporites*, *Crassoretitriletes*, *Todisporites*, *Iridacidites*, *Striatriletes*, *Cyathidites*, *Quilonipollenites*, *Lakiapollis*, *Ctenolophonidites*, *Retitrescolpites*, *Tricolporopollis*, *Malvacearumpollis*, *Chenopodipollis*, *Ericipites*, *Dipterocarpuspollenites* and *Dermatobrevicolliporites*. The assemblages of Quilon and Warkalli formations do not show much difference in floral

composition and hence the two formations may represent a facies variation. These assemblages are comparable to Miocene assemblage of Assam, Tamil Nadu and Kutch.

R.S. Singh

Carried out investigation on the materials from Ratnagiri, Goa, Kerala, Pondicherry and its adjoining areas. Sectioning and study of 40 carbonised woods from Kerala were done and study is in process. Structural details could be observed in two wood samples. Morphological and SEM investigation of carbonised woods, fruits and cuticles from Ratnagiri are in process. One wood from Kalviwadi, Sindhudurg district (Maharashtra) is tentatively identified with family Sonneratiaceae. Detailed studies were also made on dispersed angiospermous leaf cuticles from Sindhudurg Formation (Miocene) of Ratnagiri district. Photodocumentation, observation, description of the same have been done and affinities discussed. One of the cuticles has revealed a unique kind of stomatal structure not reported so far from any living or fossil plant group. Other cuticles are assignable to dicot families. Two papers have been finalised on these aspects (with **R. Tewari** and **K. Ambwani**). Another paper on fruit (*Amberiocarpon* gen. et sp. nov.) from Amberiwadi village, Sindhudurg district has also been finalised (with **K. Ambwani**).

A. Agarwal

Component 3: Palaeofloristics of sedimentary sequences associated with Deccan Traps

Macerated samples from the Deccan Intertrappean beds, exposed about 3 km. NNE of the village Papro, Lalitpur (UP), to confirm the earlier results. During the process "*paraphyses*" of the fern *Acrostichum* was recovered showing marine influence at the depositional site. Palaeocene marker species are common to the assemblage recovered from this Intertrappean bed. Samples from areas around Naskal, (AP) were also macerated and the palynomorphs are typical to the Maestrichtian assemblage. Recovery of dinoflagellate cysts is significant for palaeoenvironment of this Intertrappean site. A detail study of the assemblages from Naskal is in progress. Also undertook field work

for the collection of Intertrappean rock samples from Andhra Pradesh and Madhya Pradesh

R.S. Singh

Carried out work on dicotyledonous woods from Ghansor, Seoni district (MP). A number of fossil woods were cut, studied and photodocumented. The woods were tentatively identified as *Hydnocarpus* and *Homalium* (Flacourtiaceae), *Grewia* (Tiliaceae), *Elaeocarpus* (Elaeocarpaceae), *?Euphoria* (Sapindaceae) and *?Barringtonia* (Lecythidaceae). A paper dealing with Deccan Intertrappean woods of Kachchh was also finalised (with **J.S. Guleria**).

R. Srivastava

Project 9: Marine micropalaeontology of petroliferous basins

Component 1: Calcareous skeletal algae from the Tertiary sequences of Meghalaya and Kutch basins

Taxonomic study of coralline algae from thin sections of Tertiary (Oligocene and Miocene) limestone samples of Kachchh Basin was carried out. Late Oligocene (Chattian) coralline algae have been recorded from the topmost member (Bermoti Member) of Maniyara Fort Formation exposed in the Bermoti stream in a locality about 0.5 km SE of Bermoti village and also in the stream near village Bernani. The Chattian algal assemblage comprises species of *Lithophyllum* and *Mesophyllum*. Late Lower Miocene (Burdigalian) coralline algae have been recorded from the Chhasara Formation exposed along the Khari Nadi near the village Chhasara. The Burdigalian algal flora is represented only by species of *Corallina*. Interpretation has been made on the role of calcareous algae especially in evaluating palaeoecology and palaeobathymetry. The environment of deposition of Maniyara Fort Formation was marginal marine, littoral to shallow

inner-shelf. Marine transgressive environment shifted from lagoon to medium - high-energy open shelf environment when coral bioherms were formed. Attempts have been made to provide information on the depth distribution of coralline incrusting associations and from the Oligocene of southwestern Kachchh. In addition a conceptual model of medium-energy reef formation has been proposed on the basis of Late Oligocene (Chattian) algal forms. Taxonomic study on the coralline algae from Tertiary (Paleocene) sediments of Meghalaya have also been done on the samples of Lakadong Limestone Member, collected from K.L.M.C Limestone quarry, near Bholaganj (about 0.5 km west of western bank of Um Sohryngkew River). The coralline algal flora comprises species of *Lithoporella*, *Sporolithon*, *Phymatolithon*, *Lithophyllum* and *Mesophyllum*.

A.K. Ghosh

Component 2: Integrated phytoplankton biozonation and palynofacies analysis of Cretaceous-Tertiary sequences of Meghalaya and Kutch with emphasis on bioevents, time boundaries and palaeoenvironment

Dinoflagellate cyst bioevents identified in the upper Cretaceous-Palaeocene succession of the Khasi Hills (Meghalaya) are summarized. Detailed morphotaxonomical studies on some dinoflagellate cysts belonging to *Apectodinium* are carried out. These are characterized by a broader than long cyst lacking apical horn, reduced or absent antapical horns and broad lateral horns. These cysts differ from known *Apectodinium* species in overall shape and horn characteristics and are considered to represent a new species of the genus. LM/SEM investigation of selected samples from the Lakadong Sandstone to study preservational status of dinoflagellate cysts/organic matter in relation to the fluctuating anoxic bottom conditions indicated by *Apectodinium*-rich assemblage is carried out. Evidences of bacterial decay and pyrite-relic structures are noted on the dinocyst walls and terrestrial organic matter.

Palynofacies investigations of the lower part of the Mahadeo Formation (Therriaghat area) revealed significant variations in the vertical distribution of dinocysts and land-derived organic matter (marine/terrestrial component). Stratigraphic levels with high terrestrial component in the basal part of the succession are found to contain dinocysts in moderate/low numbers and reworked Permian palynomorphs. These are interspersed with levels rich in dinocyst assemblages (dominated by chorate cysts). Occurrence of *Xenascus ceratoides* in this assemblage is significant as its LAD indicates Lower/Upper Maastrichtian boundary.

R. Garg, Khawaja-Ateequzaman & V. Prasad

Recorded additional marker nannofossil taxa from the Langpar Formation (Danian) to update age-significant bioevents in the Upper Cretaceous-

Palaeocene succession. Two biozones and three subzones are identified in the upper part of the formation.

R. Garg

Integrated dinoflagellate cyst data with larger foraminifer data from Lakadong Limestone/Sandstone succession of Cherrapunji Plateau and Therriaghat area for precise age determination and palaeoenvironmental interpretations. These evidences are further utilized to understand lateral facies development and relative sea level changes in the Upper Palaeocene succession of the Khasi Hills. *Apectodinium*-rich dinoflagellate cyst assemblages (Late Thanetian Ahy/Aau Biozones) recovered from sediments associated with coal-bearing strata of the Lakadong Sandstone suggest that the deposition of this coal unit was a short-lived event close to the Palaeocene-Eocene boundary. The predominance of *Apectodinium* indicating reduced salinity with anoxic bottom conditions supports estuarine to coastal swamp environment of this coal-bearing sandstone. The studies have established close stratigraphic correspondence between *Apectodinium* Acme (Aau Biozone) and the larger foraminifer *Ranikothalia nuttali-Miscellania miscella* Assemblage (Shallow Benthic Zones SBZ5-SBZ6). Based on this correlation, it is concluded that the coal-bearing Lakadong Sandstone on the Cherrapunji Plateau is the synchronous lateral facies equivalent of the upper part of the Lakadong Limestone of the basal Therriaghat section. The Lakadong Limestone/Sandstone succession represents a progradational sequence developed during sea level highstand in Late Palaeocene times. The Therria Sandstone-Lakadong Limestone/Sandstone sequence of Khasi Hills is interpreted as deposits of the transgressive and highstand system tracts, representing a single depositional sequence between post-Langpar and post-Lakadong sea level falls, corresponding broadly to the 3rd order cycles TA 2.1 – TA 2.3. A paper is finalized on this aspect. Also documented the occurrence of stratigraphically significant dinocyst taxa from the upper part of the Langpar Formation and identified three informal biozones. Vertical distribution of different cyst associations (viz. *Spiniferites* group, *Cordosphaeridium* group,

Glaphyrocysta group and *Senegalinium* group) is recorded for palaeoenvironmental interpretations. Field work in parts of the Khasi and Garo Hills was carried out to study and collect samples from selected Upper Cretaceous–Tertiary sections. 336 samples in all were collected from Weiloi–Mawsynram, Tura–Barrengapara, and Siju–Rewak areas. Detailed sampling was done from thin coal-bearing horizons of Lakadong Sandstone in Jathang and Mahadek–Langpar transition near Lawbah (Mawsynram area). Lower and upper contacts of the Siju Limestone with Tura and Rewak formations have been investigated and sampled in detail in Dilni River and Siju–Rewak area. Significant lateral facies changes in Siju Formation are documented.

R. Garg & Khowaja-Ateequzzaman

Identified successive first appearance of some additional marker dinoflagellate cyst taxa from the Naredi Formation (Kachchh Basin) which are significant for age determination and biozonation. Occurrence of *C. cornuta* / *K. nuda* in the basal part (below the “*Venericardia beaumonti*” Bed) indicates definite Palaeocene age. *M. fimbriatum*, common through out the succession, ranges from Late Thanetian to early Lutetian in age. First appearance of *A. multispinosum*, *G. exuberance*/*G. vicina* above the ‘VB’ Bed suggests early Ypresian age as these species have their FAD at or just above the Palaeocene-Eocene boundary. Three informal biozones are proposed. Also documented dinocysts recovered from the basal part of the Fulra Formation.

Khowaja-Ateequzzaman & R. Garg



Apectodinium paniculatum — dinoflagellate cyst, Lakadong Sandstone, South Shillong Plateau

Component 3: Neogene microfossils from Andaman and Nicobar Islands and their stratigraphical significance

Recorded diatom and silicoflagellate assemblage from the mudstone and chalk beds of the Archipelago Group (Neogene) exposed along North-South Road in Great Nicobar Island. Morphotaxonomic study of this assemblage has been done and its biostratigraphic potential is being assessed. Completed compilation of field data from the Great Nicobar Island. An

annotated synopsis of the geological studies so far carried out in the Andaman and Nicobar Islands is being prepared. It will include bibliographical details and abstracts of papers published on all aspects of geology of the Islands.

A. Chandra & R.K. Saxena

Component 4: Late Mesozoic-Tertiary nannofossils from Andaman and Nicobar Islands and their biostratigraphical implications

Scanning Electron Microscopic documentation from Neill Island (East Coast and Nipple Hill section) is carried out. The assemblage contains reworked Cretaceous and Palaeogene nannofossils. The assemblage belongs to *Discoaster bergrenii* Zone (CN 9A) of Okada and Bukry and the lower part of

the *Discoaster quinqueramus* Zone (NN-11) of Martini of Late Miocene age. A manuscript entitled "Late Miocene endoskeletal dinoflagellates from Sawai Bay Formation, Neill Island, Andaman sea, India" is revised as per referee's suggestions.

J. Rai

Thrust Area: Quaternary Vegetation, Climate and Monsoon

Project 10: Quaternary vegetation and palaeoenvironment

Component 1: Palaeovegetation and Palaeoclimate studies of Quaternary sediments from Himalayas

Prepared data sets of all the investigated profiles from Himalaya for construction of global maps of biomes 6,000 and 18,000 yr. BP in consultation with Dr. Sutra and Professor Sandy Harrison of Germany.

C. Sharma

Completed pollen analysis of profile SRT-I (2 m thick) from Saria Tal, Kumaun Himalaya and constructed pollen diagram. Study has unveiled palaeovegetation and corresponding climate of the temperate zone of the region since Middle Holocene. Around 4,950 yr. BP area had predominance of nonarboreals with pine forest. *Quercus* encountered rarely but showed gradual increase onwards, indicating ameliorating trend of climate. At the onset of Late Holocene *Quercus* acquired marked

enhancement with corresponding fall in nonarboreals, resulted establishment of mixed oak forest with change in climate towards more warm and humid conditions but the frequency of mixed oak forest did not remain constant and faced phases of depression and expansion, indicating fluctuating climatic conditions during Late Holocene. Also carried out palaeontological investigation of lacustrine sediments from Saria Tal and prepared 2 figures which show specific distribution of Molluscs, supporting the results of pollen analytical investigations. Undertaken geochemical analysis of sedimentary profile ST (3.5 m deep) from Sukha Tal and prepared a figure which shows inverse relation in total organic matter (TOM) with total carbonate contents (TCC) throughout the sequence. About

lower half part of profile contains fluctuating high TOM and low TCC, indicating existence of wet climate at the region. The subsequent half part shows considerably low TOM and abruptly high TCC, reflecting change in climate towards dry conditions. The top of profile again contains high TOM and low

TCC, showing restoration of earlier conditions. Also carried out chemical processing of profile ST from Sukha Tal. Prepared two manuscripts on the above aspects.

A. Gupta

Component 2: Origin and history of tropical forests in peninsular India

Carried out the pollen analytical studies of a 1.5 m deep sediment profile (12210 ±110 yr. BP at 80 cm level) from Aki forest Division in Mikir hills (Assam). The study predicts that in the last 15,000 yrs. there have been four stages of vegetation developments reflecting directly on brief phases of climate such as very arid, arid, semi arid, warm and humid. The abundance of grasses both cultivated as well as wild throughout the pollen diagram has revealed the existence of an open *savannah* forest. The arboreal vegetation is poor and represented by a few scattered tropical trees and shrubs. Both monolete as well as trilete ferns are well documented in the assemblage. Some degraded pollen and spores along with fungal spores and hyphae are also found in the sediment. The low occurrence of few extra regional plant taxa like *Pinus*, *Picea*, *Abies*, *Larix*, *Betula* and *Alnus* are indicative of long distance transportation of pollen from high elevation.

S.K. Bera

Completed pollen analytical investigation of 1.5 m deep sediment core from Barkullah Swamp, Shahdol district (M.P.) and prepared pollen diagram. Three phases of vegetation development have been recognized in the region since prior to 3,000 yrs. BP— i) Phase I- indicates existence of the open tropical deciduous forests composed of a few trees of *Madhuca indica*, *Terminalia*, *Lagerstroemia*, *Emblia officinalis*, etc. in warm and less moist climatic condition, ii) Phase II- indicates that mixed deciduous forests became dense and diversified due to immigration of *Shorea robusta* (sal) as well as increase in the frequencies of *Madhuca indica*, *Lagerstroemia*, *Adina cordifolia* and *Holoptelea* in response to amelioration of climate which probably turned warm and moist, and iii) Phase III- is marked

by the establishment of modern sal forests as evidenced from the expansion of *Shorea robusta* together with its associates, such as *Madhuca indica*, *Terminalia*, *Holoptelea*, etc. This significant change in the floristic pattern reflects the prevalence of moist climate in the region.

Pollen analysis of 5 surface samples was carried out from Dongar-Sarbar, Shahdol district to study modern pollen/vegetation relationship in the region. Among the recovered arboreal taxa, *Madhuca indica* and *Shorea robusta* are somewhat better represented, whereas *Emblia officinalis*, *Terminalia*, *Lagerstroemia*, *Buchanania*, etc. are recorded sporadically. The poor representation of most of the tree taxa could be inferred to their entomophilous mode of pollination as well as poor preservation of pollen in the sediments. On the other hand, the good representation of herbaceous taxa, viz., grasses, sedges, Chenopodiaceae/Amaranthaceae and Tubuliflorae exhibits a close coherence with their actual composition in the ground flora. Pollen analysis was done 10 samples from a 1.5 m deep core in Dongar-Sarbar area. The pollen assemblage obtained has shown the presence of tropical deciduous sal forests in the region. The analysis of the remaining samples is in progress. Finalised a paper entitled "Pollen record of vegetation and climatic changes in northeastern Madhya Pradesh during last 1,600 years".

M.S. Chauhan

Studied two sedimentary soil profiles from Adyar estuary. The geochemical data reveals the input of toxic concentration of heavy metals, especially arsenic (50 - 100 µg/g), lead (400 - 1000 µg/g) and copper (80 - 400 µg/g) in surface soil as well as in profiles. Most of the arsenic in soil is water-soluble.

Accumulation of these in plants was also analysed. The palynostratigraphical records show occurrence of mangrove forest during Early Holocene in the estuary that declined during Late Holocene. The anthropogenic pressure from Chennai city is fast deteriorating the aesthetic value of the estuary. Palynostratigraphical studies from Kolleru Lake (AP) indicates the shrinking of lake in the present day due

to pressure of aquaculture and pisciculture practiced in large scale decreasing the biodiversity in the area. Preliminary analysis shows high concentration of heavy metals (arsenic, lead, and copper) in surface soil and sedimentary soil profile studied from Pichavaram (TN). High concentration of these was observed in the leaves of mangroves.

A. Farooqui

Component 3: Studies of lake sediments in Rajasthan desert proxy climate signals

Carried out LM and SEM studies of palyno taxa of families Malvaceae, Capparidaceae and Sterculiaceae collected from Rajasthan in order to facilitate the specific identification of the recovered fossil pollen and to ascertain the affinities of the genera and species to determine possible evolutionary trends in these families. Completed the pollen analytical investigations of 1.40 m deep sedimentary profile from Pachpadra, an extinct salt lake in Barmer district. The pollen diagram has been divided into three zones; each prefixed by the abbreviations PP, signifying the investigated site. Pollen zone PP-I (125-140 cm) is palynologically barren and is mainly comprised of sandy material with very little clay. PP-II (70-125 cm) reflects poor occurrence of Poaceae, Cyperaceae, Tubulifloreae, etc. comprising sandy surface and with little clay. Pollen zone PP-III (0-70 cm) revealed good frequency of palyno-taxa, viz.

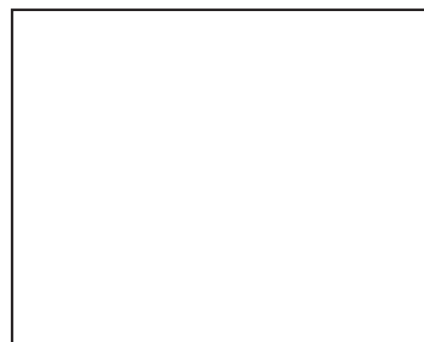
Poaceae, Cyperaceae, Tubulifloreae, Brassicaceae, Convolvulaceae, *Portulaca sp.*, *Solanum xanthocarpum* amongst non-arboreal and *Mimosa sp.*, *Syzygium sp.*, *Holoptelea*, *Ephedra sp.*, etc. of arboreal. Pollen of *Pinus roxburghii*, transported to the site has also been recorded. Pollen of *Dendrophloe falcata*, the epiphyte Loranthaceae has also been recovered. Completed pollen analytical investigation of 4.00 m deep sedimentary profile from Bagundi, another extinct salt lake, situated 30 km from Pachpadra town towards Barmer. Studies have revealed the dominance of non-arboreal over arboreal as witnessed in Pachpadra profile. Most of the samples turned out non-productive, except for the upper part (0-90 cm) with blackish clay sediment. Finalized manuscript based on the studies of surface samples from Bagundi.

C. Sharma & C. Srivastava

Component 4: Palaeomangroves and palaeoclimate in Andaman and Nicobar Islands during Quaternary Period

Pollen analysis in ten samples (nos. 11-20) of Quaternary section (BS-1595; 36,550 ±870 yr. BP) from R.K. Puram, Little Andaman was done. The palynodebris exhibited poor assemblage of pollen grains, fungal spores, fern spores, microforaminifera, etc. The pollen of Poaceae, Urticaceae, Acanthaceae, Fabaceae, Asteraceae, Cyperaceae, Oleaceae along with mangrove constituents (*Rhizophora*, *Excoecaria*, *Heritiera*) have been encountered in varying frequencies. Trilete and monolet fern spores were found in great abundance in some of the samples. Reworked striate, disaccate pollen of older horizons were also encountered.

A. Khandelwal



Pollen of *Holoptelea integrifolia* X 1000

Component 5: Aerobiology in relation to pollen production, dispersal and preservation of pollen grains

Detailed information of 28 plant taxa was collected for an atlas of air borne pollen grains of Lucknow plants and their allergenic significance. It includes data on their name, local identity, family, distribution, habit and habitat, flowering period, pollen incidence in the air of Lucknow and other parts of country, duration, peak and percentage in annual pollen calendar, pollen morphology and allergenic significance. The recorded taxa are *Ailanthus excelsa*, *Amaranthus spinosus*, *Argemone mexicana*, *Albizzia procera*, *Azadirachta indica*, *Crataeva religiosa*,

Cannabis sativa, *Cassia fistula*, *Cynodon dactylon*, *Chenopodium album*, *Dactylactenium aegyptium*, *Delonix regia*, *Eragrostis tenella*, *Eucalyptus citriodora*, *Emblica officinalis*, *Grevillea robusta*, *Holoptelea integrifolia*, *Kigelia pinnata*, *Moringa oleifera*, *Morus alba*, *Parthenium hysterophorus*, *Pithecolobium dulce*, *Prosopis juliflora*, *Putranjiva roxburghii*, *Polyalthia longifolia*, *Ricinus communis*, *Salmalia malabarica* and *Terminalia arjuna*. The work is in progress.

A. Khandelwal

Component 6: Vegetational history and climate during Quaternary in Antarctica

Pollen analyses of the samples from Priyadarshini lake collected by Dr. Rajiv Sinha, IIT, Kanpur (50 cm deep profile-II) and Dr. D.K. Upreti, NBRI, Lucknow (surface samples) was carried out. The studies have unraveled Early Holocene vegetation scenario. The studies corroborate more or less with the earlier investigated profile (profile-I) from the lake. There is overall dominance of nonarboreal taxa over arboreal. The arboreal pollen, viz. *Larix*, *Pinus*, *Podocarpus*, *Betula*, Myrtaceae, Oleaceae, etc., have the origin in far off subtropical and temperate regions and have been transported thousands of kilometers through upthermic winds, whereas the nonarboreals include mostly grasses and Caryophyllaceae having local origin representing very few taxa growing in Antarctica. *Cosmarium*, the most dominant alga besides other algal and fungal remains too are present in most of the samples. The analytical work carried out on surface samples from Antarctica is finalised and a manuscript is completed. The study (by **Bera**) of air samples over southern ocean records the low occurrence of pollen/

spore and insect scale, wings, plant fragments, algal and fungal filaments indicating the long distance distribution of microbiota in the air.

C. Sharma & S.K. Bera

Visited IIT, Kanpur to procure Gravity Corer (HYDROBIOS) and to discuss (with Dr. Sinha) about the drilling methods in remote lake sites in Antarctica. Completed the detail work done during 19th Expedition. Visited NCAOR, Goa under 20th Expedition programme and engaged in the arrangement of equipment, chemicals and other items for setting a laboratory at Antarctica. Procured a large number of palynological samples including moss turfs, frozen soil, dry algal mat, moraine, lake water,

Thick iceshelf, Indian Bay

snow and blue ice from different lake sites, valleys, nunataks and Polar ice bed in and around Schirmacher oasis of East Antarctica. Recovered one lake sediment profile from 'Long Lake' (70°45'20" S & 11°4' E), 3 km west of Priyadarshini Lake during 20th Expedition. Daily air sampling was done by exposing glycerin

smear slides using Burkard air sampler starting from 40°S of Capetown (South Africa) to Antarctica over Southern Ocean and on return voyage from Antarctica to Capetown respectively. A manuscript is also finalised on this study (with A. Khandelwal).

S.K. Bera

Project 11: Archaeobotany and dendrochronology

Component 1: Ancient plant economy of pre- and proto-historic sites in northern and western India

Continued study on the botanical remains from the non-agrarian Mesolithic site of Early Holocene times in Pratapgarh district (UP). In earlier examined material, damage caused by water-sieving, however, appeared to be considerable in the form of cracking on the surface of highly fragile grains and seeds, fortuitously preserved in carbonised state. In the current approach, retrieval of some exceedingly carbonised seeds and fruits by scooping them from the mudclods of Mesolithic habitation deposits was an scrupulous task, but some poorly preserved specimens are recovered in intact form. The species of *Rumex*, *Dactyloctenium*, *Setaria* and *Desmodium* were of similar kinds as reported earlier. A few grains of bristlegrass (*Setaria* cf. *verticillata*) and a small piece of rachilla of rice, however, made new additions. A broken piece of rice grain with a small part of husk attached, provided certain conformity with domesticated form of *Oryza sativa*. A few small pieces of wood charcoals, on being sectioned and studied, were found belonging to those of *Ziziphus* sp., *Bambusa* sp., *Butea monosperma* and *Capparis sepiaria/horrida*.

(UP), was carried out. From a wide range of cultural deposits dated from about 1800 to 800 BC, crop remains homologies with the certain grains and seeds. Remains of some weeds and other wild taxa in highly mutilated condition were also encountered in association of the crop assemblage. Study of large number of wood charcoals revealed the presence of trees and shrubs of mahua, khair/babul, salai, palash, dhera, anwala, heens/jhiri, dahia, gular, chebulic or harra, bamboo, etc. Further studies are in progress. An affluent annexation was also made in the plant economy of ancient Imlidih-Khurd in Gorakhpur District, already worked out during 1998-99. Voluminous quantities of ashy contents containing enormous, minute bits of carbonised material, recovered during excavation, were repeatedly analysed. An embrasive search led to the explicit identification of a large number of seeds and fruits.

The find of lichen (*Everniastrum cirrhatum*), from the cultural stratum datable between 1300 and 800 BC is to be reckoned with for its use as an ingredient of spices and medicine. Vernacularly known as 'Chharila', occurs on the bark of trees in the temperate forests of Himalayas, at the elevations of 1000-4000 m. the use of 'Putranjeeva' (*Drypetes roxburghii*) nuts is also evidenced highly alluring one, in the cultural lexicon. A few nuts with holes made across them suggest to had been strung up in a necklace. It is a unique evidence of a definite aspect of human philosophical thought and activity, during 1300-800 BC at Imlidih-Khurd. The opulent data generated would lend a hand in the reconstruction of ecological surroundings of this settlement, during 1700-800 BC Not surprisingly, many plants recorded

Study of botanical remains recovered through the archaeological excavation at an ancient mound in the village Malhar, situated on the bank of Karamnasa River, Chandauli district



'Putranjeeva' (*Drypetes roxburghii*) with holes made across them from Imlidih-Khurd, Gorakhpur (Ca 1300-800 B.C.) strung up in a necklace form (scale in mm)

do have economic uses and may be regarded to have been manipulated for varied purposes by ancients. A field work was undertaken to an ancient site in a village Ojyana, Bhilwara district, Rajasthan, where Rajasthan circle of Archaeological Survey of India carried out a systematic excavation to delve into an indigenous, less known and lesser studied 'Ahar Culture' of Mewar region, flourishing during third and second millennia BC. A large amount of carbonised material was collected, from a wide range of cultural deposits at the site.

K.S. Saraswat

Carried out investigation on a rich collection of botanical remains retrieved through archaeological excavations at an ancient mound in Charda-Jamoga village, district Bahraich (UP). The remains of seeds and fruits, from a wide range of cultural deposits, datable from about 800/700 BC to 1100 AD, reflect an advanced state of agricultural economy. The finds

include the remains of field-crops belonging to barley, rice, bread-wheat, dwarf-wheat, ragi/ African millet, Kodon, pigeon-pea, chick-pea, khesari/ grass-pea, lentil, field-pea, aconite bean, cow-pea, black gram, green gram, kulthi/ horse-gram, linseed, sesame, and cotton. A seed of watermelon (*Citrullus lanatus*) is also important to suggest its cultivation for its fruits. Stones and fruits of jujube (*Ziziphus* sp.) and the seeds of silk-cotton tree (*Salmlia malabarica*) and the herbaceous species of *Crotolaria*, have also been encountered. Associated finds of weeds and other wild taxa have been identified. A field work to the ancient site at Pirvitani Sariff in village Trilokpur, district Sravasti, U.P. was made for the collection of archaeobotanical remains through excavations, being conducted by the Department of Ancient Indian History and Archaeology, Lucknow University, Lucknow.

C. Srivastava

Component 2: Tree ring analysis for reconstruction of Quaternary environment

Cross-dated the tree-core samples of *Abies spectabilis* from Rargari, and Bugdyar in Munsiyari, Pithoragarh. The ring-widths of dated samples were measured and chronologies prepared. The chronology from Bugdyar (prepared from 24 tree-core) extends from AD 1778-1998, however the chronology from Rargari (22 tree-core) extends from AD 1721-1998. The chronology statistics such as mean sensitivity inter-correlation between tree samples indicate that the tree growth is moderately sensitive to climatic variations. The detailed tree-growth/climate relationship study is being worked out.

R.R. Yadav

Analysed teak (*Tectona grandis*) core samples from 23 trees and 13 discs from Parambicum Forest Division, Kerala. Tree-cores were mounted and polished for the analysis. Tree rings were counted through Skeleton Plot technique. Number of ring range from 31 to 246 years. Several tree-cores of *Pinus gerardiana* from Kinnaur, Himachal Pradesh were also analysed. Tree rings have been counted. Number of rings range from 72 to 579. Samples are found to have a large number of missing rings, which are identified and dated through 'cross dating' technique.

A. Bhattacharyya

Project 13: Geochronometry and Isotope studies

Component 1: Radiocarbon dating of deposits relating to Quaternary Period and archaeobotanical investigations and chemical analysis of sediments for palaeoenvironmental interpretations

A total of 160 samples were processed in the Radiocarbon Lab during the year, of these 152 were dated. The routine dating has been continued using Quantulus Liquid Scintillation Counter. The spectral quench parameter measured using the internal standard of the Quantulus system is being used regularly to correct counting efficiency due to self quenching while calculating results. The motor unit for vertical movement of the sample in the counting chamber in the Quantulus became defective. This part was procured and replaced at the end of November, but the counting of samples was continued using the less sensitive Rackbeta unit. Dating of high counting samples is being carried out using Rackbeta system. Efficiency correction for counting due to self-quenching has also been carried out in the same manner as in Quantulus system. Nine different kinds of samples (carbonates, cellulose, barley, etc.) were dated as a part of 4th International Radiocarbon inter-comparison measurements conducted by University of Glasgow (UK). The results agree very well with measurements carried out at 83 laboratories world over.

A peat sample (depth at 80 cm) from Kukrail was dated for reconstruction of climate and vegetation history around Lucknow. The age at was found to be 100 ± 90 Yr. BP showing a high sedimentation rate. Deeper samples are needed to infer the past vegetation changes. Organic mud samples from Jarbokho (at 90 cm), Sidhi District and Barkullah (at 25 cm), Sahdol District were dated (Jarbokho- 1360 ± 90 YBP, Barkullah- 3020 ± 90 YBP) for chronological reconstruction of vegetation and climate in different regions of MP. Organic mud samples (130-150 cm) from Dongar Sarbar, Sahdol District were dated (9470 ± 130 YBP) to reconstruct the temporal and spatial distribution of tropical deciduous forest in central India. Silty clay samples (at 4.0 m) from Dokriani Bamak Glacier, Uttarkashi were dated (9050 ± 40 YBP) for the reconstruction of climatic changes

around that region and to link glacial fluctuations in relation to ^{14}C dates. Carbonaceous sediment samples from Bhojbas, Gangotri was also dated to understand the climatic changes vis-à-vis glacial fluctuations. The sample at 0.50-0.54 m depth in the profile dates to 5990 ± 120 YBP and the one at 1.20-1.24 m depth dates to 8730 ± 170 YBP. Interpretation of glacial fluctuations on the basis of the palynological, chemical and age data are being finalised. Carbonaceous samples from Sukha Tal, Nainital were dated to reconstruct the palaeovegetation and climate of the area. The age at depth 230-235 cm works out to 8260 ± 170 YBP and at depth 335-340 cm it is 3790 ± 110 YBP.

One Carbonaceous sediment sample (at 28.96 m) from Mansar Lake, J&K was dated (8530 ± 130 YBP) for reconstruction of environment change with time of that region. Carbonaceous clay samples from Humayun's Tomb, New Delhi was also dated. Dating of carbonaceous samples (at 1.0 m depth) from Sulurpet (AP) was undertaken to infer the chronology of Holocene sea level and climatic changes, the age is found to be 2310 ± 140 YBP. Peat samples (at 3.0 m) from Kasredinilam, Sulurpet was also dated (4800 ± 180 YBP) to study the neotectonic movement in the area and the data are being correlated with Pulicat Lake and other East Coast regions. Peats (141-145 cm) from Adyar, Chennai was also dated (16680 ± 280 YBP) to derive the history of mangrove vegetation during Late Quaternary. Peats (1.25-1.35 m) from Siro, Arunachal Pradesh was dated ($>40,000$ YBP) to study the climatic changes in eastern Himalayas. Carbonaceous samples (at 21-60 cm depth) from Zub Lake, East Antarctica were dated (1310 ± 140 YBP) to understand the past climate of the region. Charcoal sample (at depth 2.75 m) from Dadupur, Lucknow was dated (3380 ± 160 YBP) to understand the ancient plant economy from Pre-historic and proto-historic sites.

G. Rajagopalan

Project 15: Special Activity

Component 1: Floristics and phytogeography of tropical and subtropical forests

Studied the diagnostic morphological characters of angiospermous pollen taxa under SEM in relation to LM. The morphographical characters were noted to supplement the preparation of pollen atlas. Further, a detailed SEM study of pollen taxa *Psudophoenix vinifer*, *Phoenix sylvestris*, *P. tomentosa* and *Plectocomia engleri* belonging to Arecaceae was carried out. It was found that the monosulcate pollen grains of *Psudophoenix* resemble with the fossil pollen grains of *Quilonipollenites*. Also visited Central National Herbarium, Howrah for the detailed study of pollen type specimens.

K. Ambwani

Carried out studies on the flora of Sidhi District, MP. The vegetation of the district is predominantly dry deciduous, with Teak forest, covering much of the area in the north and the northwest of Kaimur hills and Kehanjua hills. The hilly moist localities to the central and south and the other scattered localised

patches with more precipitation or having more humid condition possess moist deciduous vegetation with Sal forests. The vegetation of this area comprises of tree, shrubs and herbs. The trees, shrubs and woody climbers are perennial. Almost all the herbaceous plants are seasonal. Thus, the vegetation of the district may be studied under two categories— i) permanent vegetation, and ii) seasonal vegetation. Floristic survey of south Sahdol Forest Division was undertaken and plant specimens (800), polleniferous materials (300 samples), wood blocks (10), and fruits and seeds (200 samples) were collected. Ethnobotanical survey of Gond and Bagia tribal areas was carried out and documentation of various uses of about 100 plants was completed. Samples of 60 medicinal plants were also collected. Processing of collected plant materials is being done. SEM photograph of nuts of different species of genus *Fimbristylis* (Cyperaceae) was taken to study detail morphology (with **K. Ambwani**).

D.C. Saini

Contribution other than Project Work

Finalised a chapter on *Permian Ferns in India* for book 'Gondwana Alive' to be published from South Africa.

S. Chandra & K.J. Singh

Finalised a chapter on *Lycopod Galore* for book 'Gondwana Alive' to be published from South Africa. Also compiled the distribution pattern of megaspores in different horizons of India during Permian. In spite of their plentiful occurrence, the megaspores show inconsistent stratigraphic distribution pattern. Their number is low in Talchir, increases in Karharbari and Barakar, and decreases in Barren Measures and Raniganj formations. The megaspores of Talchir Formation are usually simple in structure with a smooth (laevigate) escosporium and unpitted mesosporium. However, structural complexity increases in the overlying Karharbari and Barkar formations from where all the three kinds the azonate, zonate and gulate megaspores are reported. The azonate exhibit a variety of ornamentations. The zonate and gulate megaspores are absent from Barren Measures and Raniganj formations. Exosporium in these formations too, exhibits only few variations.

R. Tewari

Analysed the subsurface material received from the Coal Wing, Geological Survey of India from Tatapani-Ramkola and Singrauli coalfields. During a field trip (along with **Vijaya**) to Singrauli Coalfield subsurface as well as outcrop samples were collected from Mahuli block.

A. Tripathi

Compiled data to establish the phytostatigraphical succession in the *Glossopteris* flora of India. Fragmentary remains of plants and spore-pollen have been reported from the beds directly overlying the glacial boulder bed. The earliest known plant fossils are gymnosperms and are represented by the species of *Gangamopteris* and *Pantophyllum*. The palynological assemblage from this level is predominated by monosaccate pollens. The succeeding assemblage shows an increase in number of *Glossopteris* sp., and the first

appearance of definite pteridophytes in the flora. Oldest Gondwana coals were laid down at this level. The next zone is a true *Glossopteris* dominated assemblage, the palynological assemblage reflecting a marked increase in the percentage of disaccate-striate pollen. It is followed by a very poor assemblage, which, however, is rich in *Densipollenites* pollen. The younger assemblages are richest in variety and number of pteridophytes and gymnosperms, which reflects both in macro- and micro-flora.

U. Bajpai

Studied the nature of sedimentary organic matter from Suket Shale Formation (850-900 Ma), Vindhyan Supergroup exposed in Mandsaur district (MP) under LM and SEM. It shows the prominence of structured and grey amorphous types of organic matter. Two types of framboids are seen, one with smooth surface and other with spinules. The framboids are syngenetic in origin. The presence of framboids suggests the prevalence of euxinic conditions during the deposition of Suket Shales. The organic matter is highly mature and seems to have released certain types of hydrocarbons during successive stages of diagenesis.

M. Shukla, U. Bajpai, M. Kumar, G.P. Srivastava & Anand-Prakash

Finalised a paper entitled "Biostratigraphy and palaeoecology of Lower Permian sediments of West Bokaro Coalfield, Bihar, India".

R. Saxena

Prepared a paper entitled "Sedimentary organic matter characterisation from intermontane Karewa Basin of Kashmir valley". The study has shown the evidences of forest fire/bacterial degradation in the Kashmir lignites.

R. Saxena, O.S. Sarate & Anand-Prakash

Checked literature and prepared reference cards for a catalogue of Indian Tertiary plant megafossils published during 1989-2001 to update the earlier catalogue (Srivastava, 1991).

R. Srivastava & J.S. Guleria

Prepared a paper entitled "Morphotaxonomical study on fossil leaves of *Ficus* from Late Holocene sediments of Sirmur District, H.P., India" (with M.P. Sah).

M. Prasad & M.S. Chauhan

Started work on a monograph including study of all the fungal remains known so far from the Indian sediments. This will include morphotaxonomic restudy of fungal taxa, their reallocation, wherever necessary, proposal of new genera and species, comments on their extant relationship, keys for identification of various genera of fungal spores and fruit bodies, etc. The taxonomic part will consist of original diagnosis and taxonomic and nomenclatural synonyms of each genus and species; and holotype, type locality, horizon and age, Indian records (with all relevant details) and present status of each taxon and type. The detailed account of each taxon will be accompanied by suitable illustrations.

R.K. Saxena & S.K.M. Tripathi

Worked on a catalogue, including all records of spores and pollen from the Indian Tertiary sediments published from 1989 to 2000. This will update the earlier catalogue on Indian Tertiary spores and pollen (Saxena, 1991).

R.K. Saxena & G.K. Trivedi

Listed all known pteridophytic spore taxa with their Indian geographic occurrence and stratigraphic range to review and synthesis present state of knowledge of some selected spores from the Indian Tertiary sediments in connection with the preparation of an atlas. 35 taxa have been selected for critical evaluation at species level.

J.P. Mandal & S. Sarkar

Evaluated critically the palynological record of angiosperms published from Indian Tertiary sediments for identifying phytogeoprovinces and their development in time and space. Attempts have been made to find out the extant analogue of the fossil forms for better understanding of the development processes and evolutionary significance of different forest types. A manuscript on this aspect has been prepared.

S. Sarkar

Carried out taxonomic study of coralline algae from Middle Pliocene sequence of Car Nicobar Island. Altogether 21 limestone samples (126 slides) have been analysed and amongst these 10 samples (60 slides) are productive. The assemblage comprises species of *Sporolithon*, *Lithothamnion*, *Mesophyllum*, *Lithophyllum*, *Hydrolithon*, *Amphiroa*, *Corallina* and *Arthrocardia*. Further study and interpretation are in progress.

A. Chandra, R.K. Saxena & A.K. Ghosh

Studied dispersed organic matters (DOM) in Neogene-Pleistocene sediments of site- 218 of the DSDP Leg 22, Bengal Fan Indian Ocean to assess depositional characteristics and sedimentary environment. The lower part of the core represents rich biodegraded terrestrial OM, while upper part exhibit rich structured terrestrial types and black debris. Spores and pollen grains are few. Some recycled Mesozoic palynotaxa have also been recorded throughout the sequence. The behaviour pattern of OM indicates gradual replacing of reducing condition from base to oxidizing condition towards upper part of the sequence.

M. Kumar, A. Chandra & R.K. Saxena

Compiled stratigraphic records of dinoflagellate cysts reported from the Indian Mesozoic-Cenozoic sedimentary sequences (post 1989 period) to update the existing computer database to prepare a revised version of the earlier Catalogue on the Indian Dinoflagellate Cysts (Khowaja-Ateequzaman, 1991).

Khowaja-Ateequzaman & R. Garg

Updated the draft of a proposed DST sponsored collaborative project (BSIP & NIO) entitled "Geochemical and palynological investigation to decipher variations in the intensity of oxygen minimum along western margin of India during Late-Quaternary" to incorporate studies on pollen, dinoflagellate cysts and marine palynomorphs (organic remains of marine zooplankton) emphasising their significance in palaeoclimate related studies on the Arabian Sea sediments.

G. Rajagoplan, C. Sharma, R. Garg & Khowaja-Ateequzaman

Carried out LM and SEM documentation of nannofossil assemblage from the basal most level of Jara Dome section, Kachchh. The assemblage contains marker *Ansulphaera helvetica*, *Stephanolithion bigotii*, *S.hexum*, *S.speciosum*, *Watznaeuria manivitae* along with other Jurassic nannoflora. The assemblage is assignable to NJ 12a *A.helvetica* zone. A manuscript on the aspect is prepared. Another manuscript entitled “An overview of nannofossil records of India” has been completed.

J. Rai

Prepared the project proposal entitled “Forensic palynology - A new research frontier for BSIP”.

C. Sharma & M.S. Chauhan

Finalised two papers entitled ‘Biodeterioration: An aerobiological approach’ and ‘Aeromycological studies in relation to biodeterioration of cultural properties’.

Discussion and interaction were made with Prof. Sandy Harrison and other members of INDSUBIO in documentation of pollen and plant macrofossil data sets for 6,000 and 18,000 yr. BP during Workshop held in Germany. Also helped in construction of global maps of biomes using a standard objective biomesation technique based on plant functional types (PFT). Also prepared Lucknow pollen data set of 48 surface samples (mud, soil, water and moss-cushions) collected from different parts of city and adjoining areas on the basis of recognised plant functional types for inclusion in BIOME 6000.

A. Khandelwal

Continued work from the garden plot area laid around historical site Humayun’s Tomb, New Delhi to have a know-how of the gardening activities during Mughal times. Pollen analytical investigations of soil samples (2.70 & 2.00 m deep profiles) have been completed. Three samples from trench-I, measuring 260-270 cm, 160-170 cm and 80-100 cm, have been ^{14}C dated to 7970 ± 220 Yrs. B.P., 2120 ± 200 Yrs. B.P. and 1670 ± 170 Yrs. B.P. respectively. Samples in the upper horizon only seem to date close to Mughal period. The palynomorphs recovered are very low in frequency. However, productivity in organic content is very high. Large number of wood charcoals and cuticle pieces,

fragments of conifer woody tissues showing cross-field pit areas have also been recorded.

The study has recorded the sporadic occurrence of non-arboreal pollen grains belonging to Poaceae, Cyperaceae, Brassicaceae, Tubulifloreae (Asteraceae), Acanthaceae, Chen/Ams and fungal spores of *Ascospores*, *Nigrospores*, *Tiliospores*, *Helminthosporium* etc. indicating open type of vegetation. Besides, the frequent encounter of large-sized *Cerealia* type of pollen along with other culture pollen taxa such as *Plantago*, Brassicaceae, Chen/Ams and charcoal pieces in good number through out the sequence implies that the area was under agricultural practices. Pollen of Asteraceae in appreciable number are of particular significance to suggest that this area was being used as pasture land by the local inhabitants through early time. *Cedrus deodara* pollen denotes its transportation from Himalayan region. The fragmentary gymnosperm woody tissues showing the cross-field pits of Pinoid, Piceoid and Taxodioid types, suggest the economic use of soft-woods made available from Himalayan forests. Fern spores, leaf cuticle showing stomata, Concentricystis and Acritarchs, etc. have also been scantily found.

C. Srivastava

Submitted two revised write-ups— i) Radio ke liye lekhan, and ii) Saakshatkar, to Indian Science Communication Society, Lucknow for the Distance Education Course on Science Journalism under NCSTC/DST programme, initiated during the Workshop held at BSIP (in 1998).

C.M. Nautiyal

Finalised the data on interpretation of climatic changes around Surinsar Lake (Jammu) based on elemental analysis, ^{14}C dating of sediment samples and palynological study. Interpretation of glacial fluctuations on the basis of the palynological, chemical and ^{14}C age data of sediment profile from an outwash plain at Bhojwasa near Gangotri Glacier, Garhwal Himalayas have also been finalised. Holocene sea level changes on the basis of palynostratigraphical and geochemical studies of Pichavaram, Tamil Nadu have also been finalised. The microwave digestion system MDS 2100 is being used regularly for preparation of samples for chemical analysis and palynological studies.

B. Sekar & G. Rajagopalan

Collaborative Work

Completed a monograph entitled "Precambrian stromatolites of India and Russia" under Integrated Long Term Program of Co-operation in Science and Technology (ILTP).

M. Sharma & A.K. Sinha (under ILTP: Indo-Russian)

Partially degraded pollen of *Arenga pinnata*, *Borassus flabellifer* and *Caryota urens* were studied with the aim to observe the morphological changes. Degradation was achieved in the three sets of experiments: i) pollen were treated with 2-aminoethanol for a period(s) of 1, 2 and 3 days, followed by ii) oxidation of pollen with the help of 1% dil. KMnO_4 for a period of 24 hrs, and iii) pollen grains treated with 2-aminoethanol were kept in merkaptoethanol for 24 hrs. Pollen were separately dissolved in 50% glycerine for 30 days to study the nature of exine, intine and protoplasmic contents. Based on the features observed after these experiments, four groups were identified in the studied pollen grains— A) unchanged monosulcate pollen grains, B) open pollen grains with endexine and protoplasm contained within the pollen, C) open pollen with ectexine and without endexine and protoplasm, and D) the endexine and protoplasm without the ectexine. Statistical data of pollen constituting each group was collected. Alteration and variation in morphology of the studied pollen grain are documented.

S.K.M. Tripathi & M. Kumar [& Professor M. Kedves (Hungary)]

Finalised a manuscript entitled "A fossil wood of *Dryobalanops* from Pliocene deposits of Indonesia".

R. Srivastava [& Noriko Kagemori (Wood Research Institute, Kyoto University, Japan)]

Dinoflagellate cysts from marine sediments as indicators of past environmental changes along the Western Indian Coast— 35 surface samples collected under the PAGES Programme from the eastern Arabian Sea off the Karwar-Marmagao Coast

(ranging from less than 50m to ~3000m depth) have been analysed to study distribution pattern of organic-walled and calcareous dinoflagellates in westernmost sediments. While organic-walled dinoflagellate cysts are observed to predominate in samples from shallower depths, other marine palynomorphs (organic remains derived from marine zooplankton—the primary consumers) have been found to occur in fairly good numbers (with dinocysts playing a subordinate role) in samples of increasing depths in some regions on the shelf. Among these microfossils, copepod egg-envelopes and exoskeleton remains, tintinnid loricae, scolecodont remains foraminiferal inner linings etc. have been identified. Some of these palynomorphs are known to constitute the relatively labile component of the marine organic matter/palynodebris assemblages and are supposed to be useful as proxy indicators of productivity and preservability of organic matter in the marine realm.

R. Garg & Khowaja-Ateequzaman [& Dr. Rajiv Nigam (NIO, Goa)]

A manuscript is completed on the stratigraphic and palaeoenvironmental significance of Early Campanian nannofossils recovered from sandstone unit (? Lameta Formation), overlying corraline limestone/marls of the Bagh Formation and underlying the Deccan Traps, exposed in Chakrud, near Zeerabad, Bagh area.

J. Rai & R. Garg [& Prof. S. Kumar (Lucknow University)]

Work on stable carbon isotopic composition of Siwalik Paleosols and its relation to C_3/C_4 plants and climate has been carried out. About 60 paleosol samples from Siwalik sequences of Suraikhola (Nepal) were analysed. The observation suggests a major shift in the carbon and oxygen isotopic composition at 6.5 Ma, which corroborates the existing record of, established Asian monsoon in Indian subcontinent. In addition to climatic shift at 6.5 Ma the present result indicates a change in the climate at 3.5 Ma supported by shift in d^{13}C and d^{18}C values.

A systematic collection of paleosol samples (about 450) from Upper, Middle and Lower Siwaliks of Suraikhola has been done. The Isotopic analysis of these samples is being carried out at PRL. Investigated plant megafossils (petrified woods and leaf-impressions) from Siwaliks of Lakshmi River section, southeast Bhutan. A paper on this aspect has been finalised. The presence of Dipterocarpaceous taxa along with other moist to evergreen elements in this assemblage indicate that tropical evergreen forest with few moist deciduous taxa flourished under warm humid climatic condition in the Himalayan foothill of Bhutan during Mio-Pliocene times.

M. Prasad [& **Dr. S.K. Bhattacharya** (PRL, Ahmedabad)]

Finalization of palynological work carried out on the Siwalik rocks of Arjun Khola section of Nepal is continuing. Palynological analysis from a 3 m thick peat profile from Sitalpur has been carried out. The profile is dated 15320 ± 280 yr. BP at base and 13270 ± 190 yr. BP at the top. Data interpretation is in progress.

S. Sarkar [& **G. Corvinus** (Nepal Research Center, Kathmandu)]

A rich palynofloral assemblage (66 taxa) is recovered from a measured stratigraphic section at Inglis Island, Andaman Sea. Stratigraphically important taxa suggest an Early Miocene age to the strata and the assemblages indicate a tropical–subtropical climate during the deposition of the sequence. Finalized a manuscript on this study.

S. Sarkar [& **J. Daneshian & V. Sharma** (Delhi)]

Finalization of palynological work carried out on the Siwalik rocks collected from three measured stratigraphic sections— Mansar, Uttarbaini and Nagorta of Jammu.

S. Sarkar [& **G.M. Bhatt** (Jammu)]

Re-investigated some samples from 6.5 m thick Quaternary section from Phulera (Champawat). Around 18 ka the region had cold and dry climate, depicted through open type vegetation comprising chiefly the grasses, sedges, Chen/Ams, Asteraceae, Rannunculaceae, Caryophyllaceae, Primulaceae, etc. Studies corroborate satisfactorily with the earlier generated data from Bhimtal-Naukuchiatal Basin and Wadda lake sites, depicting identical palaeoclimatic scenario in the Kumaun region. Finalisation of manuscript on the aspect is in progress.

C. Sharma [& **Dr. B.S. Kotlia** (Nainital)]

Completed pollen analysis of samples (23) from a 2.3 m deep trench dug out at Sanai Jheel, Rai Bareli (UP). Studies have revealed open type of vegetation, dominated by grasses and followed by sedges, Asteraceae, Chenopodiaceae/Amaranthaceae together with sparsely distributed few arboreal (*Madhuca indica*, *Holoptelea*, *Aegle marmelos*, etc.). Pollen denote that the site was under cultivation. Frequent encounter of aquatic elements (*Typha* and *Potamogeton*) together with fresh water alga-*Botryococcus* indicates that a prominent lake was present at this site.

C. Sharma & M.S. Chauhan [& **Prof. I.B. Singh** (Lucknow University)]

Ultrastructural studies of Angiosperm leaf cuticle and structure and development of epicuticular wax layer— Processing of samples of Citrus species has been initiated.

U. Bajpai [& **Prof. C.L. Verma** (Lucknow University)]

Investigated plant megafossils from Tertiary of Kameng District, Arunachal Pradesh.

R.C. Mehrotra [& **Dr. A. Joshi** (GSI, Itanagar)]

Sponsored Projects

Project : Search of palyno-event evidences for the status of Jurassic sequence on Indian Peninsula (Sponsored by DST, New Delhi, No. DST/ESS/CA-17/96)

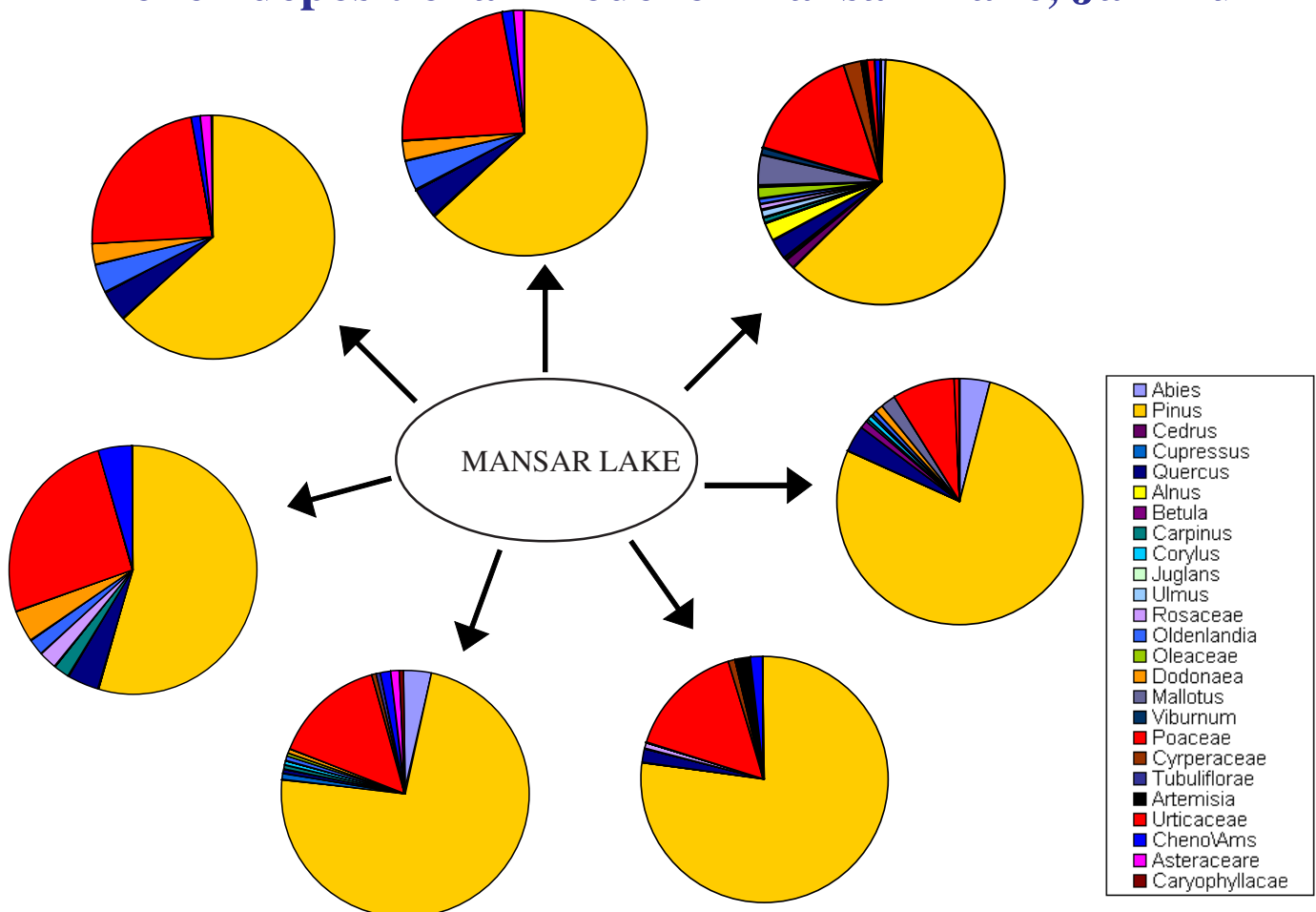
Finalised the palynological studies carried out and compiled the palyno-data for preparation of final Project Report. Also revised the manuscript on the age of Kota Formation, Pranhita-Godavari valley.

Vijaya

Project : Deccan Intertrappean palynoflora and its implication for the demarcation of K/T Boundary (Sponsored by DST, New Delhi, No. DST/ESS/CA/A4—16/96)

Compiled and finalised the project report and submitted to DST. Some of the important achievements under this project are— i) the oldest record of fresh water diatoms (*Melosira*) from the Deccan Intertrappean sediments was reported for the first time, ii) two unisexual flowers, *Flosvirulis deccenensis* and *Flosofemina intertrappea* were described from the beds of Mohgaon-Kalan, Chhindwara District (MP), iii) re-description of *Sahnipushpam* Shukla was done to assess its correct floral morphology, iv) two intertrappean sedimentary beds and three traps from the Padwar dug out well were reported for the first time, and v) the K/T transition at Padwar well (MP) and Umshrongkew river section (Meghalaya) were demarcated for the first time based on the palynological recovery.

Pollen depositional model of Mansar Lake, Jammu



However, further detailed work on the K/T boundary is necessary to demarcate a precise transition.

K. Ambwani [R.K. Kar & A. Sahni]

Project : The transition of lacustrine fauna and Floral Communities across Pleistocene-Holocene in Jammu and Ladakh (Sponsored by DST, New Delhi, No. DST/ESS/CA/A4—22/96)

Continued the pollen analysis of the 38 m deep sedimentary profile from Surinsar Lake. The studies have unraveled the vegetation history of Early Holocene. Prepared the manuscript entitled "Holocene climatic inferences from lacustrine sediments from Surinsar Lake, Jammu". Also completed pollen analysis of part of another profile from Mansar Lake. Undertook field trip to Jammu and collected large number of surface samples from Surinsar and Mansar lake sites.

C. Sharma & A. Dixit (& M. A. Malik, Jammu)

Project : High altitude plant species response to global climate change. (Sponsored by G.B. Pant Institute of Himalayan Environment and Development Kosi-katarmal, Almora, Department of Environment, New Delhi, No. GBPI/IERP/98-99/02/567)

Collected about 200 tree-core samples of *Pinus wallichiana* from various sites around Gangotri. The ring-widths of dated samples were measured. A 410-year (AD 1590-1999) long chronology has been prepared. The meteorological data of Shimla station were correlated with the ring-width chronology. The study showed that the winter temperature (December-February) is directly related, whereas June-July temperature negatively related with the tree growth. Additional samples of *Pinus wallichiana* from five more sites distributed in tree-line zones near Bhaironghati and Harshil, Uttarkashi were collected to supplement the previous data for climatic studies. The samples have been mounted and are being processed for cross dating and ring width measurements. The tree core samples of *Taxus baccata*, *Abies pindrow* and *A. spectabilis* were also

collected from various areas around Yamunotri to prepare tree-ring data network. Collection of samples for pollen analyses was also carried out from the Valley of Flowers, Garhwal Himalaya.

R.R. Yadav, S.K. Bera & J. Singh

Project : Analysis of climatic changes vis a vis glacial fluctuations using pollen and tree-ring data in Gangotri glacier area, Garhwal Himalayas. (Sponsored by DST, New Delhi, No. ES/91/018/97)

Carried out a field work in and around Gangotri Glacier area and collected tree ring samples and subsurface sediments for dendrochronological and palynological studies. In all 325 tree-cores from different conifer trees and one broad-leaved taxa were collected from diversified forests of the region. For the pollen analysis subsurface sediments were collected from twelve trial trenches at different altitudes (9 from Bhujwasa outwash plain and 3 from Tapoban palaeolake).

Subsurface sediments at different depths of the sediment profiles have been processed for C-14 dating. So far four samples have been dated from two profiles. These are 600 ±90 yr. BP (at 0.30-0.40 m) and 1590±200 yr. BP (0.80-0.90 m) of 1.25 m deep BH/I profile. For the other 1.40 m deep profile, dates are 5990±120 yr. BP and 8730±170 yr. BP at the depths of 0.50 to 0.54 m and 1.20 to 1.24 m respectively. Pollen analysis of one profile has been completed. This study shows that there are three climatic phases since around last 2000 years, i.e. cold and moist climate around 2000 to 1700 yr. BP, warm and moist 1700 to 850 yr. BP and towards aridity during 850 yr. BP to recent. Detailed palynological studies of rest of the profiles are in progress. Besides, chemical analysis and loss on ignition test for organic contents and carbonate contents of few profiles were made. All the tree-core samples were mounted in wooden frames and polished for analyses. The counting and dating of the tree rings are in progress.

A. Bhattacharyya, R. Kar & P.S. Ranhotra

Project : Analysis of climate changes in Eastern Himalayan region using tree ring data.

(Sponsored by DST, New Delhi, No. DST/ (ESS/ 44/01/98)

Tree ring samples of *Pinus kesiya*, *P. merkusii*, *P. wallichiana*, *Tsuga dumosa* were mounted and polished. Dating of *Pinus merkusii* samples has been completed. Four chronologies of the species were developed for the four different sites. Longest chronology dates from AD 1705 to 1999. Tree growth/climate relationship analysis is in progress. Dating of *Pinus kesiya* and *Tsuga dumosa* is in progress. One of the sediment profiles was macerated and the pollen counting is in progress. C-14 date shows these sediments to be above 40, 000 yr. B. P.

A field trip was undertaken in Shillong and adjacent areas of Meghalaya and the Lower Subansiri

District of Arunachal Pradesh. Total 473 cores from 236 trees were collected from three different conifer species, viz. *Pinus kesiya*, *P. wallichiana* and *Tsuga dumosa*. Besides, tree-core samples, two sediment profiles were also collected. One 1.45 m deep section was taken from the right bank of the river Kileii that comes from the Ziro and goes upto Pynegro. Thick logs as well as pieces of wood are exposed on the either side of the river but are most prominent on the right side only. At places, woods can be seen on the river bed also. Total 11 samples at 10 cm interval were collected from this profile for both pollen and C-14 analysis. The other section, which is 5.64 m deep, was collected from a place adjacent to Peak lodge, Ziro, along a roadside. Total 41 samples were collected along with 2 wood samples (present inside the peat).

A. Bhattacharyya, V. Chaudhary & K. Verma (up to 17.11.2000)

Recognition

A.K. Sinha

Presided over the 1st Session— Geology in the Himalayas at *15th Himalayas-Karakoram-Tibet Workshop* held at Chengdu, China in April, 2000.

Unanimously elected the 'Chairman' of National Committees of the International Lithosphere Program by the General Body for the period of five years (since August 2000) at *31st International Geological Congress*, Brazil.

Convened the Special Symposium F-1— Global Tectonic Zones at *31st International Geological Congress* held at Rio de Janeiro, Brazil in August, 2000. Elected 'President' of Earth Sciences System for *89th Session of Indian Science Congress*, Lucknow (2001-2002).

J. Banerji

Co-chaired the first scientific session of the *National Symposium on Recent Advances in Geology and Resource Potential of the Kachchh Basin* held at Banaras Hindu University, Varanasi during December 2000.

C. Sharma

Chaired Technical Session— Quaternary Palynology at *10th International Palynological Congress* held at Nanjing, China in June 2000.

C. Sharma & A. Dixit

Awarded Gold Medal for best Research Paper entitled "Holocene climatic inferences from lacustrine sediments from Surinsar Lake, Jammu" presented at the *National Symposium on Ecophysical Consequences of Environmental pollution* held at Narendra Deo University, Faizabad (UP) in November-December, 2000.

R. Garg, J.S. Guleria, A. Tripathi & Vijaya

Elected Fellows of The Palaeobotanical Society, Lucknow.

A. Khandelwal

Co-chairperson, *34th National Convention of the Indian College of Allergy & Applied Immunology* held at Lucknow from September 29-30, 2000.

Co-chairperson, *Geoenvironmental studies: Indian Scenario* held at Jhansi from November 9-10, 2000.

C.M. Nautiyal

Chosen for 'UP Vigyan Sancharak Award' for contribution to science communication by VICAS and District Science Club, Allahabad. Co-chaired the Valedictory Session of the *Science Writing/ Journalism Workshop*, Palampur (HP).

S. Sarkar

Chaired a session at *10th International Palynological Congress* held at Nanjing, China in June 2000.

S.C. Srivastava

Chaired the one scientific session in *Indian Botanical Conference* held at Meerut (UP) in October 2000. Received Millennium Medal of CBEM Laboratory, Hungary.

A. Gupta

Chaired Technical Session "Quaternary Palynology" at *10th International Palynological Congress* held at Nanjing, China in June 2000.

Representation in Committees/ Boards

A.K. Sinha

- ◆ Project-Investigator, International Long Term Programme, Indo-Russian Projects under DST.
- ◆ Chief Editor, “*The Palaeobotanist*”.
- ◆ Member, Local Advisory Committee, Regional Science Centre, Lucknow.
- ◆ Member, Scientific Advisory Committee, Research and Development Aspects of Conservation, Ministry of Human Resource Development, Govt. of India.
- ◆ Guest Editor, Special Issues of Himalaya, Indian Science News Association, Calcutta.

G. Rajagopalan

- ◆ Member, National Organising Committee, Nuclear track Society of India, Calcutta.
- ◆ Member, Academic Committee of School of Archaeological Dating, Jadavpur University, Calcutta.

Anand-Prakash

- ◆ Councillor, Executive Council, The Palaeobotanical Society (up to December, 2000).
- ◆ Treasurer, Indian Association of Palynostratigraphers.
- ◆ Member, Bureau of Indian Standards, Solid Mineral Fuels Sectional Committee- PCD – 7.

J. Banerji

- ◆ Vice President, The Palaeobotanical Society, Lucknow.

S. Chandra

- ◆ Co-ordinator, International Project “Gondwana Alive”.

K.S. Saraswat

- ◆ Member, Editorial Board, “*Ethnobotany*”.
- ◆ Member, Research Degree Committee (Botany), H.N.B. University, Srinagar.

C. Sharma

- ◆ Vice President, International Council of Biodeterioration of Cultural Property.
- ◆ Member, Advisory Committee, Journal of Bengal Natural History.
- ◆ Councillor, Executive Council, The Palaeobotanical Society.

K. Ambwani

- ◆ Member, Board of Directors, American Biographical Institute, Raleigh.
- ◆ Member, Selection Committee, SEM.

R. Garg

- ◆ Member, Executive Committee and Editorial Board, “*Journal of the Palaeontological Society of India*”.
- ◆ Member, Managing Council, Indian Association of Palynostratigraphers.
- ◆ Editor, “*Geophytology*”
- ◆ Member, The Indian Society of Applied Geochemists (ISAG)

J.S. Guleria

- ◆ Editor, “*Geophytology*”.

R.K. Saxena

- ◆ Secretary, The Palaeobotanical Society, Lucknow.
- ◆ Member, Editorial Board “*Geophytology*”.
- ◆ Secretary and Member, Editorial Board, Indian Society of Geoscientists.

A.K. Srivastava

- ◆ Chief Editor, Journal “*Geophytology*”.
- ◆ Member, Advisory Board, Journal “*Neobotanica*”.
- ◆ Member, Advisory Committee, Journal “*Vasundhara*”.
- ◆ Member, Editorial Board and Treasurer, Indian Society of Geoscientists.
- ◆ Member, National Working Group, IGCP Project- 411 “Geodynamics of Gondwanaland derived terranes in East and South Asia”.

G.P. Srivastava

- ◆ Vice President, Museum Association of India.
- ◆ Treasurer, The Palaeobotanical Society, Lucknow (up to December, 2000).
- ◆ Member, Editorial Board *Geophytology* (up to December, 2000).

A. Tripathi

- ◆ Member, Jurassic Microfossil Group, Interna-

tional Subcommission on Jurassic Stratigraphy.

- ◆ Member, Acritarch Subcommission.
- ◆ Editor, "Quarterly Journal of Geological Association and Research Centre".
- ◆ Member, Spore Pollen Working Group, CIMP.
- ◆ Member, Executive Committee, LUBDAA.

Vijaya

- ◆ Corresponding Member, Committee for Quantitative Stratigraphy.
- ◆ Voting Member, International Commission on Triassic Stratigraphy.

U. Bajpai

- ◆ Member, Technical Advisory Committee of U.P. Environmental Concern.
- ◆ Member, Managing Council, Indian Association of Palynostratigraphers.
- ◆ Member, Executive Committee, Electron Microscope Society of India.

N. Jha

- ◆ Editor, "Geophytology" (up to December, 2000)

A. Khandelwal

- ◆ Member, Organising Committee, 34th National Convention of the Indian College of Allergy & Applied Immunology, Lucknow.

B.K. Misra

- ◆ Member, Bureau of Indian Standards, Solid Mineral Fuels Sectional Committee- PCD – 7.
- ◆ Joint Secretary, Indian Society of Geoscientists.

C.M. Nautiyal

- ◆ National Co-ordinator, National Children's Science Congress-2000.
- ◆ Nominated Convener, NCSTC-Network, New Delhi since Jan.2001.

M.R. Rao

- ◆ Joint Secretary, The Palaeobotanical Society, Lucknow.

R. Saxena

- ◆ Associate Member, International Committee for Coal and Organic Petrology.

S.C. Srivastava

- ◆ Member, IOP Sahni Medal Committee.
- ◆ Honorary Affiliate Member in Palaeobotany, Botanical Society of America.

A. Gupta

- ◆ Member, Executive Council, Scientist's Unique and Researcher's Yare Association.
- ◆ Member, Board of Editors, "Flora & Fauna"

B.N. Jana

- ◆ Councilor, Executive Council, The Palaeobotanical Society.

M. Kumar

- ◆ Joint Secretary, The Palaeobotanical Society (up to December, 2000)

R.C. Mehrotra

- ◆ Member, Executive Council, The Palaeobotanical Society.

J. Rai

- ◆ Member, Jury 7th District level National Children's Science Congress, Lucknow.

A. Rajanikanth

- ◆ Assistant Editor, "The Palaeobotanist".
- ◆ Judge, District Level Childrens Science Congress.
- ◆ Judge, Science Motivation Programme, IISD, Lucknow.
- ◆ Member, National Working group, IGCP 434, Land-ocean interactions during the Cretaceous in Asia.

M. Sharma

- ◆ Editor, "Geophytology" (up to December, 2000).
- ◆ Assistant Editor, "The Palaeobotanist".
- ◆ Executive Editor, "Vigyan Alok".

R. Tewari

- ◆ Member, National Working Group, IGCP Project- 411 'Geodynamics of Gondwanaland derived terranes in East and south Asia'.

A. Farooqui

- ◆ Member, Executive Committee, International Society of Environmental Botanists, NBRI, Lucknow.

Lectures Delivered

By Institute's scientists outside

A.K. Sinha

- ◆ *The Geologic evolution of Himalayan Mountain System* at Government Autonomous Science College, Jabalpur (July 10, 2000).
- ◆ *Tectonic frame-work of Himalayas: Palaeogeologic reconstruction and Plate tectonics* at Southampton Oceanographic Centre, School of Ocean and Earth Sciences, European Way, Southampton, UK (August 21, 2000).
- ◆ *Evolution of Himalayas through Geological Time Scale* at Refresher Course (for teachers) in Botany organised by Department of Botany, University of Lucknow (November 29, 2000).
- ◆ *Geological evolution of Himalayas and the role of Precambrian stromatolites in Tectono-stratigraphic interpretation* at DST sponsored Winter School/Training Course "Precambrian Palaeobiology: Techniques and Methodology", Department of Geology, Lucknow University (December 2000).
- ◆ *Himalayan mountain building and Plate tectonics*, invited lecture of Earth System Sciences at 88th Session of Indian Science Congress, New Delhi (January 2001).
- ◆ *Implication of Plate tectonics in the enigmatic tectonic frame-work along the Himalayan-Karakoram transect*, Key-note address at Seminar "Geology and Natural Environment of the Lesser Himalaya: Present Status and Strategy for the next two Decades", Nainital (March 23, 2001).

G. Rajagopalan

- ◆ Two lectures on *Dating Methods* to M.Sc. students at Lucknow University, Lucknow (April 2000).

G.P. Srivastava

- ◆ *Angiosperm Taxonomy*, series of twelve lectures to the M.Sc. Plant Sciences students at Botany Department, Lucknow University.

M. Shukla

- ◆ *Proterozoic carbonaceous mega-remains* at DST sponsored Winter School/Training Course "Precambrian Palaeobiology: Techniques and Methodology", Department of Geology, Lucknow University (December 2000)

R. Garg

- ◆ *Acritarchs and their geologic significance and Dinoflagellate Ancestors, "Possible Dinoflagellates" and presumed Dinoflagellate Biomarkers in the Precambrian- Cambrian* at DST sponsored Winter School/Training Course "Precambrian Palaeobiology: Techniques and Methodology", Department of Geology, Lucknow University (December 2000)

J.S. Guleria

- ◆ *Plant fossils and antiquity of some common angiospermous plants in India* at Refresher Course in Botany organised by Department of Botany, University of Lucknow (April 24, 2000).

U. Bajpai

- ◆ *Bio-deterioration of cuticular membrane: Ultrastructural studies*— Plenary lecture at National Seminar on Bio-deterioration of Materials at DRDO, Defence Materials and Stores Research and Development, Kanpur (February 2001).

C.M. Nautiyal

- ◆ *Selection of Topics for science Writing and various sources of Scientific Information and Science Writing for Radio.*

S.K. Bera

- ◆ *Pollen grain and its role in Palaeoclimatic studies* at Maitri Research Station, Antarctica. (January 15, 2001).

M. Sharma

- ◆ *Proterozoic microbial build-up* at DST sponsored Winter School/Training Course “Precambrian Palaeobiology: Techniques and Methodology”, Department of Geology, Lucknow University (December 2000).

J. Rai

- ◆ *Mahan Vaigyanik Dr. Birbal Sahni* at All India Radio, Lucknow in ‘Vidyarthiyon ke liye’ Programme (July 17, 2000).

By outside scientists in the Institute

Shri C.V. Singh

- General Manager, Tata Engineering and Locomotive Company Limited, Lucknow
- ◆ *Six Sigma and innovation for Global competitiveness* (Engineers Day lecture on September 15, 2000)

Professor S.C. Santra

- Department of Environmental Sciences, Kalyani University, Kalyani
- ◆ *Environmental impact assessment: Current status in India* (on October 20, 2000)

Deputation/Training/Study/Visit Abroad/in Country

G. Rajagopalan

Participated as Resource Person in DST sponsored *Workshop on Fluvial Geomorphology with special reference to Flood plains* held at Indian Institute of Technology, Kanpur from April 3-4, 2000.

K.S. Saraswat

Attended *All India Official Language Conference* held at Central Drug Research Institute, Lucknow from April 13-14, 2000.

A.K. Sinha

Participated in the Post-15th *Himalayas-Karakoram-Tibet Workshop* Himalayas Field Excursion— Lhasa-Gyangze-Xigaze-Tingri (Rongbuk)-Khasa (Zham)-Kathmandu from April, 25th to May 04, 2000.

C.M. Nautiyal

Attended *Science Communication Workshop* held at HP Agricultural University, Palampur as a Resource Person, organised by SCERT, Solan and NCSTC, DST during April 25-28, 2000. Also attended the *Science Communication Course* as a faculty member by Vigyan Parishad, Allahabad University, Prayag (under a programme of NCSTC, DST) on December 9, 2000.

Attended 45th *Half-yearly Meeting of NARAKAS* held at Central Drug Research Institute, Lucknow on February 22, 2001.

K.S. Saraswat & P. Bisaria

Attended 41st *Official Language Management and Policy Implementation Seminar cum Workshop* organised by *Rajbhasha Sansthan*, New Delhi and held at Solan, Himachal Pradesh from April 26-28, 2000.

C. Sharma & A. Gupta

Visited different Institutions and historical places in Nanjing and suburbs (China), viz. Nanjing Institute of Geology and Palaeontology, Academia

Sinica; Zhongshan Botanic Garden, Dr. Sun Yetsen's Mausoleum, Confucious Temple, Meiling Palace and Yangshan Tablet Material during Mid-Congress Field trip of 10th *International Palynological Congress* in June, 2000.

S.C. Bajpai, P. Bisaria & Renu Srivastava

Attended *Joint Hindi Workshop* held at Central Drug Research Institute, Lucknow from July 6-7, 2000.

C. Sharma, A. Khandelwal & A. Bhattacharyya

Attended *INDSUBIO (INDian SUBcontinent BIOmisation) Workshop* held at Max-Planck Institut fur Biogeochemie, Jena, Germany from July 20-22, 2000. In the workshop modern (0 year) pollen/vegetation relationship in context of preparation of vegetation map based on pollen data for Indian subcontinent was discussed.

A. Tripathi

Attended *National Conference on e-Security*, Computer Society of India held at Bangalore during July 29-30, 2000.

S.K. Bera

Attended Pre-Antarctica Expedition training program at ITBP, Auli and Basudhara and medical examination at AIIMS, New Delhi from August-September, 2000 as a part of selection for 20th Expedition. Also attended "De induction course of adaptation to the Antarctic stress" organised by Defence Research Institute of Physiology and Allied Sciences, New Delhi from October 14-16, 2000. Participated in 20th Indian Scientific Expedition to Antarctica from December 23, 2000 to March 22, 2001.

R. Kar & P.S. Ranhotra

Attended the DST sponsored 5th *Glaciology Training Course*, organized by Geological Survey of India, Lucknow from August 21 to September 17, 2000.

A.K. Sinha, G. Rajagopalan, K. Ambwani, R. Garg, M. Shukla & M. Sharma

Participated as Resource personnel in DST sponsored Winter School/Training Course in *Precambrian Palaeobiology: Techniques and Methodology* organised at the Department of Geology, University of Lucknow between December 4-18, 2000.

R. Tewari

After attending the 10th RPP Meeting held at Guarulhos, Sao Paulo (Brazil) in December, 2000 visited British Museum of Natural History, London to observe Palaeozoic and Mesozoic plant megafossils, viz. a number of *Glossopteris* species and species of *Ptilophyllum*, *Pterophyllum*, *Dicroidium*, etc.

R.C. Mehrotra & R. Srivastava

Deputed (on request from Divisional Commissioner, Jabalpur) to visit Ghughua area situated near Shahpura, Dindori District (MP) in connection with development of the National Fossil Park and establishment of a small museum on the request of district authorities. Mehrotra and Srivastava also collected a number of plant fossils

from the area and nearby Deccan Intertrappean localities.

M. Sharma

Visited Geological Institute, Moscow from January 17 to February 16, 2001 under Integrated Long Term Programme between India and Russia.

C. Sharma, K. Ambwani & A. Bhattacharyya

Attended Group Monitoring Workshop of DST Sponsored Projects held at Nagpur from February 22–24, 2001 and presented their highlights of the work.

S. Sarkar

Participated in the post seminar field excursion in the Nainital and its adjoining areas of Uttaranchal on March 25, 2001.

S. Goswami

Participated in the DST sponsored Contact Programme on “Art of Petrography: a valuable guide for Petrologists” held at Department of Geology, Banaras Hindu University, Varanasi in the months of September-October, 2001.

Deputation to Conferences/Symposia/Seminars/Workshops

A.K. Sinha

- *15th Himalayas-Karakoram-Tibet Workshop* held at Chengdu, China from April 22-24, 2000.
- *88th Session-Indian Science Congress* held at New Delhi from January 3-7, 2001.

C. Sharma, S. Sarkar & A. Gupta

- *10th International Palynological Congress* held at Nanjing, China from June 24-30, 2000.

S. Chandra

- *6th International Organisation of Palaeobotany Conference* held at Qinhuangdao, Hebei Province, Republic of China from July 31-August 3, 2000.

A.K. Sinha & M. Sharma

- *31st International Geological Congress* held at Rio de Janeiro, Brazil from August 6-17, 2000.

V. Prasad

- *2nd International Conference on Application of Micro- and Meio-organisms to Environmental Problems* held at Winnipeg, Canada from August 28–September 1, 2000.

A. Bhattacharyya & V. Chaudhary

- *High Asia Dendrochronology Workshop* held at Lamont Doherty Earth Observatory, New York, USA from September 12-14, 2000.
- *Symposium-Neogene climate of Indian Ocean and the Indian Subcontinent* held at IIT, Kharagpur from March 28-29, 2001.

A. Khandelwal

- *34th National Convention of the Indian College of Allergy and Applied Immunology* held at Lucknow from September 29-30, 2000.
- *National Seminar-Geoenvironmental studies: Indian Scenario* held at Jhansi from November 9-10, 2000.

S.C. Srivastava

- *23rd Indian Botanical Conference* held at Meerut from October 14-16, 2000.

A. Farooqui

- *National Seminar on Coastal Evolution, Processes and Products and Annual Convention of Indian Association of Sedimentologist* held at Cochin in October 2000.

O.S. Sarate & A. Dixit

- *National Symposium on Ecophysiological Consequences of Environmental Pollution* held at Faizabad (UP) from November 6-8, 2000.

R. Tewari

- *10th RPP (Reuniao de Paleobotanicos e Palinologos) Meeting* held at University of Guarulhos, Guarulhos, Sao Paulo, Brazil from December 11-16, 2000.

J. Banerji, J.S. Guleria, J.P. Mandal, B.N. Jana, J. Rai & A.K. Ghosh

- *National Symposium on Recent Advances in Geology and Resource Potential of the Kachchh Basin* held at Banaras Hindu University, Varanasi from December 21-23, 2000.

M. Shukla, U. Bajpai, M. Kumar & N. Prakash

- *24th Annual Conference of Electron Microscope Society of India on Electron Microscopy and Allied Fields* held at Chandigarh from February 9-11, 2001.

U. Bajpai & A. Khandelwal

- *National Seminar on Biodeterioration of Materials* held at Kanpur from February 17-18, 2001.

A.K. Sinha, S. Sarkar, S.K.M. Tripathi, R. Kar & P.S. Ranhotra

- *Seminar Geology and Natural Environment of the Lesser Himalaya: Present Status and Strategy for the next two Decades* held at Nainital from March 23-25, 2001.

Papers presented at Conferences/Symposia/Meetings

- Bajpai U** - Ultrastructure of cuticular membrane of extinct and extant taxa of gymnosperms of India. *24th Ann. Conf. EMSI*, Chandigarh, February 2001.
- Bajpai U, Kumar M & Singh VK** - Morphology, size and EDAX analysis of pyrite framboids on degraded plant tissues in coal and shales of Ledo Coalfield, Assam. *24th Ann. Conf. EMSI*, Chandigarh, February 2001.
- Banerji J** - Mesozoic megafloora of Kachchh Basin and its palaeoecological interpretation. *Nat. Symp. Rec. Adv. Geol. & Res. Potent. Kachchh Basin*, Varanasi, December 2000.
- Bhattacharyya A & Chaudhary V** - Trees- natural recorders of past climate: Some studies from India. *Symp. Neogene climate Indian Ocean & the Indian Subcontinent*, Kharagpur, March 2001.
- Chandra S** - Distribution of Late Devonian-Permian plant sequences in India. *6th IOP Conf.*, China, July-August 2000.
- Farooqui A** - Potentials of multi-proxy data in analyzing estuarine depositional Environment. *Nat. Sem. Coastal Evol. Process. & Prod. and Ann. Conv. IAS*, Cochin, October 2000.
- Ghosh AK** - Palaeoecology and taxonomy of the Tertiary coralline algae from southwestern Kachchh. *Nat. Symp. Rec. Adv. Geol. & Res. Potent. Kachchh Basin*, Varanasi, December 2000.
- Guleria JS 2000** - Endogeneous fungi in silicified woods of Kachchh, Gujarat. *Nat. Symp. Rec. Adv. Geol. & Res. Potent. Kachchh Basin*, Varanasi, December 2000.
- Gupta A** - Palaeovegetation and past climate of Late Holocene from temperate zone in Nainital District, Kumaun Himalaya. *10th IPC*, China, June 2000.
- Jana BN** - Palaeopalynology of Kachchh: Mesozoic megaspores. *Nat. Symp. Rec. Adv. Geol. & Res. Potent. Kachchh Basin*, Varanasi, December 2000.
- Kar R, Bhattacharyya A, Ranhotra PS & Sekar B** - Palynological evidences around Gangotri Glacier area, Garhwal Himalayas. *Workshop Geol. & Nat. Envir. Lesser Himalaya: Present Status and Strategy for the next two decades*, Nainital, March 2001.
- Khandelwal A** - Dominant and air-borne pollen grains of Lucknow. *34th Nat. Conv. Indian college of Allergy & Applied Immunology*, Lucknow, September 2000.
- Khandelwal A** - Biodeterioration: An aerobiological approach. *Nat. Sem. Biodeterioration of Materials*, Kanpur, February 2001.
- Khandelwal A, Kohli D & Gupta HP** - A palynological record of mangrove vegetation at Chandrapur, Chilka Lake, India. *Workshop Geoenvironmental studies: Indian Scenario*, Jhansi, November 2000.
- Kumar M, Bajpai U, Prakash N, Shukla M, Anand-Prakash & Srivastava GP** - Structural changes in biologically degraded leaf cuticles during early diagenesis. *XXIV Ann. Conf. EMSI*, Chandigarh, February 2001.
- Mandal J** - Depositional environment and palynomorphs from the lignite mines of Kachchh. *Nat. Symp. Rec. Adv. Geol. & Res. Potent. Kachchh Basin*, Varanasi, December 2000.

- Prakash N** - Structural changes in biologically degraded leaf cuticles during diagenesis. *14th EMSI Conf.*, Chandigarh, February 2001.
- Prasad V & Sarkar S** - Depositional environment of the Subathu Formation (Late Thanetian-Early Ypresian) in the Garhwal Himalayas, India – Evidence from Cyanobacterial mats. *2nd Int. Conf. Appl. Micro- & Meio-organisms to Environmental problems*, Canada, August-September 2000.
- Rai J** - Early Callovian nannofossils from Jara Dome, Kutch, western India. *Nat. Symp. Rec. Adv. Geol. & Res. Potent. Kachchh Basin*, Varanasi, December 2000.
- Rigby JF & Chandra S** - Permian flora of the Mersey Coal Measures, Tasmania. *6th IOP Conf.*, China, July-August 2000.
- Sarkar S** - Diversification of angiosperms in India through ages (Palaeocene–Pliocene). *10th IPC*, China, June 2000.
- Sarkar S & Prasad V** - Palynological evidences of sea level changes during Early Eocene in the Morni Hills, Lesser Himalaya, India, *10th IPC*, China, June 2000.
- Sharma C, Chauhan MS, Bera SK, Sinha R & Upreti DK** - Early Holocene sedimentological and palynological studies from lake Priyadarshini, Eastern Antarctica. *10th IPC*, China, June 2000.
- Sharma C, Dixit A & Sekar B** - Holocene climatic inferences from lacustrine sediments from Surinsar lake, Jammu based on pollen and chemical analysis. *Nat. Symp. Eco-physiol. Consequ. Envir. Poll.*, Faizabad, November 2000.
- Sharma M & Shukla M** - Gigantism in Neoproterozoic carbonaceous mega-remains, a possible marker event: evidences from the Bhima and the Kurnool basins of south India. *31st Int. Geol. Congr.* Brazil, August 2000.
- Shukla M, Bajpai U, Kumar M, Srivastava GP & Anand-Prakash** - Nature of sedimentary organic matter from Suket Shale Formation, Vindhyan Super Group, District Mandsaur, Madhya Pradesh. *XXIV Ann. Conf. EMSI*, Chandigarh, February 2001.
- Sinha AK** - Subduction and accretion tectonics of Himalayan and Karakoram terranes and their palaeogeological configuration. *15th Himalayas-Karakoram-Tibet Workshop*, China, April 2000.
- Sinha AK** - Continental subduction of Indian margin in Himalayan orogens leading to development of ultrahigh pressure metamorphic (UHPM) regim. *31st Int. Geol. Congr.*, Brazil, August 2000.
- Sinha AK, Chandra R & Upadhyay R** - Tectonic framework of Himalayas-Karakoram orogenic subduction zones in Ladakh and eastern Karakoram. *31st Int. Geol. Congr.*, Brazil, August 2000.
- Srivastava SC & Prakash N** - Reconstructed pteridophytic fossils and palaeogeographic distribution. *23rd Indian Bot. Conf.*, Meerut, October 2000.
- Tewari R** - Megaspores from Late Palaeozoic of India- Structural trends and stratigraphic correlation. *10th RPP Meeting*, Brazil, December 2000.
- Tripathi SKM & Shukla U** - Palynological and sedimentological studies on Middle Siwalik sediments exposed in Jammu area. *Sem. Geol. & Nat. Envir. Lesser Himalaya: Present Status and Strategies for the Next Two Decades*, Nainital, March 2001.

Consultancy/Technical Assistance rendered

Sixty-four samples have been dated in the Radiocarbon Lab as a part of consultancy services offered by the Institute. Also technical assistance (Radiocarbon dating of samples) rendered to following organizations/individuals:

Geological Survey of India,
Anna University, Chennai,
Kumaon University, Nainital,
National Institute of Oceanography, Goa,
Deccan College, Pune,
ASI, Bhopal,
Centre for Earth Science Studies, Trivandrum,

and

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

K. Ambwani & V.K. Singh provided consultancy services in Scanning Electron Microscopy to the scientists/students of the different Institutions and Universities.

J.S. Guleria identified fossil samples sent by Commissioner of Jabalpur as bone pieces and submitted a report on that.

M. Shukla & R. Babu extended help to Professor A.D. Ahluwalia and his student Sandeep Walia of Department of Geology, Chandigarh University for the isolation of microbiota from the sediments of Krol-Tal succession, Lesser Himalaya.

A. Khandelwal imparted aerobiological training to two M.Sc- 4th Semester students of Environmental Science, Lucknow University for their environment oriented aerobiology projects: i) *Study on aerial prevalence of Parthenium hysterophorus L. pollen in relation to pollen allergy*, and ii) *Bio-monitoring of grass pollen and grass pollen allergy*.

M.R. Rao provided technical assistance to Mr. Salman Velayati, Department of Geology, Tehran University, Iran for the identification of Tertiary spore-pollen recovered from the metamorphic rocks exposed at Kord Kouy, Gorgan, north-east of Iran.

C. Srivastava provided practical training and interpretational assistance to Mr. A.P. Singh, M.Sc. student in Environmental Science, Lucknow University, on the problem entitled *Palaeo-ethnobotanical studies at ancient Charda-Jamoga (ca. 800 BC-1100 AD), District Bahraich (UP)*.

S.K.M. Tripathi provided scientific assistance to Miss Nidhi Rai, 4th Semester student of Environmental Science, Lucknow University in completing her Project report on *Role of Palynology in hydrocarbon generation and crude oil pollution*.

M.S. Chauhan carried out the pollen analysis of one Quaternary sample from Meghalaya received from Geological Survey of India.

R.C. Mehrotra & R. Srivastava helped in identification of big logs of fossil woods and other plant megafossils placed in the Ghughua fossil park situated near Shahpura, District Dindori (MP).

A. Farooqui provided scientific assistance to two students of M.Sc. Environmental Sciences, Lucknow University for their dissertation on *Impact of Anthropogenic pressure on coastal vegetation in Adyar and Pichavaram estuaries*.

Units

Publication

Journal - *The Palaeobotanist*

Volume 49(1) and 49(2) of the Journal were published incorporating research papers on various topical aspects. The latter volume was a collection of research papers on the palaeobotanical contributions of BSIP in North-East India. It was released on Founder's day (14th November) by Shri B.C. Bora, Chairman-cum-Managing Director, ONGC. Papers for the Volume 49(3) have been processed and edited.

Monograph

Galley proof of the text of "Monograph - An introduction to Gymnosperms, Cycads and Cycadales" by Professor D. D. Pant has been processed and necessary corrections were incorporated. Relevant figures were processed for resketching and retouching.

Newsletter

Newsletter (June 2000) was published with information on important activities of the Institute including participation in exhibitions, conferences, Hindi *Pakhwara* (fortnight), new additions to library, new administrative measures and related information along with pertinent photographs. It was released on Foundation Day (10th September) by Prof. K.B. Powar, Secretary General, Association of Indian Universities.

Annual Report

Bilingual (English/Hindi) Annual Report—1999-2000 was published consisting of Research reports, Conference participation, Awards, Research papers published, Foundation/Founder's Day function, Annual Accounts and related matters with relevant graphics and photographs. It was released on Founder's Day (14th November) by Prof. Ashok Sahni, Chairman, Governing Body.

Hand-outs

Biographical sketches and lecture themes of talks delivered on Foundation Day and Founders Day by the guest speakers Prof. K.B. Powar, Shri B.C. Bora and Late Prof. S.S. Raghuvanshi were published.

Invitation / Greeting Cards

Invitation cards of the Foundation Day and Founders Day celebrations were published. Two colourful Greetings—2001 depicting fossil Mosquito recovered from an Amber and another showing logo of the Institute were printed.

Sale of Institute Publication

This year the publication of the Institute netted an income of Rs. 2,38,281/-.

Chairman, Governing Body, Prof. Ashok Sahni releasing Annual Report 1999-2000.

Library

The infrastructure facilities specially computer hardware has been updated and Library is disseminating the information about new arrival on Institute Website. The contents of Current Awareness Service have also been incorporated on web page (<http://www.bsip.res.in>).

The current holdings of Library are as under:

Particulars	Additions during 2000-2001	Total
Books	28	5,319
Journals	09	10,830
Reprints	135	36,181
Reference Books	—	317
Hindi Books	—	153
Ph.D Thesis	—	89
Reports	—	46
Maps & Atlases	—	61
Microfilm/Fisches	—	294
CD	19	34

Currently the Library is receiving 159 journals, (81 are subscribed and 78 are in exchange). There are 155 registered card holders for use of the Library.

Exchange Unit:

Journals received on exchange basis	78
Reprints of research papers purchased	47
Reprints sent out in exchange	1,520
Institutions on exchange list	65
Individuals on exchange list	165

Computer Aided Library:

Computerisation of Library assets being done through LAN under UNIX O/S continues. Software employed is UNIFY RDBMS and the utilities are programmed in 'C' giving different levels of securities. Data-base of library holdings

of journals continued through dBase III+ package.

Current Awareness Service:

Current Awareness Service (CAS) completed one year in its revised form. Library has been sending bimonthly CAS bulletin to renowned institutions and scientists throughout India who are interested in palaeobotany, earth sciences and related fields.

Lamination and Xeroxing:

Lamination and xeroxing of old and rare publications are in progress. Xeroxing facility is provided to institute scientists and also to scientists of other organisations.

The following Institutions/organisations availed the Library facilities:

Department of Physical Geology and Mining, Tehran University, Iran

Department of Botany, Lucknow University, Lucknow

Department of Botany, CIMAP, Lucknow
Babasaheb Bhimrao Ambedkar University, Lucknow.

Institute of Mass Communication in Science and Technology, Lucknow University

Department of Geology, University of Delhi, Delhi

D.A.V. College, Kanpur

Department of Geology, Banaras Hindu University, Varanasi

Department of Botany, University of Burdwan, Burdwan

Department of Botany, University of Allahabad, Allahabad

Department of Earth Sciences, Kurukshetra University, Kurukshetra and Kumaun University, Nainital.

Late Prof. S.S. Raghuvanshi releasing the Current Awareness Service Bulletin.

Museum

Work on preparation of inventory of type and figured specimens – III is under progress. Prof. B.D. Sharma, Department of Botany, Jai Narain Vyas University, Jodhpur (Rajasthan) has deposited his type and figured specimens (86) and slides (159) to the Museum of the Institute. Museum is playing an important role in dissemination and popularisation of palaeobotanical knowledge.

An exhibition was held at Lucknow University in the month of December on the occasion of Lucknow Vishva Vidyalaya Mahotsav. The plant fossils attracted large number of students and general public. Institute joined the Nation in celebrating Engineers' Day (September 15th) by observing this day as an open house. We also celebrated National Technology Day (May 11th) and National Science Day (February 28th). A Science Motivation Camp for talented students was jointly held at the Institute with the Institute for Integrated Society Development. The students were taken round the Museum, Herbarium and Labs of the Institute. Lectures were also arranged for them. The Director gave away the prizes to the winners. The aim of holding such camps is to create interest of young students towards science.

Type and Figured specimens/slides/negatives

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

Particulars Types	Additions during 2000-2001	Total
Type and Figured Specimens	213	6,148
Type and Figured Slides	277	12,111
Negatives	290	16,047

New Collections

Specimens/samples were collected and deposited by the scientists from 108 localities for investigations as under:

	<i>Specimens</i>	<i>Samples</i>
Project-4	381	709
Project-5	506	16
Project-6	92	46

Project-7	336	501
Project-8	178	93
Project-9	-	208
Project-10	-	916
Project-11	-	83

In addition, the scientists under various sponsored projects running at the Institute also collected 324 samples.

Plant Fossils Gifted

Specimens to the following Centres/Institutions during the year were gifted:

Abroad -

Prof. Kazuhiko Uemura, Department of Geology
National Science Museum, 2-33-1-Hyakumin-
CHO, Shinzuku-Ku, Tokyo-169.

Within the Country -

The Head, Zakir Husain College, L.N.L. Marg, Delhi
University, Delhi

The Head, Department of Botany, Dharmarao
College of Science, Aheri, Maharashtra

The Head, Department of Botany, SKVT College,
Anada Gardens, Rajmundry (Andhra Pradesh)
Department of Museology, University Museum of
Science, AMU, Aligarh

The Head, Department of Botany, ASC College,
Taloda, Maharashtra

The Principal, Sarojini Naidu Govt. Girls PG
College, Shivaji Nagar, Bhopal

The Principal, Govt. CHD College, Maharajpur
District, Chhatarpur, M. P.

Institutional Visitors

Student of Botany Department, Dibrugarh University,
Assam

Student of Botany Department, Delhi University,
New Delhi

Teachers attending Refresher Course, Academic Staff
College, Lucknow University

Student of Kendrya Vidyalaya, Gomtinagar,
Lucknow

Student of Botany Department, Vidya Sagar College
for Women, Kolkata

Herbarium

During the period about 900 plant specimens, 30 wood blocks, 400 polleniferous materials and 400 samples of fruits and seeds were added in the Herbarium from east Sidhi Forest Division (MP). All these plant materials were processed, identified, registered and incorporated in their respective sections and families. Correction in inventory of Carpothek is being done. Preparation of cards and data feeding work for preparation of inventory of Sporotheke and Xylarium are in progress.

Holdings:—

Particulars	Additions during 2000-2001	Total
Herbarium		
Plant specimens	900	17,821
Leaf specimens	50	570
Laminated mounts of venation pattern	10	50
Xylarium		
Wood blocks	30	4,089
Wood discs	5	65
Wood cores	438	1,470
Wood slides	-	4,146
Palm slides (Stem, leaf, petiole, root)	-	3,195
Sporotheke		
Polleniferous materials	400	1,790
Pollen slides	25	11,739
Carpothek		
Fruits/Seeds	432	3,358

Show Cases installed

Display of herbarium sheets of Professor Birbal Sahni's collection, 1941

Display of specimens of Professor K.N. Kaul's gift, 1934-1961

Display of herbarium sheets representing Indo-Japanese Expedition, 1960

Display of Photographs

Photographs bearing the dominant taxa contrib-

uting air borne pollen in Lucknow.

Photographs of Antarctica Expedition—1999-2000.

Herbarium facilities provided to

Mr. Praveen Sarkar, Department of Environmental Science, Gurukul Kangri University, Haridwar (UP).

Dr. H.O. Sharma, Government KRG College, Gwalior (MP)

Dr. Rakesh Kumar, F.G.P.G. College, Rai Bareilly (UP)

Dr. R.B. Srivastava, Department of Botany, M.S.P.G. College, Muzafferpur (Bihar)

Dr. M.P. Verma, Department of Botany, L.N.T. College, Muzafferpur (Bihar)

Dr. K.L. Meena, Silviculturist, Sal Region, Haldwani Forest Division, Nainital (Uttarakhand)

Mr. C.B. Chhimwal, Silviculture Research Office, Sal Region, Haldwani, Nainital (Uttarakhand)

Mr. R.K. Singh, St. Andrew's College, Gorakhpur (UP).

Distinguish visitors

Dr. Dorian Q. Fuer, Institute of Archaeology, University College, London.

Mr. Pierre Bourgue, Mayor of Montreal, Canada.

Mr. Robert Smith, Advisor of the Mayor, City of Montreal, Canada.

Mr. U. Srivastava, President, Board of Trustees, Bharat Bhawan Foundation, Montreal, Canada.

Mr. C.B. Singh, Motri Dom, West Montreal, Bharat Bhawan Foundation, Montreal, Canada.

Mr. S.C. Rai, Mayor of Lucknow, India.

Prof. S.N. Bhattacharya, Department of Museology, University of Calcutta, Kolkata, (WB).

Institutional Visitors

Students of Botany Department, L.N.T. College, Muzafferpur, Bihar.

Team of Silviculture Scientists, Sal Region Haldwani Forest Division, Nainital.

Students of J.K.M. Inter College, Kanpur.

Teachers attending Refresher course, Academic Staff College, Lucknow University, Lucknow.

Electronic Data Processing

Proxy, Mail, DNS and Backup Servers are successfully configured on Windows NT platform. Proxy Server provides the Internet security from unauthorized access and it will also control the access authority at the workstation. External hosts do not connect directly to clients in Institute Network. The client communicates with the proxy server, which in turn relays approved client requests to servers and then relays responses back to clients. E-mails accounts for scientists, units/sections have been opened through Mail Server using Institute Domain Name (i.e. BSIP.RES.IN). The cabling work of Local Area Network (LAN) completed and it provides the Internet Connectivity in the Institute at the 60 nodes. At present 29 Pentium Computers are connected through LAN which Provides 24 hrs. Internet facility to the Institute employees through 64 KBPS leased line internet connection. This year Institute procured six Pentium-III 866 MHz computers, six inkjet printers, six 500VA offline UPS, three HP laser Jet printers and one internal CD-writer.

Menu driven Software package using dBase–III+ has been developed for inventory management of the store. It will keep record of consumable and non-consumable items and will facilitate the issue-return system of the stores. Through it, we can get status of any items, current holding of any individual or section and we generate several reports like total issue/return from an individual or section, re-order an item, generate “no dues certificate” etc. A windows based software package in Visual Basic 6.0 with MS-Access RDBMS for Museum is being prepared. It will keep the computerized data of fossil specimens. This will help in generating various reports like photography slips for details of type and figured specimens, locality data forms and the status of restricted toposheets.

Payroll / pension packages developed for accounts section have been modified as per their latest requirements and the yearly report/ audit report/ balance sheet for the Year 2000-2001 have been prepared. The Unit has provided constant support to the scientific staff of the Institute in preparing charts, tables, graphic presentations, manuscripts etc.

Section Cutting Unit

Section Cutting Unit is one of the important units of the Institute where fossil and rock samples are cut and their thin sections are made. During the year about 400 slices and 600 slides of thin sections of fossil material were prepared for detailed investigation as per requirements of the scientists.

An automatic polishing machine with hydraulic vacuum system was added to the unit. The machine was designed and fabricated indigenously. A number of scientists and students who visited the Institute also visited the Unit. They were briefed about various machines available and steps involved in preparation of thin sections.

Foundation Day and Founder's Day

On September 10, 2000 the Foundation Day of the Institute was celebrated. On this occasion Professor K.B. Powar, Secretary General, Association of Indian Universities, New Delhi delivered 'Fourth Golden Jubilee Commemoration Lecture' on the topic "*Research in the Universities and linkages with National Institutions*". Professor Ashok Sahni, FNA, Chairman, Governing Body of the Institute presided over the function. Many guests and scientists from and outside Institute attended the function.

On November 14, 2000—the Founder's Day, the Institute's staff and distinguished guests from other organisations offered *Pushpanjali* on the *Samadhi* of the Founder Professor Birbal Sahni, FRS in the campus. Same day, two memorial lectures were organised :

Shri B.C. Bora,
Chairman-cum-Managing Di-

rector, Oil and Natural Gas Corporation Limited, New Delhi delivered the '30th Birbal Sahni Memorial Lecture' on the topic "*Fossil fuels and energy security*".

†Dr. S.S. Raghuvanshi, Ex-Professor of Botany, Lucknow University, Lucknow delivered the '46th Sir Albert Charles Seward Memorial Lecture' entitled "*Some frontline areas in Biology*". The Chairman, Governing Body of the Institute presided over the function.



A view of Foundation Day function

National Science Day

On February 28, 2001 National Science Day was celebrated on the theme "*Information Technology for Science Education*" on a low profile due to earth quake in Gujarat. An exhibition on earth quake, its

genesis and precautionary measures was created at the Institute. The students and general public were highly appreciated the exhibition. The local media both print and electronic covered the event.

Distinguished Visitors

Mr. Pierre Bouraque

Mayor of Montreal,
Canada

Dr. S.C. Rai

Mayor of Lucknow,
India

Mr. Robert Smith

Advisor to the Mayor of Montreal,
Canada

Mr. C.B. Singh

Bharat Bhavan,
Montreal,
Canada

Prof. K.B. Powar

Secretary General,
Association of Indian Universities,
New Delhi.

Mr. B.C. Bora

CMD,
Oil and Natural Gas Corporation,
New Delhi

†Dr. S.S. Raghuvanshi

Ex Professor of Botany,
Lucknow University,
Lucknow

Professor M. Kedves

J.A. University,
Szeged,
Hungary

Professor B.B. Lal

Ex-DG,
Archaeological Survey of India,
New Delhi

Status of Official Language

To promote the usage of Hindi in official work, many concrete steps were taken. Institute continued to be an active member of city's Official Language Implementation Committee (*Nagar Rajbhasha Karyanvayan Samiti*— NARAKAS), Unit- 6. Four meetings of the Institute's *Rajbhasha Samiti* were held during the year. Samiti has unanimously decided to enhance the use of official language in various departments/sections of the Institute and to interact with other scientific organisations in this regard.

Abstracts of the research papers for the volume 49, nos. 1, 2 & 3 of the Institute's journal '*The Palaeobotanist*' were translated in Hindi for publication. Annual Report of the Institute for the year 1999-2000 was documented in Hindi. The report received a 'Shield' and a 'Commemoration Certificate' from the Chairman, NARAKAS during its 45th half-yearly meeting held at Central Drug Research Institute, Lucknow. Hindi section of the BSIP Newsletter (June – 2000) was also processed.

As per the instructions of the Department of Science and Technology, Govt. of India "Reply of the questionnaire for parliamentary material on reservation for and employment of SCs and STs in various central institutions/organisations of the DST" was prepared on Microsoft Word and the same was sent to DST, New Delhi along with its English version. Four quarterly reports and one annual report consisting of the information regarding Hindi activities of the Institute were prepared on MS Word and sent to DST. Two half-yearly Reports were also prepared on MS Word and sent to the NARAKAS, Lucknow. During the year, Institute participated in two half-yearly meetings of the NARAKAS.

For doing maximum work in Hindi in the Institute, cash prizes were given away by Professor Ashok Sahni, Chairman, Governing Body on the occasion of Founders Day (November 14th). In this category, two 1st prizes (Rs. 1000/- each) were given to Dr. Anand Prakash and Dr. K.S. Saraswat, three 2nd prizes (Rs. 600/- each) were received by Drs.

(Mrs.) Usha Bajpai, Dr. (Mrs.) Rashmi Srivastava and Sri H.S. Srivastava, and five 3rd prizes (Rs. 300/- each) went to Dr. (Mrs.) Alpana Singh, Sri Chandra Pal, Sri Chandra Bali, Sri Gopal Singh and Sri K.C. Chandola.

Hindi Terminology

During the year one Hindi term has been on display daily. For this purpose, with the help of multilingual software, a database was prepared on computer.

Hindi Fortnight

During September 14-28, 2000 *Hindi fortnight* was organised, in which staff of the Institute participated in a befitting manner. The contest inauguration ceremony was held on 16th September and the function was presided over by Professor A.K. Sinha, Director. Noted literateur and Historian of Lucknow city, Shri Yogesh Praveen graced the occasion as Chief Guest. His lecture on "*Lucknow ke vikas mein Nariyon ka yogdan*" was very well appreciated. On this occasion a 'debate' on the topic "*Mahila arakshan ki upadeyata*" was also held. The first, second and third winners were Dr. S.A. Jafar, Mrs. Rita Banerjee and Sri Madhavendra Singh respectively.

On 19th September "*Hindi noting and Précis writing*" contest was held in which Dr. K.J. Singh, Sri Avinesh K. Srivastava and Dr. D.C. Saini were the 1st, 2nd and 3rd prize winners respectively. An 'essay contest' on the topic "*Ikkeesween shatee mein soochna praudyogiki*" was held on 20th September. The top two positions went to Sri Syed R. Ali (1st), Ms. Kiran Verma (2nd) and Sri Madhavendra Singh, Ms. Anjali Dixit and Sri K.C. Chandola shared third place. On 22nd September a '*Prashnamanch* contest' was organised among seven teams, namely *Gomti, Brahmaputra, Kaveri, Narmada, Tapti, Ganga* and *Sutlej*. Each of the team had one person each from Scientific, Technical and Administrative staff. The winning team was *Gomti* (members: Dr. Rakesh Saxena, Sri Avinesh K. Srivastava and Sri Avinash

K. Srivastava). *Brahmaputra* team (members: Dr. A.K. Ghosh, Sri S.K. Manna and Sri S.S. Panwar) got the second position, while *Kaveri* team (members: Dr. Rahul Garg, Sri V.K. Singh and Sri M. Pillai) received the third prize. 'Hindi Elocution contest' was held on 25th September. The winners were Dr. K.J. Singh (1st), Sri K.C. Chandola (2nd) and Dr. Rakesh Saxena and Mrs. Rita Banerjee (jointly 3rd). On 26th September, a 'Hindi Terminology contest' was held in which Sri. V.K. Singh, Ms. Kiran Verma and Mrs. Ruchita Bose secured 1st, 2nd and 3rd positions respectively. *Hindi fortnight* was concluded on 28th September. On this day, all first prize winning entries were put on display. On the Founder's Day (Nov 14th), the winners of various activities of the *Hindi fortnight* were awarded a medal and a certificate each.

Miscellaneous

Based on a survey on status of Hindi knowledge of Institute, information was sent to the Department of Official Language. It was found that more than 90% of Institute staff (excluding class 'D') has working knowledge of or proficiency in Hindi. A summary for a popular book on *Palaeobotany and related aspects* was processed for publication proposal. In addition, various administrative forms of the Institute were made bilingual and a number of official Hindi letters were drafted. For the different exhibitions, various museum write-ups, labels, hoardings, folders, hand-outs, etc. were translated in Hindi. Dr. Puneet Bisaria provided assistance to Mr. Sanjai Gaur of Lucknow University to prepare a practical book on functional Hindi.



A view of *Hindi Pakhwara* celebrations

Reservations and Concessions

To provide adequate representation to Scheduled Castes and Scheduled Tribes and Other Backward Classes for posts meant for direct recruitment, the General Reservation Orders of the Government of India as applicable to Autonomous Bodies and as amended from time to time have been sincerely being followed by the Institute. The Roster for reservation of Scheduled Castes and Scheduled Tribes and other Backward Classes is maintained by

post-based Roster as directives of the Government of India, Department of Personnel and exempted from the purview of the General Reservation Orders.

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

The Staff

Director

Professor Anshu K. Sinha

Scientists

(The names are in alphabetical order according to 'surnames')

Scientist 'G'

Dr Govindraja Rajagopalan

Scientist 'F'

Dr (Ms) Jayasri Banerji
Dr Anil Chandra
Dr (Mrs) Shaila Chandra
Dr Kripa S. Saraswat
Dr (Mrs) Chhaya Sharma

Scientist 'E'

Dr Krishna Ambwani
Dr Rahul Garg
Dr Jaswant S. Guleria
Dr Ramesh K. Saxena
Dr Manoj Shukla
Dr Ashwini K. Srivastava
Dr Gajendra P. Srivastava
Dr (Mrs) Archana Tripathi
Dr (Ms) Vijaya

Scientist 'D'

Dr Anil Agarwal
Dr (Mrs) Usha Bajpai
Dr (Mrs) Neerja Jha
Dr (Mrs) Asha Khandelwal
Dr Jagannath P. Mandal
Dr Basant K. Misra
Dr Chandra M. Nautiyal
Dr Ram Awatar
Dr Mulagalapalli R. Rao
Dr Samir Sarkar
Dr Rakesh Saxena
Dr Rama S. Singh
Dr (Mrs) Chanchala Srivastava
Dr Shyam C. Srivastava
Dr S.K.M. Tripathi
Dr Ram R. Yadav

Scientist 'C'

Dr Rupendra Babu
Dr Samir K. Bera
Dr Amalava Bhattacharyya
Dr Anant P. Bhattacharyya
Dr Mohan S. Chauhan
Dr (Ms) Asha Gupta
Dr Brijendra N. Jana
Dr Khowaja Ateequzzaman
Dr Madhav Kumar
Dr Bhagwan D. Mandaokar
Dr Kindu L. Meena
Dr Rakesh C. Mehrotra
Dr (Mrs) Neeru Prakash
Dr Mahesh Prasad
Dr (Mrs) Jyotsana Rai
Dr Annamraju Rajanikanth
Dr Dinesh C. Saini
Dr Omprakash S. Sarate
Dr Mukund Sharma
Dr (Mrs) Alpana Singh
Dr Bhagwan D. Singh
Dr Kamal J. Singh
Dr (Mrs) Rashmi Srivastava
Dr (Mrs) Rajni Tewari
Dr Gyanendra K. Trivedi

Scientist 'A'

Dr (Mrs) Anjum Farooqui
Dr Amit K. Ghosh
Dr (Mrs) Vandana Prasad

Sponsored Project

Miss Debi Dutta, JRF (till 11.10.2000)
Mr Jagdish Prasad,
Field/Lab Attendant (till 13.06.2000)
Dr Vandana Chowdhuri, Research Associate
Mr Parminder S. Ranhotra, JRF
Miss Anjali Dixit, JRF
Mr Sandeep Bisaria, Lab Assistant
Mr Jayendra Singh, Project Assistant
Dr. Ratan Kar, Research Associate
Miss Kiran Verma, JRF (resigned w.e.f.
17.11.2000)

Technical Personnel

Publication

Mr R.L. Mehra (Technical Assistant 'E')
Mr Syed R. Ali (Technical Assistant 'D')

Library

Mrs Kavita Kumar (Technical Officer 'A')
Mr V.K. Nigam (Technical Assistant 'E')
Mr S. K. Manna (Technical Assistant 'D')
Mr Dharendra Sharma (Technical Assistant 'D')
Mr S.R. Yadav (Technical Assistant 'C')
Mr Avanish Kumar (Technical Assistant 'B')

Museum

Mr P.K. Bajpai (Technical Officer 'C')
Mrs Sunita Khanna (Technical Officer 'A')
Mr Prem Prakash (Technical Officer 'A')
Mr S.K. Singh (Technical Assistant 'D')
Mr R.K. Tantua (Technical Assistant 'D')
Mr Pawan Kumar (Technical Assistant 'A')

Herbarium

Mr S.M. Vethanayagam (Technical Assistant 'D')

Photography

Mr Pradeep Mohan (Technical Officer 'A')
Mr D.S. Bisht (Technical Assistant 'D')

Laboratory Services

Dr B. Sekar (Technical Officer 'D')
Dr (Mrs) Madhabi Chakraborty (Technical Officer 'B')
Mrs Indra Goel (Technical Officer 'B')
Mrs Asha Guleria (Technical Officer 'B')
Dr E.G. Khare (Technical Officer 'B')
Mr T.K. Mandal (Technical Officer 'B')
Mr. V.K. Singh (Technical Officer 'B')
Mrs Reeta Banerjee (Technical Officer 'A')
Mr Chandra Pal (Technical Officer 'A')
Mr V.P. Singh (Technical Officer 'A')
Mr A.K. Srivastava (Technical Officer 'A')
Mr R.C. Mishra (Technical Officer 'A')
Mr Keshav Ram (Technical Assistant 'E')
Mr Shreerupa Goswami (Technical Assistant 'D')
Mr S. Suresh K. Pillai (Technical Assistant 'D')

Technical Services

Mr P.S. Katiyar (Technical Officer 'B')
Mr Madhukar Arvind (Technical Assistant 'E')
Mr A.K. Ghosh (Technical Assistant 'E')
Mr V.S. Panwar (Technical Assistant 'E')
Mr Y.P. Singh (Technical Assistant 'E')
Mr D.K. Pal (Technical Assistant 'D')
Mr Madhavendra Singh (Technical Assistant 'D')
Mr Chandra Bali (Technical Assistant 'C')
Mr C.L. Verma (Technical Assistant 'C')
Mr M.S. Rana (Technical Assistant 'B')
Mr S.C. Singh (Technical Assistant 'B')
Mr A.K. Srivastava (Technical Assistant 'B')
Mr Om Prakash Yadav (Technical Assistant 'A')

Administrative Personnel

Registrar

Mr S.C. Bajpai

Accounts Officer

Mr J.C. Singh

PS to Director

Mrs M. Jagath Janani
(Officiating)

Section Officers

Mr I.J. Mehra
Mr R.K. Takru
Mr Ramesh Chandra
Mr N.N. Joshi

Maintenance Officer

Mr R.B. Kukreti

Accountant

Mr I.J.S. Bedi

Assistants

Mr R.K. Kapoor
Mrs V. Nirmala
Mr Dhoom Singh
Mrs Ruchita Bose
Mrs Usha Chandra
Mrs P. Thomas

Hindi Translator

Dr. Puneet Bisaria

Upper Division Clerks

Mr Hari Lal
Mr Koshy Thomas
Mrs Swapna Mazumdar
Mr K.P. Singh
Mr Gopal Singh
Mr M. Pillai
Mr N. Unnikannan
Mrs Shail S. Rathore
Mrs Renu Srivastava
Mr Mishri Lal
Mr S.S. Panwar

Lower Division Clerks

Mr Rameshwar Prasad
Mr Avinash K. Srivastava
Ms Chitra Chatterjee
Mr. Akhil Antal

Drivers

Mr Nafees Ahmed ('II')
Mr D.K. Misra ('I')
Mr V.P. Singh ('I')
Mr M.M. Mishra ('I')
Mr. P.K. Misra ('I')

Attendants 'III' (SG)

Mr Raja Ram

Attendants 'III'

Mr Satruhan
Mr Sunder Lal
Mr Prem Chandra

Mr K.C. Chandola
Mr Haradhan Mohanti
Mr Ram Singh
Mr Kesho Ram
Mr Ram Deen
Mr Ram Kishan

Attendants 'II'

Mrs Munni
Mr Sri Ram
Mr Bam Singh
Mr Kedar N. Yadav
Mrs Maya Devi
Mr Kailash Nath
Mr Mohammad Shakil
Mr Mani Lal Pal

Attendants 'I'

Mr Ram Ujagar
Mr Ram Dheeraj
Mr K.K. Bajpai
Mr Dhan B. Kunwar
Mr Hari Kishan
Mr S.C. Mishra
Mr V.S. Gaikwad
Mr Ramesh Kumar
Mr R.K. Awasthi
Mr Inder Kumar
Mr Deepak Kumar
Mrs Ram Kali

Mali

Mr Rameshwar Prasad Pal ('III')
Mr Mathura Prasad ('I')
Mr Ram Chander ('I')
Mr Ram Kewal ('I')

Appointments and Promotions

Appointments

Mr. Saurabh Pradhan, Technical Assistant 'A' w.e.f. 21.11.2000.
Miss Nandani, Attendant 'I' w.e.f. 15.05.2000.
Mrs. Beena, Attendant 'I' w.e.f. 30.03.2001.

Promotions

Dr. (Ms) Jayasri Banerji Scientist 'F', w.e.f. 01.04.2000.
Dr. Kripa S. Saraswat Scientist 'F', w.e.f. 01.04.2000.
Dr. Vijaya, Scientist 'E' w.e.f. 01.04.2000.
Dr. Jaswant S. Guleria, Scientist 'E' w.e.f. 01.04.2000.
Dr. Rakesh Saxena, Scientist 'D' w.e.f. 01.04.2000.
Dr. (Mrs.) Chanchala Srivastava, Scientist 'D' w.e.f. 01.04.2000.
Dr. Ram Awatar, Scientist 'D' w.e.f. 01.04.2000.

Dr. B. Sekar, Technical Officer 'D' w.e.f. 01.04.2000.
Mr. P.K. Bajpai, Technical Officer 'C' w.e.f. 01.04.2000.
Mr. R.C. Mishra, Technical Officer 'A' w.e.f. 01.04.2000.
Mr. Pradeep Mohan, Technical Officer 'A' w.e.f. 01.04.2000.
Mr. M.S. Rana, Technical Assistant 'B' w.e.f. 01.04.2000.
Mr. Ajay K. Srivastava, Technical Assistant 'B' w.e.f. 01.04.2000.

Mr. S.C. Singh, Technical Assistant 'B' w.e.f. 01.04.2000.

Mr. Avanish Kumar, Technical Assistant 'B' w.e.f. 01.04.2000.

Mr. Mishri Lal, UDC w.e.f. 01.06.2000.

Mr. S.S. Panwar, UDC w.e.f. 01.06.2000.

Mrs. S.S. Rathore, UDC w.e.f. 01.06.2000.

Mrs. Renu Srivastava, UDC w.e.f. 01.06.2000.

Mrs. Jagath Janani, Officiating PS to Director w.e.f. 01.11.2000.

Retirements

Dr. Pramod Kumar, Scientist 'D' retired on 30.04.2000 (AN).

Dr. Suresh C. Srivastava, Scientist 'F' retired on 30.06.2000 (AN).

Dr. Syed A. Jafar, Scientist 'F' voluntary retirement w.e.f. 30.11.2000 (AN).

Mr. H.S. Srivastava, Section Officer retired on 28.02.2001 (AN).

Dr. Anand Prakash, Scientist 'F' voluntary retirement w.e.f. 26.03.2001 (FN).

Termination

Mr. K. Nagapooshnam, Technical Officer 'B' services terminated w.e.f. 19.04.1998 (AN).

Obituary

Mr. Diwakar Pradhan, Technical Officer 'A' expired on 14.04.2000.

Research Papers published

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- Farooqui A 2000.** Leaf cuticular and epidermal traits and elemental status in *Rhizophora* species in a coastal wetland ecosystem. *Phytomorphology* 50(3&4): 317-325.
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AUDIT REPORT
to the Governing Body of the
Birbal Sahni Institute of Palaeobotany, Lucknow

We have audited the attached Balance Sheet of Birbal Sahni Institute of Palaeobotany, Lucknow, as at 31st March, 2001, Income and Expenditure Account and Receipt & Payment Account for the year ended on that date and subject to our comments and observations as given in attached Annexure 'A', we report that :-

In our opinion and to the best of our information and according to the explanations given to us the said accounts give a true and fair view :

- (i) In the case of Balance Sheet, of the State of affairs of the Institute as at 31st March, 2001.
- (ii) In the case of Income and Expenditure Account, of the excess/deficit of income over expenditure for the year then ended, and
- (iii) In the case of Receipt and Payment Account, of the receipts and payments of Institute for the year then ended.

For Singh Agarwal & Associates
Chartered Accountants

Date : 26.06.2001
Place : Lucknow

Sd/-
Mukesh K. Agarwal
(Partner)

ANNEXURE - 'A'

(Annexed to and forming part of the Audit Report for the year ended 31st March, 2001)
Comments/Audit Observations on Accounts of Birbal Sahni Institute of Palaeobotany, Lucknow
for the year ended 31st March, 2001

ACCOUNTS

1. The Institute is getting separate grants for Plan & Non-Plan expenses based on the budgets approved by the DST. During the year under report, the institute has utilised Rs. 1,48,10,000/= relating to non-plan head, from Plan head budget with the approval of its Governing Body. It seems that DST grant is not commensurate with the requirement of the Institute under non-plan.

2. Unsettled advances (capital head) pending for recovery/adjustment as on 31/3/2001 is that of Rs. 1,33,18,359/=. Out of this old unsettled advances, under the head "Research Apparatus & Equipment" and "books & journals" are to be properly taken care of at the Institute level for early adjustment.

LIBRARY

3. No physical verification of the library books was carried out by the management during the year under audit. It was explained to us, that as per Central Government Rules, the library stocks are physically verified after a time-gap of 5 years. Last physical verification was done in April, 1997 and the next is due in April, 2002. The periodicity of verification should be changed to a practical one.

PUBLICATIONS

4. On scrutiny of records of the priced publications of the Institute, it has been observed that during the last several years, the Institute had brought-out publications on different subjects with an objective to sell-out the same, in the market. The stock position of these priced publications as on 31.03.2001 was Rs.28.76 lacs apart from the reserved stock of Rs. 4.65 lacs. Thus the total stock of the publications stood at Rs. 33.41 lacs at the close of the year, which seems to be on higher side. Practical assessment has to be made for the quantity to be got printed together with its economics etc, so that wastage and blockage of funds can be avoided.

STORES

5. The Fixed Assets register & stores register is being maintained properly. Physical verification was last carried-out in 1999 but no authentication, in the form of signatures/ initials etc, was visible on the registers.

6. The Institute, being a non-profit earning organisation, no depreciation on fixed assets has been provided.

RESERVE FUND & PENSION FUND

7. Reserve Fund amounting to Rs. 126.51 lacs was utilised during the year with the approval of Governing Body. Pension Fund of Rs. 49.73 lacs is still not invested & continues to appear in the books as on 31.03.2001.

EMPLOYEES PROVIDENT FUND

8. As against the total reserves of Rs. 286.21 lacs against the Employees Provident Fund as on 31.03.2001, a sum of Rs. 255.37 lacs was invested with Nationalised Banks and other organisations as prescribed under the provisions of the Bye-Laws of the Institute.

*For Singh Agarwal & Associates
Chartered Accountants*

Date : 26.06.2001
Place : Lucknow

Sd/-
Mukesh K. Agarwal
(Partner)

Seriatim Replies to the comments offered by the Chartered Accountants on the final accounts of the Institutes for the Year 2000-2001

ACCOUNTS

1. The matter was taken up with the DST. However, the DST could release only Rs. 190.00 lacs under non-plan and hence the Institute had no option than using Plan funds to disburse the salary and pension relating to non-plan with the approval of the Governing Body.

2. The efforts are being made by the Institute to settle the outstanding advances of 1,33,18,359/=.

LIBRARY

3. The Library is holding more than 50,000 publications. For physical verification of Library books, the Institute follows the rules as applicable in other Government Organisations. As per these rules, next physical verification of Library books is due in April 2002.

PUBLICATIONS

4. As per the revised publications policy, the print order for the journal "The Palaeobotanist" has been reduced from 400 copies to 300 copies. Similarly, the copies of other publications to be printed are critically reviewed before giving print orders. The Institute is giving wide publicity to sell the old stock of publications. The stock of publications in future years will be considerably reduced.

STORES

5. The authentication was made by the Officer who conducted the physical verification as per normal practice.

6. No depreciation on fixed assets has been provided as per normal practice so far.

RESERVE FUND & PENSION FUND

7. Reserve Fund amounting to Rs.126.51 lacs was utilised with the approval of the GB for disbursement of salary and pension under non-plan.

EMPLOYEES PROVIDENT FUND

8. No comments.

Sd/-
J.C. Singh
(Accounts Officer)

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
Anshu K. Sinha
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow

Balance Sheet as at March 31, 2001

Fig. in Rupees

Previous Year 1999-2000	(Liabilities) Sources of Funds	Current Year 2000-2001
94885471	1. Capital Fund	101520471
17636058	2. Current Liability	2556240
0	3. Excess of Income	1908696
12650889	4. Reserve Fund	0
4942816	5. Pension Fund	4942816
877757	6. Donated Fund	890222
123185	7. Deposit Accounts	148686
26096917	8. General Provident Fund	28620765
157213093	Total	140587896

Previous Year 1999-2000	(Assets) Application of Fund	Current Year 2000-2001
	1. Fixed Assets	
84438618	I) Owned Assets	87660155
671075	II) Donated Assets	671075
192000	2. Investments	151000
13387481	3. Excess of Expend. over Income	0
14833297	4. Loans and Advances/Deposits	18542085
12650889	5. Reserve Fund	0
4942816	6. Pension Fund	4942816
26096917	7. General Provident Fund	28620765
157213093	Total	140587896

CERTIFICATE

Certified that the figures of Assets as shown in the Balance Sheet have been reconciled with the total figure of Assets shown in the relevant Registers of the Institute.

For Singh Agarwal & Associates

Chartered Accountants

Sd/-

Mukesh K. Agarwal
(Partner)

Sd/-

J.C. Singh
(Accounts Officer)

Sd/-

S.C. Bajpai
(Registrar)

Sd/-

Anshu K. Sinha
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow
Income and Expenditure Account for the year ending March 31, 2001

Fig. in Rupees

Previous Year 1999-2000			Summary	Current Year 2000-2001		
Plan	Non Plan	Total		Plan	Non Plan	Total
			Income			
26729844	17300000	44029844	1. Grants	25365000	31650889	57015889
0	361051	361051	2. R and D Receipts	0	561932	561932
0	50670	50670	3. Misc. Income & Recoveries	0	1571248	1571248
0	166753	166753	4. Interest	0	211354	211354
26729844	17878474	44608318	Total	25365000	33995423	59360423
			Expenditure :			
18477663	14043787	32521450	1. Pay & Allowances	16745415	19550471	36295886
638494	69641	708135	2. Academic Expenses	1147706	0	1147706
569260	32035	601295	3. Expenses on Units/Services Ancillary to Research	679773	7169	686942
559325	0	559325	4. Travelling Expenses	361121	0	361121
58540	301497	360037	5. Publication Expenses	21504	153532	175036
3189478	437358	3626836	6. Contingencies	3656207	708177	4364384
1532077	0	1532077	7. Maintenance & Repairs	1033171	0	1033171
1705007	2994156	4699163	Balance Carried Down	1720103	13576074	15296177
26729844	17878474	44608318	Total	25365000	33995423	59360423
1705007	2994156	4699163	Balance of Income & Expenditure	0	0	0
			Less Appropriation during the Year			
0	0	0	Reserve Fund	0	0	0
0	0	0	Pension Fund	0	0	0
			Balance Transferred to Capital Fund	1720103	13576074	15296177
1705007	2994156	4699163	Net Excess of Income over Expend.	1720103	13576074	15296177

For Singh Agarwal & Associates
Chartered Accountants
Sd/-
Mukesh K. Agarwal
(Partner)

Sd/-
J.C. Singh
(Accounts Officer)

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
Anshu K. Sinha
(Director)

Birbal Sahni Institute of Palaeobotany, Lucknow
Receipts and Payments Account for the year ending March 31, 2001

Fig. in Rupees

Receipts	Plan	Non-plan	Total	Payments	Plan	Non-plan	Total
To Opening Balance				By Fixed Assets	6104442	0	6104442
Bank Current Account							
Revenue & Capital	730	-17775145	-17774415	By Pay And Allowances	16745415	11736668	28482083
G.P.F.	0	0	0	By Retiring Expences	0	7813803	7813803
Deposit A/C Capital	100435	0	100435	By Academic Expenses	1147706	0	1147706
Revenue	22750	0	22750	By Expn Services/Units	679773	7169	686942
				Anciliary To Research			
Cash In Hand	0	491	491	By Travelling Expenses	361121	0	361121
				By Publication Expenses	21504	153532	175036
Donation Account	0	14681	14681	By Maintenance & Repairs	1033171	0	1033171
To Project Accounts				By Contingencies	3656207	708177	4364384
Opening Balance	1360200	0	1360200	By Advances	1720000	103500	1823500
Grants	607674	0	607674	By General Provident Fund	284266	7425158	7709424
To Grants :	32000000	19000000	51000000	By Miscellaneous Payment	86575	3970073	4056648
To Refund Of Cnr Advance	0	0	0				
To Donation And Endowment				By Investment/Appropriation Fund	12650889	0	12650889
Maturity	0	41000	41000	By Deposit Account	12500	0	12500
Interest	0	12465	12465	By Project Account	1734107	0	1734107
To R & D Receipts	0	561932	561932	By Donation Account	0	0	0
To Admn. Receipts	370841	12588239	12959080	By Closing Cash & Bank Balances			
To Deposit Account	49401	0	49401	Deposit Account (C.n.r.)	130936	0	130936
To Interest	0	6212	6212	Current Account(capital)	541958	0	541958
To Misc Income & Recovery	0	1569599	1569599	Deposit Account (Revenue)	17750	0	17750
To Pension Fund				G.p.f	0	0	0
Opening Balance	0	4942816	4942816	Current Account (Revenue)	833	-3316042	-3315209
Addition	0	0	0	Cash In Hand	0	179	179
To Reserve Fund				Donation Account	0	68146	68146
Opening Balance	12650889	0	12650889	Project Accounts	233767	0	233767
Addition	0	12650889	12650889	Pension Fund	0	4942816	4942816
To Other Receipt	0	0	0	Reserve Fund	0	0	0
Total	47162920	33613179	80776099	Total	47162920	33613179	80776099

For Singh Agarwal & Associates
Chartered Accountants
Sd/-
Mukesh K. Agarwal
(Partner)

Sd/-
J.C. Singh
(Accounts Officer)

Sd/-
S.C. Bajpai
(Registrar)

Sd/-
Anshu K. Sinha
(Director)

ANNUAL REPORT
2000-2001

© BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY, LUCKNOW 226 007, (U.P.) INDIA

Compiled by

Research Planning and Coordination Cell

Produced by

Publication Unit

Published by

The Director

Birbal Sahni Institute of Palaeobotany

Lucknow 226 007

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Front Cover : Plant Fossil heritage of Rajmahal Hills, Jharkhand (Courtesy-Museum).

Back Cover : *In situ* Petrified Wood in Rajmahal Hills, Jharkhand (Courtesy-Prof. A.K. Sinha).

Printed at : Dream Sketch, 29 Brahm Nagar, Lucknow 226 020 Ph: 368630

November 2001

Acknowledgements

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

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Preface

The Birbal Sahni Institute of Palaeobotany, Lucknow is a foremost research institution committed to dissemination of palaeobotanical knowledge. The organisation has a long tradition of collaborative research both at regional and global level. Research programmes have been reoriented to focus on the topical aspects of fossil plant study and its applications. Inter-disciplinary approach has been adopted to generate new data and novel interpretative outcome. The Institute functions as an autonomous organisation under the Department of Science and Technology, Ministry of Science and Technology, Government of India.

Research challenges and problems in the chosen area of scientific search have been formulated under five identified thrust areas and thirteen research projects. Methodologies of studies have been interpolated with state of the art equipment and technological know-how. Selected aspects of plant evolution, palaeoclimate, palaeo-palynology, coal-petrology, isotope investigation, stratigraphic and tectonic studies have been provided a new momentum and inquiry.

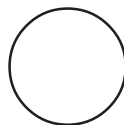
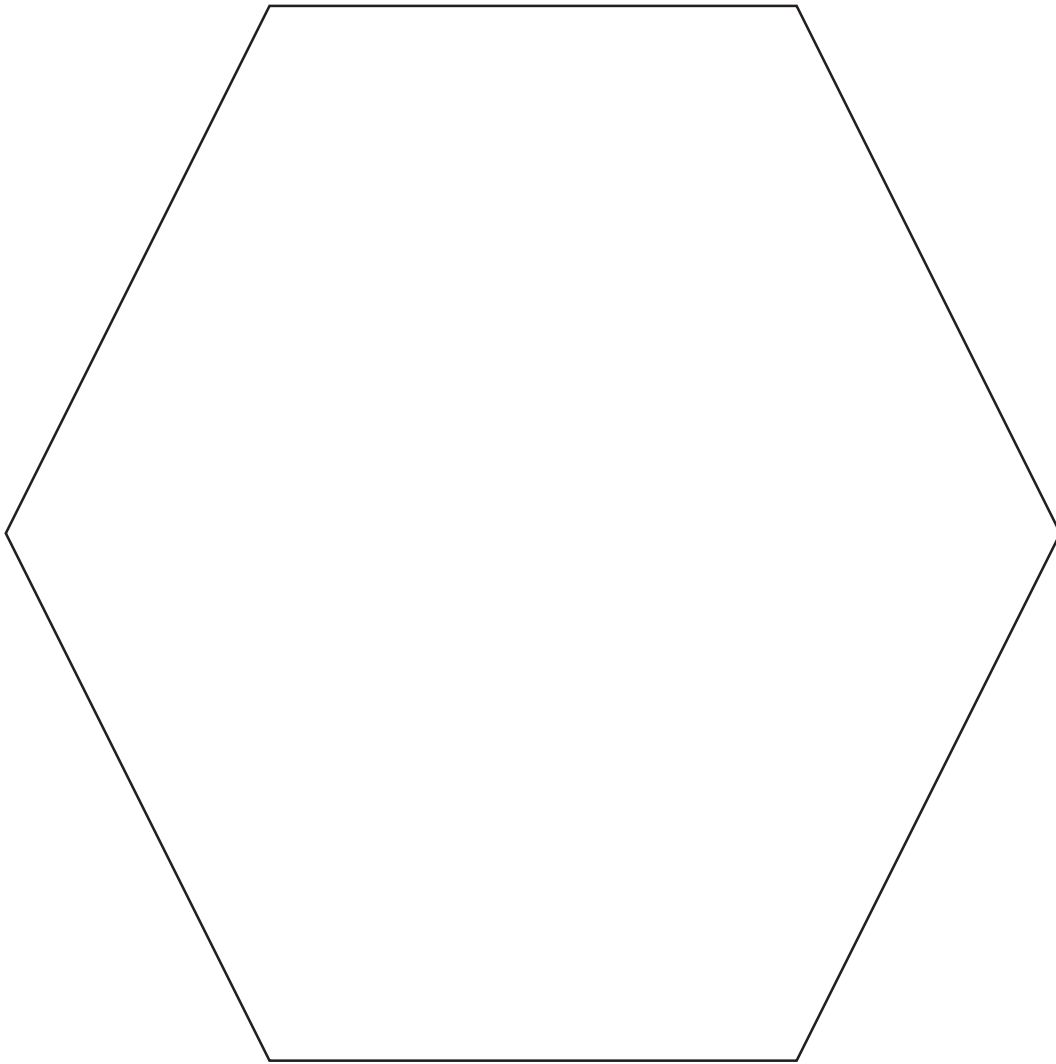
Individual, group and collaborative efforts have been encouraged to broad-base the anticipated research output. External agencies have also been extended Institute's expertise in the form of consultancy, contract research and training. Besides, scientist's experience has been utilised in advising establishment of national fossil parks and their importance in eco-tourism.

I am extremely happy to forward this report, depicting participatory involvement at various levels. The advice and guidance of the Governing Body and the Research Advisory Council has been a constant inspiration to accomplish target oriented tasks. The help extended by project co-ordinators and senior scientists is appreciated. Untiring inputs by the members of Research Planning and Coordination Cell ; Publication Unit, Museum and other scientific, technical and administrative staff helped to bring out this document. I thankfully acknowledge their co-operation.

Anshu K. Sinha
Director

ANNUAL REPORT

2000-2001



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BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY, LUCKNOW
(An Autonomous Institute under Department of Science and Technology, Government of India)

Executive Summary

The Birbal Sahni Institute of Palaeobotany, Lucknow, a premier research organization dealing with academic and applied aspects of palaeobotany is carrying out research activities during the period 2000-2001 in 13 projects of IX Five Year Plan under the following Thrust Area Programmes:

1. Antiquity of Life
2. Gondwana Supercontinent: Regional geology, floristics, terrane accretion, plate tectonics and configuration
3. Biopetrology of Indian coals in relation to coal bed methane
4. Floristics of petroliferous basins
5. Quaternary vegetation, climate and monsoon

In the year 2000-2001, 74 research papers and 48 abstracts were published and 50 papers were accepted for publication. 8 scientists were deputed to attend International conferences, while 18 scientists attended the conferences organized in the country. Scientists in various conferences presented 32 research papers.

Important Research Contributions

The main research work is concerned with the understanding of plant evolution through geological time. Emphasis has been made to derive knowledge about the diversification of Pre-Cambrian life, diversity, distribution and inter-basinal correlation of Gondwana and Tertiary flora and to understand interaction between the climate and change of vegetation in Quaternary Period.

- A reasonably diversified macrofossil assemblage consisting of *Longfengshania*, *Tawuia*, and thallophyte algae has been recorded in Kurnool Group. Organic Walled Microfossils (OWM) from Chhatisgarh Basin exhibit distinctive size variation through stratigraphy.

- Himalayan mountain building is the product of collision of Indian and Eurasian plates beginning in Eocene. It is suggested that Karakoram terrane was included to Asia during Late Jurassic-Early Cretaceous.
- In the Permian deposits of NE Himalaya plant megafossils and microfossils occur along with *Botryococcus* colony. Pollen assemblages of Middle Jurassic-Early Cretaceous age (Spiti Shale) are correlated with Ammonite zones.
- Plant assemblages of Satpura and Mand Raigarh coalfields indicate the presence of Karharbari floral elements in Lower Barakar and their disappearance in Upper Barakar flora.
- Petrological studies on coals of Kargali Seam, Bokaro coalfield indicate its composition and rank within the threshold of methane (thermogenic) generation. Coals of Makhum and Dilli Jaypore coalfields originated from woody tropical vegetation under mildly alkaline, anoxic milieu.
- Similarity of Intertrappean flora of Kachchh with that of Central India suggests that the two floras are coeval. The occurrence of moisture loving elements signifies tropical climate with plenty of rainfall during the deposition.
- Kasauli Formation (H.P.) has yielded well-preserved leaf impressions. Drastic change in the climate during upper part of Middle Siwalik has been suggested due to presence of *Ctenolophon* pollen.
- Palynoflora of Miocene deposits of Ratnagiri indicates nearshore environments with fair representation of mangrove plants.
- Integration of dinoflagellate cyst data with other fossil and stratigraphic parameters has helped in establishing a sequence stratigraphy for Late Palaeocene deposits of Meghalaya which were

deposited in sea level highstand. Siju Formation was deposited in tropical warm-humid climate with mangrove vegetation in the coastal zone of the shallow sea.

- Pollen data set of the Himalaya has been utilized to prepare global maps of biomes at 6000 and 18000 years B.P.
- In Shahdol district (M.P.) the establishment of modern Sal forest has been dated around 3000 years BP.
- Concentration of heavy metals, particularly arsenic (50 - 100 µg/g), lead (400 - 1000 µg/g) and copper (80 - 400 µg/g) have been found in the sediments of Adyar estuary. Anthropogenic factors are decreasing the biodiversity in the area.
- Record of lichen (*Evermistrum cirrhatum*) from a cultural horizon of 1300–800 B.C. indicates its use in spices and medicines in ancient time. There is evidence for use of Putranjeeva (*Drypetes roxburghii*) nuts in necklace during the same period.
- Tree-ring chronology has helped in establishing chronology and climate variation dating back to AD 1721-1998 in different parts of the Himalaya.
- Pollen analysis of the sediments of Priyadarshini Lake, Antarctica revealed existence of Early Holocene vegetation in the region. Presence of arboreal pollen indicates long transport through upthermic winds.
- Determination of radiocarbon dates along with pollen studies has helped in understanding changes in vegetation history of Holocene.
- The finding of resin embedded insect fossils discovered by Institute's scientists was highlighted by *Nature News India*.

Some significant research publications

Banerjee J 2000. Occurrence of angiosperm remains in an Early Cretaceous Intertrappean bed,

Rajmahal Basin, India. *Cret. Res.*, United Kingdom 21: 781-784.

Garg R & Khowaja-Ateequzzaman 2000. Dinoflagellate cysts from the Lakadong Sandstone from Cherrapunji area: biostratigraphical and palaeoenvironmental significance and relevance to sea level changes in the Upper Palaeocene of Khasi Hills, South Shilong Plateau, India. *Palaeobotanist* 49 : 461-484.

Tripathi A 2001. Permian, Jurassic and Early Cretaceous palynological assemblages from subsurface sediments in Chuperbhita coalfield, Rajmahal Basin, India. *Rev. Palaeobot. Palynol.*, Amsterdam 113 : 237-259.

Upadhyay R, Chandra R, Sinha AK, Kar RK, Chandra S, Jha N & Rai H 2000. Discovery of Gondwana plant fossils and palynomorphs of Late Asselian (Early Permian) age in the Karakoram Block. *Terra Nova*, Oxford 11: 278-283.

Vijaya 2000. Palynology of the Jurassic-Cretaceous transition in the Rajmahal Formation, W.B., India. *Alcheringa*, Australia 24: 125-133.

Yadav RR & Park W-K 2000. Precipitation reconstruction using ring-width chronology of Himalayan cedar from western Himalaya: preliminary results. *Proc. Indian Acad. Sci. (Earth Planet. Sci.)* 109(3): 339-345.

Important Achievements

Antarctica Expedition— One scientist participated in 20th Indian Antarctica Expedition from December 23, 2000 to March 22, 2001. Collected a large number of palynological samples including moss trufs, frozen soil, dry algal mat, moraine, lake water, snow and blue ice from different lake sites, valleys, nunataks and Polar ice bed in and around Schirmacher oasis of East Antarctica. A lake sediment profile from 'Long Lake', 3 Km west of Priyadarshini lake was also procured. During the expedition, daily air sampling was done by exposing glycerine smeared slides using Burkard air sampler.

Forensic Palynology— A draft paper on the objectives and the setting of Forensic Palynology Lab in the Institute is prepared. Prof. Mildenhall – an internationally reputed expert in Forensic Palynology who presently heads the Institute of Geology and Nuclear Sciences at Lower Hutt, New Zealand when approached for his advice and help in our new endeavour to organize and setting Forensic Palynology Laboratory commented the “*much of the excellent palynological research coming out of BSIP is directly applicable to forensic palynology and BSIP has a very strong background to build on*”.

Integrated Long Term Programme between BSIP and Russian Academy of Sciences— Under the project entitled ‘Floral and climatic evolution based on Geologic and Biotic events during Precambrian and Phanerozoic Time’ under ILTP co-operation in Science and Technology between India and Russia, Dr. Mukund Sharma, visited Geological Institute, Moscow from January 17 to February 16, 2001. A comparative study on the Russian and Indian Stromatolites has been finalized. A study has been initiated with Dr. V.N. Sergeev on comparative study of microbial remains of Anabar Uplift and Turukhan Uplift of Siberia. Dr. V.N. Sergeev and Dr. S. Naugholnykh were awarded the ILTP Fellowship by DST, Government of India to work at Birbal Sahni Institute of Palaeobotany.

Monograph— A monograph entitled “*Precambrian Stromatolites of India and Russia*” is being finalized under the Integrated Long Term Programme of co-operation in Science & Technology (Indo-Russian). In the present monograph 90 form genera are systematically described. An extensive photo-documentation and line-diagrams of these forms have been provided. There are fourteen plates of stromatolite taxa showing three-dimensional pictures and the morphological details in the outcrops and in polished slabs.

Monograph entitled “*An introduction to Gymnosperms, Cycas and Cycadales*” of late Prof. D.D. Pant, Allahabad, is ready for publication.

Consultancy Services— The Institute has provided consultancy services to various organizations, viz., Geological Survey of India; Anna University, Chennai; Kumaoun University, Nainital; National Institute of Oceanography, Goa; Deccan College, Pune; Centre for Earth Science Studies, Thiruvananthapuram and other organisations.

Library— Library is disseminating the information about the latest literature on palaeobotany through Current Awareness Service Bi-monthly Bulletin as well as on web-site <http://www.bsip.res.in>. The Library is well connected with all the leading libraries of the world through Internet.

K-Ar Geochronological Laboratory— The MS-10 Mass Spectrometer donated by the Director, National Geophysical Research Institute as a mark of good-will gesture is being installed, and process is on to restart the K-Ar Lab.

Memorial Lectures

Fourth Jubilee Commemoration Lecture on 10th September 2000 was delivered by Professor K.B. Powar, Secretary General, Association of Indian Universities on Foundation Day. Shri B.C. Bora, Chairman-cum-Managing Director, ONGC Ltd. delivered the 30th Birbal Sahni Memorial Lecture on the topic ‘Fossil Fuel and Energy Security’ and Professor S.S. Raghuvanshi, Ex-Professor of Lucknow University delivered the 46th Sir Albert Charles Seward Memorial Lecture on “Some Frontline areas in Biology” to mark the Founder’s Day Function on 14th November 2000.

Web Site and Internet Access

The contents of the Institute Web-Site is available at www.bsip-india.org and is regularly updated. The detailed information about the vacancies and the Training Course being conducted by the Institute are incorporated on the Web-site. Proxy, Mail, DNS and Backup Servers are successfully configured on Windows NT platform. Proxy Server provides the Internet security from unauthorized access and it will also control the access authority at the workstation.