# BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY LUCKNOW

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## CONTENTS

# I. RESEARCH

## 1. LOWER GONDWANA

### 1.1 Glossopteris flora-morphological studies.

#### 1.1.1 *Handappa, Mahanadi Valley, Orissa*

An extensive collection of fossil plants was made from the lower Gondwana of Handappa in Orissa. Detailed studies on some plants of this assemblage, e.g., *Glossopteris*, *Sphenopteris*, *Schizoneura*, *Raniganjia* and several scale leaves have been nearly completed.

#### 1.1.2 *Aurunga and Daltonganj Coalfields*

An interesting collection of Barakar fossil plants particularly rich in well preserved sterile and fertile fronds of *Sphenopteris* was made from the Aurunga coalfield. This material and some mega-and micro-fossils from the Karharbaris of Daltonganj Coalfield were preliminarily studied.

### 1.2 Sporae dispersae and Palyno-stratigraphy

#### 1.2.1 *Jayanti Coalfield, Talchir Stage*

Rich miospore assemblages, comprising 50 species belonging to 30 genera were recorded for the first time from the whole sequence of Talchir stage in the Jayanti coalfield. Four new genera were instituted viz., *Plicatisporites*, *Jayantisporites*, *Tuberisaccites* and *Circumstriatites*. Monosaccates are predominant in the whole assemblage. The distribution of the miospores in the whole sequence is studied and comparisons are made with known equivalent assemblages. Palaeobotanical significance of these results was evaluated.

#### 1.2.2 *South Karanpura coalfield-Barakar shales.*

Palyno-stratigraphical studies on the Barakar shales of South Karanpura coalfield have been completed. Four miospore assemblages have been distinguished in the succession.

**1.2.3** *South Karanpura Coalfield–Palynological Survey of geological sequence.*

Maceration of all the coal and shale samples is complete. Slides have been prepared in glycerine jelly. Slide of 20 samples have been scanned. Photomicrography of 5 samples is complete. Study is in progress.

**1.2.4** *Talcher Coalfield, Orissa*

A systematic description of miospore assemblage recovered from the coals of Talcher coalfield has been done. The mioflora is referred to 36 genera and 71 species out of which 11 species are new. The new species have been described and illustrated and biometric analyses of the morphographic characters, wheresoever necessaary, have been done.

**1.2.5** *Singrauli Coalfiled, M.P.*

Jhingurdah seam, the top most seam of Singrauli coalfield, M.P. has been sporologically investigated. The *Sporae dispersae* represented in this seam consists of a large variety of trilete, monolete, monosaccate and alete miospores. In all 100 species belonging to 49 genera have been described out of which 35 species are new. The fundamental approach behind the generic and specific circumscriptions is based upon the detailed study of various morphographic characters borne by different individuals.

**1.2.6** *Pench-Kanhan and Pathkhera Coalfields*

A systematic study of miospore assemblage recovered from the coals of Pench-Kanhan and Pathkhera Coalfields has been done. The miospores have been referred to 37 genera and 61 species out of which one genus and 5 species are new. The new genus, *Misrapollenites*, is monosaccate in organisation and circular to sub-circular and bilaterally oval in shape. Central body is usually well defined and oval to circular in shape. Proximally the body exine does not bear any germinal mark or any sort of grooves or striations. Morphographic characters of the new species have been described in detail.

**1.2.7** *Bisrampur Coalfield, M. P.*

Sporological study of 21 bore core coal samples from Bhatgaon, Khargaon and Songara blocks of Bisrampur Coalfield, M. P. has been done. The qualitative as well as quantitative distribution of various

palyno-taxa among the samples has suggested the occurrence of four distinct assemblages. Miospore Assemblage A is marked by the higher representation of *Microbaculispora* associated with *Dentatispora*. Assemblage B is characterised by the dominance of *Indotriradites* while Assemblage C has the dominance of *Brevitriletes* in association with *Sulcatisporites* and Assemblage D is dominated by an association of *Brevitriletes* and *Horriditriletes*. These four palynological assemblages suggest the occurrence of four coal seams among the samples investigated.

**1.2.8** *Mohpani Coalfield, M. P.*

Mohpani Coalfield, the northernmost extension of the Satpura Gondwana Basin, is a small highly disturbed area. Due to lack of evidence of unconformity or a sudden change between the lithology of the Talchirs and the coal-bearing beds, it is difficult to demarcate the boundry between the two formations on purely lithological grounds. Coal-bearing beds considered to be the representatives of Karharbari Stage, have been variously grouped by earlier workers either with Talchir series or with Damuda series. The geology and the stratigraphical setting of the Lower Gondwana rocks in the area have been worked out in the light of field observations and palynological data. Our observations show that the coal-bearing beds form a continuous sedimentary cycle in the Talchir succession. The palynological observations on the coal-bearing beds also confirm the Talchir affiliation. Biostratigraphically there are four cenozones which are based on quantitative analysis of the palynofossils. A revised geological map, section and detailed stratigraphical succession of the rocks have been presented.

**1.2.9** *North Karanpura Coalfield*

Palynological investigation of surface and subsurface Lower Gondwana sediments comprising Talchir, Karharbari, Barakar, Barren Measures and Raniganj stages have been completed. It was observed that the lithological boundaries suggested by the Geological Survey of India broadly correspond with the palynological ones. This was a joint project in collaboration with the Coal Division, Geological Survey of India, Calcutta.

**1.2.10** *Lower Gondwana Microfloristics*

Palynological study of the coal and shale deposits of the Lower Gondwana System in India has revealed during its span, the existence of

phases, rich in pteridophytic spores or gymnospermous pollen grains. The significance of this information has been discussed with regard to the climatic conditions and the nature of the flora occurring at various stratigraphic levels. Palynological evidence has been adduced to confirm the occurrence of two glacial phases in the older horizons of the Lower Gondwana System in India.

### 1.3 Palyno-petrology of coals.

#### 1.3.1. *Wardha Coal Basin*

The coals show typical Lower Barakar miofloral composition (prominent in triletes with common striated, nonstriated saccates) indicating a characteristic type of vegetation which ultimately formed coal. However, during the coalification process, the source material seems to have been transformed into three different coal types as evidenced from physical characteristics of the coal components. The type one is mostly clarianish with rich lignogene and liptogene material. The second type is dominated by dull durain type and the third type is mostly composed of fusinized organic material constituents. The available evidence apparently suggests variable conditions during the deposition of coal in the three areas investigated in Wardha Coal Basin.

#### 1.3.2 *Pench-Kanhan Coalfield*

A detailed palynological and petrological study on the coals of working collieries from Pench-Kanhan Coalfield has been completed. The channel coal samples sent by the Regional Coal Survey Station, Nagpur and other collected samples were analysed. On the basis of statistical palynological study, the four biozones corresponding to the four coal seams have been suggested. The overall palynological assemblage recovered from these coals compares closely with the known assemblages of the Lower Barakar Stage. Hence, the Lower Barakar age has been suggested for these coals. Palynological study in conjunction with the petrological study has revealed some interesting facts regarding the sedimentological conditions prevalent during the formation of the coals. In fact, there were two main cycles of deposition each starting with the bad source material (plant matter) and later the conditions improved resulting into the formation of good coal. The presence of fusain in considerable amounts is an indicative of shallow water conditions and the partial exposure of the peat due to the fluctuations in the water level of the basin.

**1.3.3.** *Godavari Valley Coalfields*

Large number of blocks, pellets from both individual and mean samples were prepared according to the methods developed in the laboratory. Morphographic studies of dispersed organic constituents and microphotography of characteristic types have been made.

**1.3.4** *Korba Coalfield-bore hole NCKB 19*

Coal, coaly shale and sandy shales encountered in this bore hole were macerated. Spores and pollen recovered were studied. Quantitative analysis as well as the maceral analysis is complete. Preliminary microlithotype analysis and morphographic study of the interesting miospores have been done.

**1.3.5** *Petro-palynology of Durain Coals*

By chemical treatment the exinite (spore exines) has shown a rich and diversified spore and pollen assemblage of cryptogamic and gymnospermous plants. Palynologically they show a rich assemblage of triletes, striated and non-striated bisaccate miospores forming distinct microfloristic zonations. The anthrocological analyses of these coals reveal characteristic sequential formation of the Durain and strengthen the theory that parallels exist between miospore assemblage and coal types. A brief account of the composition of dispersed spores, their assemblage leading to the determinations of Durain coal types, their nature and formation are given.

## 2. PALAEOZOIC FROM ABROAD

### 2.1 Congo-Lukuga Series

Samples from Puit Christine, Puit 1950 and Old Puit, Greinerville, Congo, have yielded a rich palynological assemblage comprising algal bodies, monolete and trilete spores, monosaccate, nonstriate and striate bisaccate, polyplicate and monocolpate pollen grains Among the algae, *Tetraporina* is frequently met with Trilete genera are more common than the monoletes in the assemblage. Among the azonate triletes, *Punctatisporites*, *Leiotriletes* and *Neocalamospora* are found in good percentage. In some samples *Indotriradites* and *Enigmaspora* are very well represented. *Laevigatosporites* and *Tiwariasporis* mostly represent the monoletes. The

monosaccate genera are not found in abundance and they are mostly represented by *Plicatipollenites*, *Cannanoropollis*, *Parasaccites*, *Divarisaccus* and *Potonieisporites*. The nonstriate bisaccate genera like *Cuneatisporites*, *Monoletesaccites* and *Sulcatisporites* are occasionally met with. The striate genera like *Striatites*, *Gondwanipollenites* and *Faunipollenites* are quite common. Monocolpate pollen grains are rarely found and they are mostly represented by *Ginkgocycadophytus*.

### 2.2 Czeckoslovakia—Givetian

Among the 15 taxa of the Middle Devonian (Givetian) miospores and microplanktons from the Srbsko formation (Czechoslovakia), the prevalance of saccate-zonate types is striking. The microplanktons include four types.

### 2.3 Libya—Carboniferous and Permo-Triassic

**2. 3. 1.** *Palynology of Permo-Triassic Sequence from Libya.*

**2. 3. 2** *A Carboniferous palynological assemblage from Libya (bore-core samples).*

### 2.4 Antarctica

Fossil wood has been discovered at several localities in Antarctica. Most specimens consist of only secondary wood, a few show pith and primary xylem. Preservation is usually poor. Specimens are mostly limonitic, sometimes partly silicified and calcified. A few specimens are siliceous and these show better preservation. Specimens have been assigned to seven genera, all of which, except the genus *Antarcticoxylon*, occur in the Lower Gondwana sediments of other continents too. There are 10 identifiable species, of which 3 (*Dadoxylon weaverense*, *Megaporoxylon antarcticum*, and *M. canalosum*) are new. Other species identified are *Araucarioxylon bengalense* (Holden), *A.* sp. cf. *A. ningahense*, (Maheshwari) *A. allani* (Kraeusel), *Protophyllocladoxylon dolianitii* Mussa, *Damudoxylon* sp. cf. *waltonii* Maheshwari, *Polysolenoxylon lafoniense* (Halle), and *P. kraeuselii*( Surange & Maithy). The taxonomic position of the genus *Dadoxylon* Endlicher has been reviewed and it has been suggested that woods with uniseriate (rarely partly biseriate) xylem rays should not be assigned to *Dadoxylon*, but to the genus *Araucarioxylon* Kraus which has also been emended. The genera *Damudoxylon* (Maheshwari) and *Megaporoxylon* (Kraeusel) are emended to include both homogenous as well as heterogenous pith. The names

*Barakaroxylon* and *Indoxylon* are later synoyms of *Polysolenoxylon*. A study of the distribution of fossil wood in other Gondwananland continents shows that the Antarctic fossil wood is most closely comparable with those described from deposits usually regarded as Lower Permian in age.

## 3. MESOZOIC

### 3.1 Triassic

#### 3.1.1 *Panchet of Asansol*

A large number of shale samples from Noonia Khal and Noonia Khas, in the vicinity of Asansol, was macerated. In both these areas the Panchets seem to conformably overlie the Raniganj beds and are characterized by the presence of the crustacean *Estheria*.

The miofloral assemblage comprises genera like *Dictyophyllidites*, *Verrucosisporites*, *Cyclogranisporites*, *Podocarpidites*, *Gondwanipollenites*, *Klausipollenites*, *Striatites*, *Lunatisporites* and *Lahirites*. The palynlogical investigations show that the strata immediately above the contact have a preponderance of striate bisaccate pollen, similar to the condition met with in the Raniganj. The strata further above the contact area have dominance of trilete spores, the striate and non-striate bisaccate pollen being subdominant.

Besides the miospores, the megafossils collected are also under study. So far *Schizoneura gondwanensis*, *Glossopteris indica*, *G. communis*, *G. angustifolia*, *G. linearis*, *G. retifera*, *G. browniana*, *Dicroidium sp.* and *Vertebraria indica* have been identified.

#### 3.1.2 *Panchet of Deobar, Auranga Valley.*

A few samples from Deobar were macerated for miospores. The samples yielded a fairly rich assemblage. Out of them four new genera have been recognized. The Deobar assemblage is overwhelmingly dominated by the triletes (69%). The monoletes (1%) are hardly met with. Alete spores are next in abundance to trilete and are 20% of the total assemblage and bisaccates and monocolpates are more or less equally represented (4% and 5% respectively).

Amongst the mega-fossils collected, *Schizoneura gondwanensis*, *Glossopteris indica*, *G. communis*, *G. angustifolia*, *G. linearis*, *Dicroidium sahnii* and *Noeggerathiopsis* sp. have so far been identified.

### 3. 1. 3. *Nidpur*

Based on cuticular studies, three species of *Dicroidium*, viz., *D. nidpurensis*, *D. papillosum* and *D. gopadensis* have been erected. The cells in *D. nidpurensis* have smooth surface wall but in *D. papillosum* and *D. gopadensis* the cells are papillate. The subsidiary cells in *D. nidpurensis* are also devoid of papillae, in *D. papillosum* they may or not be papillate and in *D. gopadensis* they are usually papillate.

## 3.2 Jurassic-Lower Cretaceous

### 3.2.1 *Rajmahal flora*

The previously described Indian species of *Masculostrobus* were re-examined. They have now been referred to a new genus *Podostrobus*. Under this genus only two species have been described, viz., *P. rajmahalensis* (Rao) and *P. sahnii* (Vishnu-Mittre). *P. rajmahalensis* is characterized by the presence of bisaccate pollen grains, whereas, in *P. sahnii* they are mostly bi-or tri-saccate.

### 3.2.2 *East-Coast Gondwana*

From Gollapalle, Raghvapuram and Vemavaram a large number of specimens belonging to the genus *Ptilophyllum* has been studied. They have mostly been referred to *P. acutifolium* Morris and *P. cutchense* Morris. A few specimens from Vemavaram, which were previously described as *Otozamites rarinervis* Feistmantel, have now been described as *Ptilophyllum rarinervis* (Feistmantel). The pinnae in this species have very few veins (mostly 3, rarely 2).

### 3.2.3 *Sehora flora*

On the basis of cuticular structure four distinct species of *Ptilophyllum* have been recognized. They are *P. horridum* Roy, *P. distans* (Feistmantel) Jacob & Jacob, *P. institacallum* Bose and *P. jabalpurense* Jacob & Jacob.

### 3.2.4 *Trambau flora*

From Trambau in Kutch a large number of carbonized specimens of *Ptilophyllum* were collected. Out of them, on the basis of cuticular structure, five species have been described. The species described are, *P. oldhamii* Jacob & Jacob, *P. indicum* Jacob & Jacob, *P. horridum* Roy, *P. sakrigaliensis* Sah and *P. distans* (Feistmantal) Jacob & Jacob.

### 3.2.5 *South Rewa Basin*

The work on *Todites indicus, Gleichenia gleichenoides, Hausmannia* sp., *Cladophlebis medlicottiana* and *Sphenopteris* sp. from the Lower Cretaceous of South Rewa Gondwana basin has been completed. Out of these, the cuticular structure of *Hausmannia* sp. has been studied in detail. In this species the stomata are present on the lower side. They are crowded, irregularly distributed and orientated. The subsidiary cells are like the ordinary epidermal cells and mostly 4 or 5 in number. Epidermal cells are usually rectangular or polygonal with sinuous and thick anticlinal walls. The cells over the veins are narrow, elongate, rectangular or polygonal. The anticlinal walls of these cells are wavy or almost straight.

### 3.2.6 *Palynology of Lower Cretaceous in India*

The known spore assemblages from the Jabalpur Stage, Umia Stage and Dalmiapuram Grey Shales Stage have been reviewed and briefly discussed. The compositional similarities or wide differences in the assemblages have been high-lighted. Finally the general distributional pattern of spore-pollen floras, during the Lower-Cretaceous times and their relationship with the immediately underlying and overlying assemblages have been discussed.

### 3.2.7 *Distributional pattern of the Sporae dispersae in the Upper Gondwana*

The distributional pattern of the dispersed spores and pollen grains in the Upper Gondwana Strata of the Salt Range (West Pakistan), Rajmahal Series (India), Andigama Shales (Ceylon), and Jabalpur Series (India), ranging from Liassic to Lower Cretaceous, has been studied. Six distinct palynological assemblages have been biostratigraphically studied and analysed. Each assemblage seems to be quite characteristic for

its associated horizon and is easily distinguishable mostly at generic level. The Salt Range assemblage (Liassic) is dominated by *Classopollis* and *Perinopollenites* whereas the Rajmahal assemblages (Middle-Upper Jurassic) possess mostly cycadophytic and non-saccate pollen grains, together with a representation of pteridophytic spores. In the assemblage of Andigama Shale (Uppermost Jurassic), pteridophytic spores with a dominance of *Contignisporites cooksonii* constitute the most striking feature. The palynological changes in the Jabalpur Series (Lower Cretaceous) as compared to the Jurassic assemblages are distinct and have been discussed. From the preliminary and broader comparative analysis of different assemblages it seems possible that palynological studies on the Upper Gondwana sediments of India can be successfully applied for finer separation of the strata.

### 3.2.8 *Palynology of Vemavaram Shale, Andhra Pradesh with remarks on the age of the bed*

The palynological assemblage comprises 21 genera and 43 species. The assemblage is dominated by gymnospermous pollen represented by *Callialasporites*, *Singhiapollis*, *Podocarpidites*, *Laricoidites* and *Araucariacites*. The trilete spores are rare and mostly represented by *Cyathidites*, *Ramanujamiaspora*. Operculate pollen grains are also rare and represented by *Classopollis* and *Granuloperculatipollis*. Palynological evidence indicates an upper Jurassic age for the Vemavaram shales.

## 3.3 Palynology of coals

### 3.3.1 *Jabalpur Stage-Sporae disporsae*

Seven new miospore genera have been described from the Jabalpur Stage. Among these 5 are trilete, viz., *Haradisporites*, *Coniatisporites*, *Biformaesporites*, *Lametatriletes* and *Venusteaesporites* and 2 are monolete; viz., *Metamonoletes* and *Dettmannites*. The miospore genera, *Neoraistrickia* (Potonie), *Matonisporites* (Couper), *Callispora* (Dev), *Boseisporites* (Dev), *Densoisporites* (Weyland & Krieger), and *Callialasporites* (Dev) have been emended. Thirty-six miospore genera with 57 spore species from Lameta Ghat, fourty-four miospore genera and 74 species from Sehora and fifty-seven spore genera and 94 species from Hathnapur have been identified and described. Qualitatively, the miofloras are chiefly characterized by the presence of coniferous elements, e.g., *Araucariacites*, *Callialasporites*,

*Classopollis* and *Podocarpidites* etc., and cycadalean or bennettitalean elements, e.g., *Cycadopites* and *Monosulcites*. The cryptogamic elements are poor in occurrence in Lameta Ghat but are well represented in Sehora and Hathnapur miofloral assemblages. Chiefly, they are *Cyathidites*, *Haradisporites*, *Gleicheniidites*, *Matonisporites*, *Lametatriletes*, *Densoisporites*, *Lycopodiumsporites* and *Laevigatosporites* etc.

**3.3.2** *Jabalpur Stage-Palyno-stratigraphy*

A miofloristic analysis of the *Sporae dispersae* from Lameta Ghat, Sehora and Hathnapur has been compared with the Jurassic-Lower Cretaceous spore-pollen assemblages known from India as well as other Gondwana countries. The miospore genera, *Cyathidites*, *Gleicheniidites*, *Osmundacidites*, *Cicatricosisporites*, *Podocarpidites*, *Alisporites*, *Araucariacites*, *Cycadopites* and *Classopollis* etc. constitute the major portion of the whole assemblage. In addition to these there occur scantily forms, viz., *Cyathidites punctatus*, *Contignisporites glebulentus*, *Densoisporites mesozoicus*, *Rouseisporites* spp. and *Crybelosporites* etc. Quantitatively, the mioflora of the Jabalpur Stage is characterized by the prominence of *Araucariacites* associated with the common occurrence of *Cycadopites* and *Callialasporites*. The genera such as *Podocarpidites*, *Alisporites* and *Classopollis* are fair in amounts.

## 3.4 Mesozoic from Abroad

**3.4.1** *Triassic of Salt Range, W. Pakistan*

The palynological investigation of a few samples from Kingrialli and Sakesar from the Triassic of Salt Range, W. Pakistan has been taken up. The assemblage is characterized by the presence of *Zeillerisporites*, *Punctatisporites*, *Lophotriletes*, *Pityosporites* and *Alisporites*.

**3.4.2** *Triassic of Germany*

Systematic study of miospores from the Lower Triassic of Buntsandstein, Goettingen, W. Germany shows that the assemblage is dominated by *Cyclotriletes*, *Punctatisporites*, *Lophotriletes*, *Striatisaccus*, *Caytonipollenites*, *Sulcatisporites*, *Vesicaspora*, *Platysaccus*, *Alisporites* and *Chordasporites*.

**3.4.3** *Palaeoecology and Pollen spore flora of Upper Cretaceous (Mancos) Coal Beds of Utah, U. S. A.*

Further work on this project, though slow, was continued.

## 4. TERTIARY

### 4.1 Morphological and anatomical studies

#### 4.1.1 *Siwalik formation*

Studies of leaf impressions from near Jwalamukhi (Himachal Pradesh) and Poonagiri Hill near Tanakpur, District Nainital, and fossil woods from near Bhakra Dam and Nalagarh, Himachal Pradesh were continued.

#### 4.1.2 *Eastern India*

Fossil woods from near Hailakandi, District Cachar, Assam; and Deomali, NEFA were studied.

#### 4.1.3 *Cuddalore Series*

Fossil woods from Cuddalore Series of South India were studied. Fossils of the families Rubiaceae, Sapindaceae and Dipterocarpaceae, were identified.

#### 4.1.4 *Kutch*

Leaf impressions from Panandhro and Khari river bed near Mokhra were tentatively identified. A preliminary study on the fossil woods from Pliocene of Dhaneti and Mothala was done.

### 4.2 Sporae dispersae and palynostratigraphy

#### 4.2.1 *Kutch*

Shale samples from the Palaeocene deposits of Matanumadh were investigated. About 1500 well preserved pollen and spores were examined in detail for identification with the modern taxa. They correspond to about 40 families of angiosperms besides the gymnospermous pollen and pteridophytic and fungal spores.

#### 4. 2. 2. *Assam*

Preliminary study on the pollen and spores of the Palaeogene of Damalgiri, Ledo, Tipongpani and Baragolai was done.

**4. 2. 3.** *Palyno-stratigraphy of Tertiary formations of Assam.*

The stratigraphic geology of the southern part of Shillong Plateau was invistigated to clarify the geology of the area and its depositional environment and stratigraphic succession. Palynological fossils were also taken into consideration for this study. Special emphasis has been made on the age, palaeoecology and depositional environment of Cherra Sandstone Stage. It has been concluded that this stage belongs to Palaeocene.

The microplanktons consisting of 11 genera and 13 species have been described from a green calcareous shale (Langpar formation) exposed along the eastern bank of the Umssohryngkew river, Therriaghat. The assemblage is dominated by *Achomosphaera* and *Hystrichosphaeridium* while the genera *Leptodinium, Baltisphaeridium, Apteodinium* and *Fromea* are meagrely represented.

Palynological studies on the Girujan Sandstone Stage, Assam, on the request of Oil India Ltd., Duliajan, Assam for finding marker fossils are continued. Palynological fossils recovered have been photographed.

Palynological studies on Bargolai and Tikak Parbat stages have been continued.

Palynology of the Sylhet Limestone Stage was investigated. The spores and pollen grains recovered have been systematically described.

**4. 2. 4.** *Lower Tertiary of Kutch*

Palynological investigation of 13 bore-cores from the Lower Tertiary of Kutch, Gujarat has been completed. A very rich palynological assemblage comprising algal and fungal bodies, pteridophytic spores, gymnospermous and angiospermic pollen grains have been recovered. This assemblage has also been compared with the known Lower Tertiary assemblages from India.

**4. 2. 5** *North Western India*

A new project on the above subject has been planned and rock samples collected around Chandigarh, Kalka and Hoshiarpur. The main objective of the proposed study is to attempt a palynologic analysis of the evolutionary development and environmental differences in assemblages of palynomorphs found in well exposed suits of sediments.

**4. 2. 6** *Jowai-Baderpur road section, Assam*

About 75 samples have been macerated and of these only a few have been fossiliferous.

**4. 2. 7** *Fungal remains from the Kerala Coast*

Some epiphyllous and other fungal remains have been recovered from carbonaceous clay sample collected from Padappakara, Quilon, Western Ghats. The main constituents of this fungal assemblage are microthyriaceous and chytridialean remains along with some other types. In all nine genera and 8 species have been described out of which 4 genera and 6 species are new. The new genera are *Parmathyrites*, *Paramicrothallites*, *Diploneurospora* and *Quilonia*. A classification of fossil microthyriaceous fungi has been proposed considering the presence and absence of ostiole and some other features as generic characters.

**4. 2. 8** *Palana, Rajasthan*

Palynological investigation is being carried out from the different measured sections of Palana basin, Rajasthan. A rich palynological assemblage has been obtained.

**4. 2. 9** *Stratigraphical significance of Dandotiaspora.*

The stratigraphic significance of a pteridophytic spore, viz., *Dandotiaspora* has been discussed in the Lower Eocene sediments of India. The morphological variations met within the genus have been described and illustrated.

## 4. 3 Petrographical studies

**4. 3. 1** *Organic remains of Neyveli Lignite*

Microscopic examinations of lignite blocks has revealed well preserved microfossils. Different types of dispersed plant tissues such as parenchyma, sclerenchyma, fibres, vessels, cork cells have been recognized apart from spores and pollen (Euphorbiaceae, Sapotaceae, Santalaceae, Meliaceae, Labiatae, Cruciferae, Caprifoliaceae, Gramineae, Polypodiaceae etc.) and woody structures of Leguminosae, Dipterocarpaceae, Combretaceae etc. The lignite samples investigated can be classified or separated into woody and non-woody types on the basis of the distribution of microconstituents of the above types.

#### 4. 3. 2 *Microconstituents of some lignite samples from Kutch*

From the preliminary studies of the four samples made available, it is surmised that the lignites are dominantly composed of angiospermic microconstituents of small twigs and branches representing near shore vegetation along with fungal spores and sclerotia (Telutospores, Urediospores, Teliospores of *Puccinia* and Microthyriaceae). The pteridophytic spores belong to *Cyathidites, Osmundacidites, Polypodiosporites.* The angiospermic pollen belong to *Nymphaeoipollis, Stephanocolpites, Lakiapollis, Polyporopollenites.* The mangroves pollen are also present indicating near shore vegetation.

### 4. 4 Tertiary from Abroad

#### 4. 4. 1 *Kifwa Kasongo, Congo*

A new genus *Boutakoffiaspora* of fossil *Salvinia* has been found from Kifwa–Kasongo, Congo in which the anatomical and morphological details are very much similar to the megaspores of extant genus *Salvinia.* Two new species, viz., *Boutakoffiaspora congoensis* and *B. cahenii* have been described.

## 5. QUATERNARY

### 5. 1 Palynology

#### 5. 1. 1 *Palynology of Solanum spp.*

Pollen morphology of two herbarium specimens of *Solanum hispidum* and *S. torvum* and a specimen each of the species collected fresh from the field was undertaken on the request of Shri K. M. Vaid, Research Officer, Systematic Bot. Branch, Forest Research Institute, Dehra Dun. The problem was suggested by Shri Vaid who found that the herbarium specimens did not match with the normal specimens and requested that the problem be looked into palynologically.

Observations and measurements have been based upon fifty random acetolysed pollen grains in each specimen and bimodal curves constructed for the length (Polar and equatorial axes), diameters of apocolpium, and of the OS, etc.

Variability in aperture (3-5 colporate) has only been noted in specimen No. 21762. Pollen in the other specimens is 3 colporate.

Four and five colportate grains in this specimen are 11.7% and 15.6% respectively. Slight variations have been noted in the overall length and breadth, the diameters of the apcolpium and OS. Two modes in specimen Nos. 21762 and 21764 reveal that these two herbarium specimens are morphologically different from the normals, as observed by Shri Vaid. The specimens deserve a cytological study.

### 5.1.2 *Cereal VS Non-Cereal Pollen*

Pollen morphological data of as many as 75 wild and cultivated grasses in India have been collected. It has been discovered that some of the wild grasses produce pollen as large as that of maize, so that on size criteria alone it is not possible to recognise a cereal pollen from that of wild grass pollen particularly in a dispersed state. The other criteria are too widely distributed in the species examined to be of any help. In view of these observations the reports of fossil cereal pollen from India should be considered redundant. For evidence of former pastoral activity, we may have to rely upon the shifts in pollen curves, the appearance of pollen of weeds and the recovery of the forest. Large sized grass pollen should preferrably be referred to as "Cerealia type" rather than *Cerealia*.

## 5.2 Pollen analysis

### 5.2.1 *Kashmir*

The work carried out at several sites and in different plant communities in the Kashmir Valley has revealed that in general the pollen spectra do represent the plant communities but in particular the poverty or lack of pollen of insect-pollinated species some of which are the important constituents of the forest communities, the presence of high pollen producers such as Pine, and the grazing pressure on the ground vegetation vitiate the pollen spectra so that a true picture of the plant community can hardly be had. In the Valley particularly the atmosphere is too highly charged with Pine pollen to reflect the communities adequately. The neglegible NAP is not factual, but owing to intense grazing. It certainly distorts the composition of forest as reflected by the pollen spectra. The study also brings to light pollen of *Rhus*, *Aesculus*, *Fraxinus* and *Ulmus* carried up at high altitude by the upthermic winds. Possibilities have also been indicated of the contamination of modern pollen spectra by the Pleistocene silt blown up by wind.

### 5.2.2 *Kumaon*

Pollen spectra from the oakwoods in the vicinity of Bhim Tal and Naukuchiya Tal have been studied. In regions of dominant oak woods, the spectra show 60-80% pollen of *Quercus*.

### 5.2.3 *Himachal Pradesh*

Through the investigation of moss remains recovered from Khajiar and Rewalsar lakes in Himachal Pradesh, it has been possible to recognize *Sphagnum fimbriatum* and *S.squarrosum*. These two sphagna, though of rare occurrence, have been found in most samples from both the lakes. These two species occur even today in Himachal Pradesh.

Modern pollen spectra have been studied from surface samples collected from Punjab plains extending to temperate areas in Himachal Pradesh.

The pollen spectrum from Punjab plains depicts open area with abundance of non-arboreal vegetation. The surface samples from between 1500′ and 3000′ reveal the transitional character of local flora with open lands and forests existing side by side. The sample at about 4500′ brings out the composition of Conifer-mixed Oak forest. The samples from temperate areas reflect the closed nature of the forest. The sample collected about 8000′ shows the dominance of arboreal vegetation, but the sample was collected from an open meadow.

### 5.2.4 *Rajasthan*

Pollen content of surface samples from the arid, semiarid, semihumid, humid and moist belts of Rajasthan, and extending over the adjoining states has been investigated. The pollen spectra from the various belts have been found to reflect more or less local vegetation though proportionately less the insect-pollinated species. Pollen of *Aerua* and *Calligonum* is abundantly present in the very arid-arid belt;of halophytic elements in the semi-arid belt; of *Anogeissus* and *Acacia* is frequently present in the semihumid belt; pollen grains of *Artemisia* and of arboreal vegetation increase in the humid and moist belts.

Pollen of *Alnus*, *Betula* and *Pinus* has been found in almost all the belts but of *Cedrus*,*Abies*, *Celtis* and *Juglans* have been recovered in the moist zone. These pollen grains have been transported from long distances.

The frequencies of Gramineae and *Artemisia* pollen in the modern pollen spectra are inversely related in contrast to their equally high values in the pollen diagrams. The values of Cheno-Amarnths are higher in the pollen diagrams than in modern pollen spectra.

### 5.2.5 *Nalsarovar, Gujarat*

Pollen analysis of the extensive brackish water shallow Nal lake (Nalsarovar) above 37 miles south-west of Ahmedabad was carried out form the samples placed at our disposal by the Tata Institute of Fundamental Research, Bombay.

The samples were found deficient in pollen for any statistical evaluation. The pollen content comprised pollen of Gramineae, Cyperaceae, Cheno-Amaranths, Myrtaceae, *Holoptelea*, *Labiatae*, *Artemisia*, and *Leguminosae*. Only the top and the bottom samples have pollen slightly more than 100. Microforams have been found at various levels indicating marine influence. The radio-carbon dates the top two metres of the clayey sediments to about $6395 \pm 290$ B. P. During this period of time marine influence is recorded at $4500 \pm 270$ and $6395 \pm 290$ B. P. respectively. The fine brown sand—a fluvial deposit between 2 and 2.50 metres suggests washing away of a part of the profile, it is therefore that the radiocarbon date at 2.60 m is about $28485 \pm 2570$ years B. P. Marine influence is further noted at 3.50 to 3.60 metres and at 6 m. also.

### 5.2.6 *Malvan,Gujarat*

Material for pollen analysis of this coastal archaeological site was collected by Miss Statira Guzder by the kind permission of Dr. F. R. Allchin of Cambridge. The samples have been found to be sufficiently rich in pollen. The microforams of rotaloid and biseriate types have been found in almost all the samples. The coastal environment is quite apparent. The pollen sequence reveals the prevalence of open conditions. The vegetation largely consisted of grasses and members of Centrospermae. An indication of distant arboreal vegetation is provided by low percentages of such high pollen producers as *Holoptelea* and Myrtaceae. A few trees of *Acacia* here and there cannot be overlooked. There is decrease in the pollen frequency of arboreals towards the top of the pollen diagram. Some of the pollen grains grouped under Cerealia type and measuring about 40 to 60$\mu$ might belong to cereals or else to some of the polyploid maritime grasses. The pollen grains of Carophyllaceae, Acanthaceae, Labiatae, Leguminosae, Compositae, Umbelliferae, Urticaceae etc., could

very well belong to the weeds of cultivation. In view of the coastal environment indicated by the sediments the members of these families could as well belong to this natural environment.

The extremely small percentages of pollen grains of *Pinus*, *Cedrus*, *Alnus* and *Betula* are of considerable interest. Their pollen has either been transported by sea or by wind from pretty long distances because none of these grow in the region. Their possibility of having grown in this region in the past is very little.

**5. 2. 7** *Bengal*

Peat at Sankrail and Rajganj is of amorphous nature. Fruit of *Chara*, moss fragments other than *Sphagnum* and sporangia of polypodiaceous ferns together with tiny wood fragments are the only microscopic remains contained in the peat. The peat is of fresh water origin as evidenced by the presence of pollen of *Potamogeton*, *Lemna*, *Typha* and *Myriophyllum*.

Based on the available radiocarbon dates, the peat at Sankrail Pit 1 was deposited at the rate of 1 cm. in 32.50 years (45 cms. in 1460 years). The sediments comprising peat, clay and clayey peat constituting a part of the profile from 3.04 m—6.25m have been deposited at the rate of 1cm. in 3-4 years, about 10 times faster than peat formation at Sankrail Pit 1. The formation of peat within the top 6 metres commenced about 3000 B. C. and continued, though intermittently, to 600 B. C. The land then must have stood higher in level than today. The major subsidence obviously took place after 700 B. C.

The pollen sequences built up from the peaty bands only reveal the occurrence of local fresh water swamps at Sankrail which were colonised by *Potamogeton*, *Myriophyllum*, *Lemna*, etc., along the shores of which *Typha*, Reeds and sedges grew. The mangrove vegetation did not grow very far from the sites and it was the fresh water *Heritiera* community which existed here. By about 660 B. C. either this innermost belt of mangrove vegetation migrated close to the sites or its pollen and wood were transported in increased quantity through water and wind into these swamps.

The destruction and final extermination of *Heritiera* from the western part of the Bengal basin could be attributed to rise in the level of the basin through the deposition of thick loads of silt and clay and

also to the large demand of its wood for boat building, buggy shafts, building and other purposes (fuel).

No evidence of cultivation has been noted. Some Cerealia type pollen have, however, been recovered.

### 5. 3 Archaeobotany

#### 5. 3. 1 *TER, Maharashtra*

At this early historical site as dated by C 14 (TF–746, 1690±105 and TF–747, 2105±100), the plant economy consited of *Triticum sphaerococcum, Oryza sativa, Hordeum vulgare, Paspalum scrobiculatum, Cicer arietinum, Lens culinaris, Pisum* sp., *Dolichos biflorus, Phaseolus* sp., *Lathyrus sativus, Ricinus communis*, and *Zizyphus nummularia*, Bamboo, *Sonneratia* sp., *Terminalia coriacea, Tectona grandis, Boswellia serrata* and *Acacia.*

Wheat and rice were equally important during the Satavahana Period, but later wheat predominated in the later Satavahana Period (100 A.D.–250 A.D.) Chick pea (*Cicer arietinum*) was introduced first in the late Satavahana Period and soon became an important article of food. Barley and *Paspalum* were introduced later.

A dry deciduous plant community comprising *Tectona grandis, Terminalia, Boswellia serrata* and *Acacia* existed in the vicinity from which both timber and fuel were derived by the ancient Terians. The occurrence of a similar community though in much degenerated from in this region today suggests that the climate here has remained unchanged during the last 2000 years.

The wood of *Sonneratia acida*, if the identification is unquestionable, was probably obtained by the ancient inhabitants of Ter from the coastal region of Bombay the nearest source of this typical mangrove plant. Even if the wood turns out to be *S. apetala* which is used as fuel, one remains to wonder as to why only for the sake of fuel the ancient Terians had chosen to transport it from a pretty long distance.

### 5. 4 Aeropalynology

#### 5. 4. 1 *Lucknow—for the year 1970-1971*

Pollen and spore catch for Lucknow for the year 1970-71 has been completed. The annual calender is under preparation. Pollen grains of

*Aegle marmelos* and *Jasminum* sp. and the fungal spores of *Torula*, *Botryodiplodia* and *Zygodsmus* are the new additions in the aerospora of 1970-71 over that of 1969-70.

The dates of the first appearance this year of pollen of several species have shifted from the dates observed last year as shown below. With the only exception of *Holoptelea integrifolia* whose first pollen appeared on the same date during these two years.

| | *1969-70* | *1970-71* |
|---|---|---|
| *Holoptelea integrifolia* | 5th March | —5th March |
| *Pinus sp.* | 5th March | —25th March |
| *Salmalia malabarica* | 5th March | —8th March |
| *Morus alba* | 5th March | —2nd March |
| *Argemone mexicana* | 7th March | —10th March |
| *Emblica officinalis* | 18th March | — 15th April |
| *Azadarichta indica* | 19th March | —13th April |
| *Putranjiva roxburghii* | 26th March | —24th March |
| *Polyalthia longifolia* | 8th April | —13th April |
| *Prosopis juliflora* | 12th April | — 4th March |
| *Ricinus communis* | 1st Aug. | —10th Aug. |
| *Xanthium strumarium* | 4th Aug. | —8th Sept. |
| *Artemisia* sp. | 21st Aug. | —9th Oct. |
| *Alnus* sp. | 8th Oct. | —6th Oct. |

Pollen of *Xanthium strumarium, Pennisetum typhoides, Holoptelea integrifolia, Ricinus communis* and *Putranjiva roxburghii* was collected in bulk and given to Dr. Jamil of Tuberculosis Dept. of King George Medical

College, Lucknow to determine the reaction of these pollen grains on the patients. The results of the clinical tests are shown below :—

| Name of the pollen antigen. | No. of patients | – | + – | + | + + – | + + | + + + – | + + + | + + + + – | + + + + |
|---|---|---|---|---|---|---|---|---|---|---|
| *Xanthium strumarium* | 15 | 1 | 2 | 6 | 3 | 3 | – | – | – | 1 |
| *Pennisetum typhoides* | 79 | 13 | 14 | 14 | 15 | 14 | 5 | 4 | – | – |
| *Holoptelea integrifolia* | 51 | 12 | 12 | 16 | 6 | 4 | – | 1 | – | – |
| *Ricinus communis* | 80 | 16 | 11 | 17 | 16 | 9 | 3 | 8 | – | – |
| *Putranjiva roxburghii* | 51 | 13 | 8 | 18 | 7 | 3 | 1 | 1 | – | – |

The bioassy and other chemical treatment has revealed the presence of pharmacologically active substances (Histamine 60 $\mu$ g/gm., and 5-Hydroxytryptamine 22.3 $\mu$ g/gm.) in the pollen of *Holoptelea integrifolia*.

From the weekly exposure of petri-disshes during this year it has been possible to identify most of the fungi of which the spores have been caught on the slides. The species identified are given below:

*Aspergillus ( fischeri, niger, fumigatus, fumigatus* var. *albus, flavus, ustus brunneouniseriatus, flavipes, nidulans* var. *latus, tamarii, terreus, sydoui, sulphureus, japonicus. tubingensis) Penicillium, (citrinum, brofeldianum, funiculosum, vinaceum, pallidum, stipitatum), Paecilomyces (varioti, fusisporus,marquandii) Trichoderms lingnorum, Achaetomium strumarium, Dactylium fusarioides, Acrostalagmus cinnabarinus, Trichothecium roseum,Acrophialophora nainiana, Fusarium, (semitectum, merismoides, moniliforme), Chaetomium globosum and Alternaria tenuis*

### 5.5 Palaeobotanical history

**5.5 1.** *Rajasthan*

A critical review of the palaeobotanical history of Rajasthan was completed.

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## III. ABSTRACT OF THESES

### Contribution to Palaeobotany of the Talchir Series

Rehana Makada (Karim)

The present thesis contains the results of the investigations undertaken on aspects of stratigraphy, palaeobotany and palynology of the Lower Gondwanas of India, particularly the Talchir Series, which includes the Talchir and Karharbari Stages. Studies were undertaken in the two basins, Viz. (1) Jayanti Coalfield and (2) Singrauli Coalfield.

*Jayanti Coalfield*

In this basin the Lower Gondwanas consists only of the Talchir and the Karharbari Stages. The material for the study of micro and megafloras has been collected from surface samples along the sections exposed in the nala cuttings. A rich miospore assemblage is recorded from the Talchir stage comprising 102 species belonging to 45 genera *Plicatisporitis, Jayantisporites, Tuberisaccites circumstriatites* and 20 species are new to science. Of particular interest is finding of miospores from two boulder beds intercalated in the Talchir sequence. The megafosils are few consisting of 3 genera and 4 species.

The miospore assemblage from the Karharbari Stage of this basin is also fairly rich, consisting of 57 species assignable to 33 genera, five species are new. Megafossils records are from 3 localities of Karharbari Stage. There are 16 recognisable species belonging to 7 genera. Of special interest are the morphological and cuticular studies on *Noeggerathiopsis*,*Glossopteris* and *Gangamopteris*. Two new species viz. *Noeggerathiopsis conspicua* and *Glossopteris jayantiensis* are established on the basis of cuticular structure.

*Singrauli Coalfield*

In this basin the fossil flora of the Talchir Stage and of the overlying Coal-bearing formation which has hitherto been considered as Karharbari or Barakars, is studied in detail. The Talchir strata contain megafossils but are devoid of microfossils. The problematical Coal-bearing

beds overlying the Talchir Stage have yielded both micro and megafossils. The miospore assemblage comprises 62 species belonging to 41 genera. One genus *Costasaccus* and seven species are new. The megafossils belong to 6 genera. Cuticular structure of *Glossopteris* with a single new species *G. Singrauliensis* has been recorded.

The entire palaeobotanical evidences (both micro and megafossils) from the two basins under study have been compared with each other and with those from other Lower Gondwana basins. The results have helped in solving the controversy regarding the age and stratigraphical position of these strata, overlying the Talchir Stage in these areas. The evidence now indicates that in the Jayanti Coalfield the strata above the Talchirs are of Karharbari age and should be included in the Talchir series. On the contrary the coal bearing beds in the Singrauli Coalfield have yielded a Barakar micro and megaflora, and should, therefore, be excluded from the Talchir Series. The studies also indicate that the Talchir and Karharbari Stages are distinguishable by their floras. At the same time the two stages are floristically intimately related. Their grouping under the Talchir series is, therefore justifiable.

**Palyno—petrostratigraphy of some Lower Gondwana Coals of India.**

Anand Prakash

The investigation has been undertaken with a view to define the nature, distribution and the stratigraphical value of the dispersed fossil spores and pollen grains in conjunction with the petrological characteristics of the coals of Satpura Gondwana Basin. The results obtained from the palynological study from the coals of Mahpani, Pench-Kanhan and Pathakhera Coalfields and the Petrological study of Pench-Kanhan coals have been submitted in the thesis in three parts.

The first part deals with the Taxonomic considerations, Nomenclature, classification and Systematic description of the dispersed spores and pollen grains. 37 genera and 62 species, including 1 new genus (*Misrapollenites*) and 7 new species, have been recorded.

The second part "Palynostratigraphy of Mohpani Coal Deposits" deals mainly with the sporological assemblage present in the coals of Sitarewa River Cutting about a mile East of Mohpani. The sporological assemblage is characterised by the dominance of *Brevitriletes*, *Indotriradites*

and *Sulcatisporites*. On the basis of this assemblage these beds have been placed in the Lower Karharbari Stage.

The palynological and petrological characteristics of Pench Kanhan coals have been dealt with in the third part of the thesis. Various petrological constituents of these coals have been systematically studied and classified according to the classification proposed by Spackman and Thompson (1969). The statistical maceral composition has suggested four characteristic coal types present in the coals of this area. Similarly, the quantitative palynological study has suggested four distinct sporological assemblages, one characteristic of each coal type. Thus, on the palynopetrological findings, the presence of four coal seams has been proved in the area, each containing a diagnostic coal type and a sporological assemblage. In addition to this, the correlation and lateral extension of the coal seams has also been established.

The sporological assemblages and the coal types studied from the Pench-Kanhan coals closely resemble those known from Lower Barakar coals of other coalfields. Therefore, all the four coal seams have been placed in the Lower Barakar Stage.

The other aspect of the investigations dealing with the genesis of Pench-Kanhan coals has suggested two main cycles of coal formation in this basin. In the first cycle of coal formation the IV and the III and in the second cycle the II and the I coal seams were deposited. The conditions of the coal formation and also the quality of the source material (vegetal matter) has considerably improved in the later parts of these cycles. The comparatively high percentage of vitrinite and low percentage of Inertinite form the basis of the above conclusion. The notable amount of fusain indicates the possible fluctuations in the water level of the basin.

The coals of Mohpani are of Lower Karharbari stage and those of Pench-Kanhan are of Lower Barakar Stage, the latter being definitely younger, it has been concluded that the deposition of coal started first in the northern (Mohpani) and later extended to the southern (Pench-Kanhan) parts of the Satpura Gondwana Basin. The favourable conditions for the formation of coal lasted longer in Pench-Kanhan area resulting into the deposition of thick workable seams. Unlike Mohpani, the tectonic and erosional factors have also not affected this area much hence, it is the most promising coalfield in whole of the Satpura Basin for the economic exploitation of coal.

## IV. FIELD EXCURSIONS

Glossopteris flora and palynological samples (Lower Gondwana) were collected from Daltonganj, Tattitola (Rajmahal) and Auranga Coalfield, Bihar.

### Panchet of Raniganj, Deobar and Nidpur

### Raniganj Coalfield

Triassic megafossils and samples for miospore studies were collected from a number of sections at :

(a) Noonia Jor

(b) Noonia Khal

(c) Damodar river near Junut village

The mega-fossil collection includes *Schizoneura, Glossopteris, Dicroidium* and *Vertebraria.*

### Auranga Valley

Triassic plant remains were collected from Auranga river section near Deobar. The collection comprises *Glossopteris, Dicroidium* and some scale-like leaves. A large number of shale samples were also collected for maceration.

### Gopad Valley

Near Nidpur, in the Gopad river cutting, a large collection of mega-fossils was made. The collection includes *Glossopteris, Dicroidium, Taeniopteris,* conifer shoots and a few fructifications belonging to Pteridosperms.

### Jurassic—L.Cretaceous

### Jurassic of Rajmahal

In the Rajmahal Hills fresh collections were made from a number of localities. Among them, Amarjola, Khatangi hill, Parhargama, Onthea, Bindaban, Mandro and Basko Beds yielded the best preserved fossils. At Basko Beds many good specimens of *Dictyozamites* have been collected.

## East Coast Gondwana

Fossiliferous localities near Ghantikhal ( Atgarh sandstone ) and Vemavaram were visited,. A large number of Pteridophytes, cycadophytes and conifers represented by *Phlebopteris*, *Pterophyllum*, *Araucarites* and many others were collected.

## Kutch

Visited the Tertiary localities around Bhuj, namely Matanamadh, Panandhro, Nareda, Baranda, Mokhra (Khari River bed), Mothala and Dhaneti and collected Tertiary petrified woods and leaf impressions and Tertiary and Mesozoic palynological samples from measured sections.

## Mohpani Coalfield

The complete succession of Lower Gondwana sequence exposed in the Sitarewa River was covered in this area for the field mapping by clinometer and collection of samples for palynological and sedimentological studies. The outcrops were measured for the preparation of measured stratigraphic columns and coal and rock samples were collected at various places for the biostratigraphical analysis. The contacts between the distinguishable formations have been marked on the map for the preparation of a geological section of the area showing the structure of the coalfield.

## Auranga Coalfield

The field study and the collection of some rock samples from the various horizons of the Gondwana Succession have been done mainly from the Auranga River cutting and Deobar areas of the Coalfield. Systematic collection of coal samples have been done from the Jagaldaga area. Samples were collected from the old working quarry for palynological studies.

## Nepal

During the brief visit to Kathmandu valley a general survey of the Quaternary deposits was made, which are mostly disposed in the terraced upland surrounding the flat valley. Dark grey lake deposits occur in the valley itself, which are dug out and used as fertiliser. Bands of lignite are exposed along the banks of rivers of road cuttings. Samples for pollen analysis and radio carbon dating have been collected.

Water samples from storage tanks (Pokhars) and moss cushions have been collected to determine the present day sedimentation of pollen and spores.

### Madras

The places visited are Coonor, Upper Bhawani, Kotagiri Road, Kakathope, Palada, Dodabette, etc. Surface samples, moss cushions and samples for C 14 dating have been collected. Profiles for pollen analysis were collected from Upper Bhawani and Kakathope.

### Punjab

A field excursion was undertaken to collect rock samples from the sedimentary basins of Punjab and Himachal Pradesh, particularly from the early and late Tertiary sequences. About 132 samples were collected.

### France

An excursion to Aquitain, South West France was undertaken in the month of September 1970 for 7 days, and collected samples for nannoplanktons study from Jurassic and Eocene formations near Biarritz and Cretaceous-Eocene sediments near Donzacq.

## V. TRAINING PROVIDED TO OUTSIDERS.

Training was provided in techniques and research to the following persons.

1. Dr. Ma Khin Sein, Colombo Plan Trainee
2. Mr. D.E.P. Jeya Singh. Lecturer, Botany Department. Madras Christian College, Madras.
3. Mr. M.S. Rawat, Asstt. Prof. of Botany, Govt. College, Schore, Bhopal.
4. Mr. M. T. Shiekh, Research Scholar, College of Science, Nagpur, Deccan Intertrappean flora of India (For Ph. D. thesis).
5. Mr. Mahesh Chandra, Research Scholar, Geology Department, Banaras Hindu University, Banaras.

6. Mr. V. D. Borkar, M. A. C. S. Research Lab. Law College Road, Poona.

7. Mr J. N. Rai, Geology Deptt., Banaras Hindu University, Banaras.

8. Miss S.R. Chitinis, Botany Deptt. Shivaji University, Kolhapur.

9. Mr. Ram Chandra Khare, Banaras Hindu University, Banaras.

10. Miss Archana Dwivedi, Lucknow.

## VI. TECHNICAL ASSISTANCE

| | | |
|---|---|---|
| 1. | Age determination of samples from the Lukuga Series of Congo. | Director, Musee Royal de 'l' Afrique Centrale, Tervuren (Belgium). |
| 2. | Samples for identification and Pollen Analysis. | Prof. B.P. Sinha, Director of Archaeology, Patna. |
| 3. | Samples for identification and Pollen Analysis. | Prof. L. Dupree of Afghanistan. |
| 4. | Samples for pollen analysis. | Mr. Abdul Waheed Khan, Director, Archives and Museum, Hyderabad. |

## VII. SPONSORED/COLLABORATIVE RESEARCH

The following research projects have been undertaken by the Department of Mesozoic Palaeobotany with different Universities and institutions.

1. Palynological investigation of the shale samples from the Triassic of Germany (Buntsandstein) (in collaboration of Coal Department).

2. Miospores from the Chinle formation, Arizona, U. S A. (in collaboration with the Coal Department).

3. Miospores from the Lukuga Series, Congo (in collaboration with the Department of Oil Palynology).

The following research projects have been undertaken by the Department of Coal Palaeobotany with different universities and institutions.

4. Palyno-petro-stratigraphical studies of the Lower Gondwana coals and associated deposits with Coal Division of the Geological Survey of India (in collaboration with the Palaeozoic Department).

5. Palynology and study of physical constituents of coals with the Central Fuel Research Institute, Jealgora.

6. Palyno-petrology of Wardha Valley coals with Geology Department, Banaras Hindu University.

7. Palynology of Godavari Valley coals with Geology Department, Osmania University.

8. Palyno-petrology of Kutch lignites with State Geological Survey of Gujarat.

9. Palyno-petro-stratigraphical studies of Neyveli lignite deposits with Neyveli Lignite Corporation of India.

10. Palaeo-ecology and pollen-spore floras of Upper-Cretaceous (Mancos) coal beds of Utah, U. S. A. with Geology department of Michigan State University, U. S. A.

The following research projects have been undertaken by the Department of Quaternary Palaeobotany with universities and institutions.

11. Vegetational history and environment archaeology of Marwa-Madh islands, Bombay and Kutch with Tata Institute of Fundamental Research, Bombay.

12. Pollen allergy with Departments of Pharmacology and Tuberculosis of the King George Medical College, Lucknow.

The following research projects have been undertaken by the Department of Oil Palynology with universities and institutions.

13. Palaeoecology and pollen spore floras of Upper Cretaceous

(Mancos) Coal beds of Utah, U. S. A. with Geology department of Michigan State University, U. S. A.

14. In collaboration with the Companie Francaise de Petrole, Bordeaux, France, three long term projects, as mentioned below, are in progress.

(a) Palaeopalynology of Libya basin, N. W. Africa.

(i) Carboniferous palynology.

(ii) Permo-Triassic Palynology.

(b) Palaeopalynology of Bedouri bore core, Queensland, Australia.

**VIII. Papers and Lectures at Symposia/Conferences/Meetings etc.**

PAPERS

| | | |
|---|---|---|
| 1. An early triassic mioflora from Asansol area. | Dr. H.K. Maheshwari & Jayasri Banerji. | Seminar on Palaeopalynology and Indian Stratigraphy, Calcutta. |
| 2. Fossil woods of *Careya* and Barringtonia from the Tertiary of Assam. | Dr. U. Prakash | 23rd Scientific meeting Palaeobotanical Society |
| 3. Ancient plant economy at Ter, Dist. Osmanabad, Maharashtra. | Dr. Vishnu-Mittre, Dr. U. Prakash & Dr. N. Awasthi. | ,, |
| 4. Occurrence of *Dipterocarpus* in the Cuddalore Sandstones near Pondicherry, South Arcot, Tamil Nadu. | Dr. N. Awasthi | ,, |
| 5. Lower Gondwana Microfloristics. | Dr. D. C. Bharadwaj | Seminar on Palaeopalynology and Stratigraphy, Calcutta. |

| | | |
|---|---|---|
| 6. Petro - palynological studies of Lower Gondwana Durain-Coals. | Dr. G. K. B. Navale | ,, |
| 7. Geology of Mohpani Coalfield. | Drs. D. C. Bharadwaj & Anand Prakash | 23rd Scientific meeting, Palaeobotanical Society. |
| 8. Palyno-petrology of Pench-Kanhan Coalfield. | Drs. D.C, Bharadwaj, G. K. B. Navale & Anand Prakash | ,, |
| 9. Significance of elaters in the taxonomy of *Anthocerotales*. | Dr. D. C. Bharadwaj | ,, |
| 10. Palaeobotany and the environment of Early Man in India. | Dr. Vishnu-Mittre | Seminar held by the Archaeological Soc. of India. |
| 11. Problems and prospects study of Quaternary deposits in the Bengal Basin. | Dr. Vishnu-Mittre | Seminar Palaeo-palynology and Indian Stratigraphy, Calcutta. |
| 12. Pollen analytical study of Quaternary deposits in the Bengal Basin. | Drs. Vishnu-Mittre & H.P. Gupta | ,, |
| 13. On the events of subsidence and the former rate of sedimentation in the Bengal Basin. | Dr. Vishnu-Mittre | ,, |
| 14. Pollen analysis of Bengal Peat. | Dr. Vishnu-Mittre | 23rd Scientific meeting, Palaeobotanical Society. |
| 15. Pollen analysis of Nalsarovar, Gujarat. | Mrs. Chhaya Sharma | ,, |

| | | |
|---|---|---|
| 16. History of Cereals-cytogenetic and archaeobotanical reconnaissance. | Dr. Vishnu-Mitrre | ,, |
| 17. Stratigraphic range of *Dandotiaspora* gen. nov. in the Lower Eocene sediments of India, | Dr. S.C.D. Sah<br>Dr. R.K. Kar &<br>Mr. R.Y. Singh | ,, |
| 18. Palynostratigraphic evaluation of the Lower Eocene sediments of India. | Dr. S.C.D. Sah | Seminar Palaeo-palynology and Indian Stratigraphy, Calcutta. |
| 19. Palynology of the Lower Cretaceous sediments of India. | Dr. H.P. Singh | ,, |
| 20. Etude palynologique des argiles grises de Delmiapuram Dist.de Trichinopoly, Indes. | Dr. K.P. Jain &<br>Mme. Tougourdeau-Lantz | IInd Planktonic Conference, Rome. |
| 21. Palynological assemblage from the Barren Measures (Permian) of India. | Dr. R.K. Kar | Seminar Palaeo-palynology and Indian Stratigraphy, Calcutta. |
| 22. A comparative study of cryptogamic spores of Upper Jurassic and Lower Cretaceous from Kutch, Gujarat and their stratigraphic value. | Dr. R.K. Kar | ,, |
| 23. Palynological investigation of the Lower Cretaceous sediments exposed at Dayapar, Kutch, Gujarat. | Dr. R.K. Kar &<br>Dr. B.S. Venkatachala | ,, |

| | | |
|---|---|---|
| 24. Algal and Fungal remains from the Tura Formations. | Mr. R.Y. Singh | 23rd Scientific meeting Palaeobotanical Society. |
| 25. Permian Fossil wood from Antartica. | Dr. H.K. Maheshwari | ,, |

*LECTURES*

| | | |
|---|---|---|
| 1. Coal in India. | Dr. G.K.B. Navale | Engineers Association, Chakrata, U. P. |
| 2. The March of Procession of Life. | Dr. Vishnu-Mittre | Botany Department, Tribhuvan University, Kathmandu. |
| 3. Our Tiny Friends and Foes of the Past. | Dr. Vishnu-Mittre | Indian Library, Kathmandu. |
| 4. Glossopteris flora of India. | Dr. H.K. Maheshwari | Department of Geology, Ohio State University, Columbus, U. S. A. |

Following lectures were delivered at the Birbal Sahni Institute of Palaeobotany.

| | | |
|---|---|---|
| 1. Dr. S V. Meyen | 28.12.70 | Relation of the Main Carboniferous and Permian floras. |
| 2. Dr. S.V. Meyen | 29.12.70 | The origin of the Mesozoic flora. |
| 3. Prof. K.Faegri | 1.1.71 | Quaternary Palynology, Past, Present and Future. |
| 4. Dr. N. K. Srivastava | 28.1.71 | Moon rocks and its minerals. |
| 5. Dr. S. V. Meyen | 29.1.71 | Parallelism and its significance for Systematics of fossil plants. |

| | | |
|---|---|---|
| 6. Prof. Louis Dupree | 16.2.71 | Archaeology in Afghanistan. |
| 7. Dr. A.R.H. Martin | 20.3.71 | Development of Palaeobotany and Palynology in Australia. |
| 8. Dr. A.R.H. Martin | 22.3.71 | Modern Australian vegetation and Historical plant geography-illustrated. |
| 9. Dr. A.R.H. Martin | 23.3.71 | Palynological history of angiosperm in Australia and its application in stratigraphy. |
| 10. Dr. A.R.H. Martin | 24.3.71 | Family Proteasceae–present and past–Illustrated. |

## IX. DEPUTATION/TRAINING/STUDY ABROAD

| | | |
|---|---|---|
| 1. | Dr. Vishnu Mittre | Kathmandu, Nepal to collect materials for the project on Central Himalaya. |
| 2. | Dr. S. C. D. Sah | U. S. S. R. Under Indo-Soviet Cultural Exchange Programme. |
| 3. | Dr. H. K. Maheshwari | do |
| 4. | Dr. P. K. Maithy | Bonn, Germany at Institute Fur Palaontologie, Rheinshe Freidrict Wilhelms University, Bonn-German Academic Exchange Service Fellowship. |
| 5. | Dr. R. S. Tiwari | Senckenberg, Frankfurt (Germany) at Palaeobotanical Section, Natur-Museum and Forschung Alexender Von Humboldt Foundation Fellowship. |

## X. HONOURS/AWARDS

| | | |
|---|---|---|
| 1. | Mr. Anand Prakash | "Palyno-petrostratigraphy of some Lower Gondwana Coals of India" (Ph. D. Lucknow University) |

2. Mrs. R. Makada — "Contributions of Palaeobotany of the Talchir Series" (Ph.D. Lucknow University).

## XI. FOUNDERS DAY

As usual the Founders Day was celebrated on 14th November, 1970, the birthday of Professor Birbal Sahni, FRS, the Founder of the Institute.

In the morning wreaths and flowers wers placed on the Samadhi of Professor Birbal Sahni.

The main function started at 11 a.m. which was inaugurated by Dr. B. Gopala Reddi, Governor of Uttar Pradesh. Dr. V.K.R.V. Rao, Minister for Education and Youth Services, Government of India, New Delhi was the Chief Guest. Professor T.S. Sadasivan, Chairman, Birbal Sahni Institute of Palaeobotany welcomed Dr. B. Gopala Reddi, Professor V.K.R.V. Rao, Professor A.R. Rao, Mrs. Savitri Sahni and other guests. Dr. V.K.R.V. Rao suggested that the Institute of Palaeobotany should try to establish scientific collaboration with such organisations as Geological, Botanical and Archaelogical Surveys of India, the Oil and Natural Gas Commission, the Indian Councils of Agricultural and Medical researches and various State departments of forests, geology and mining.

Dr. Rao said : "The major hurdles in India in the way of science assuming an effective role in society are social conservatism, outdated attitude and rigid organisation. There is, therefore, imperative need to develop a new image of science and to evolve the machinery necessary to support this image."

Referring to the museum of the Institute Dr. Rao said: "A visitor is struck by the wealth of information which is available here regarding the diversity and richness of plant life that existed on our planet during the geological past".

From the simple and lowly plant organisms of the pre-cambrian era to the highest evolved flowering plants of today there was a fascinating story of plant evolution he added.

Dr. Rao said : "The continuous stream of everchanging life and the magnitude of time that has gone by makes one feel humble and

stand in awe and admiration of the great power that is at the back of this great drama whose beginning and end is beyond comprehension"

The Institute he went on was deciphering the structure and distribution of fossil plants that existed from the earliest known time till about a milion years ago. Their studies had thrown light on such fundamental phenomena as the theory of continental drift and rise of Himalayas.

Dr. Rao said such studies may not appear to possess any direct utilitariran advantages to man but fundamental knowledge is like the main stream of a great river from which canals can be diverted for proper use whenever required.

Referring to the applied aspect of Palaeobotany Dr. Rao said that the Institute had not completely ignored this aspect. The scientists were applying palaeobotanical knowledge in solving problems of economic geology and archaeology. They are specially rendering valuable service in age determination and correlation in coal and oil-bearing strata he added.

Dr. Rao said, "they are using palynostratigraphical and bio-petrological studies in making age, determination or identification of strata of unknown or disputed geological age, correlation of well and surface sections and outlinking favourable areas for oil exploration".

After the learned address of the Chief Guest, Prof. A. R. Rao, delivered the XVIII Sir Albert Charles Seward Memorial Lecture on "Jurassic flora of the Rajmahal Hills".

Later, Mrs. Savitri Sahni, presented the "Pratul Chandra Bhandari Gold Medal" to Dr. Shyam Chandra Srivastava and the "Chandra Dutt Pant Memorial Gold Medal" to Mr. Anil Chandra for the best piece of research carried out at the Sahni Institute among the Junior Research Assistants and Research Scholars during the three/two preceeding years respectively.

Dr. K.R. Surange, Director, Birbal Sahni Institute of Palaeobotany, Lucknow, thanked the Governor Dr. B. Gopala Reddi, the Chief Guest Dr. V.K.R.V. Rao, Dr. A.R. Rao, Mrs. Savitri Sahni and other guests.

## XII. REPRESENTATION ON COMMITTEES/BOARDS

| | | |
|---|---|---|
| 1. | Dr. K. R. Surange | Member, Sectional Committee-VI Indian National Science Academy. |
| | | Member, International Committee for Palaeobotanical Nomenclature. |
| | | Secretary, Editorial Board "The Palaeobotanist". |
| | | Councillor, Executive Council, The Palaeobotanical Society. |
| | | Member, Editorial Board, "Geophytology". |
| 2. | Dr. R. N. Lakhanpal | Chief Editor, "Geophytology". |
| | | Member, Editorial Board, "The Palaeobotanist". |
| 3. | Dr. D. C. Bharadwaj | Member, International Committee on Palynology. |
| | | Secretary, Sub-commission on Spores, International Commission on Palaeozoic Microfloras. |
| | | Member, International Sub-commission on Carboniferous stratigraphy of I.U.G.S. Convener for Permian Stratigraphy in the International Commission on Palaeozoic Microfloras. |
| | | Secretary, Palaeobotanical Society. |
| | | Member, Editorial Boards, of "Review of Palaeobotany and Palynology" "The Palaeobotanist" and "Geophytology". |
| 4. | Dr. M. N. Bose | Vice-President, J. Sen Memorial Committee. |
| | | Member, Editorial Board, "The Palaeobotanist". |
| | | Member, Executive Council, the Palaeontological Society of India. |

| | | |
|---|---|---|
| | | Chairman, Mesozoic Section, Seminar on Palaeopalynology and Indian Stratigraphy. |
| | | Convener, Morphological and Stratigraphical Palaeobotany, Palaeobotanical Conference, Lucknow. |
| 5. | Dr. Vishnu-Mittre | Member, Indian Radiocarbon Dating Committee, Tata Institute of Fundamental Research, Bombay. |
| | | Member, Executive Council, Indian Archaeological Society. |
| | | Member, Executive, Indian Quaternary Research Society. |
| | | Member, Executive, Indian Pre-historic Society. |
| 6. | Dr. S. C. D. Sah | Joint Secretary, The Palaeobotanical Society. |
| 7. | Dr. G. K. B. Navale | Member, International Committee on Coal Petrology. |
| | | Member, International Coal Nomenclatural Commission. |
| | | Member, International Lignite Nomenclatural Commission. |
| | | Member, National Committee of Coal Petrology. |
| 8. | Dr. H. K. Maheshwari | Councillor, Executive Council, the Palaeobotanical Society. |
| | | Member, Editorial Board, "Geophytology". |

## XIII PUBLICATIONS

The Journal–**The Palaeobotanist**

During the year the following numbers of *The Palaeobotanist* were published.

(a) Numbers 2 & 3 of Vol.18

(b) Numbers 1 & 2 of Volume 19 were sent to the Press.

**Seward Memorial Lecture**

XVII Sir Albert Charles Seward Memorial Lecture on 'Plants in the Arctic today and in the past' delivered by Prof. O. A. Hφeg, University of Blindern, Oslo, Norway, was sent to the press.

**Sale**

During 1970-71, an income of Rs. 39,300 was registered from the sale of the Institute's publications. This sum includes the following foreign exchange earned through the sale of publications :

US $ 2,687.00

£ 238.00

## XIV. LIBRARY

**Books**

| | |
|---|---|
| Number of books added during the year | 108 |
| Total number of books as on 31-3-71 | 2454 |

**Journals**

| | |
|---|---|
| Number of issues of Journals received during the year | 2510 |
| Total number of issues of journals as on 31.3.71. | 5300 |
| New Journals subscribed | 4 |

**Reprints**

| | |
|---|---|
| Number of reprints received during the year | 1536 |
| Total number of reprints as on 31-3-71 | 19,621 |

**Microfilms**

| | |
|---|---|
| Total number of Microfilms as on 31-3-71 | 153 |

**Exchange**

| | |
|---|---|
| Number of papers purchased for exchange | 43 |
| Number of papers received as gifts | 11 |
| Total number of reprints sent out on exchange | 3,854 |
| Number of individuals on exchange | 327 |
| Number of institutions on exchange | 61 |

65 complete sets of reprints of Professor B. Sahni were sent out.

**Requests for exchange received from the following :**

(i) All Union Geological Library, Leningrad, U. S. S. R.

(ii) Biological Research Division, The Burma Research and Development Committee, Rangoon, Burma.

(iii) Geologicky Ustav Dionyza Stura, Bratislava, Czechoslovakia.

As in other years a number of research students and scientists who visited the Institute took the opportunity to consult the latest literature in the Library. Books, Journals etc. were loaned to the Geological Survey of India (Northern Circle), Botany Departments of Lucknow, Calcutta, Kalyani and Punjab Universities, National Botanic Gardens, Lucknow, Geology Department, Dibrugarh University, Bose Institute, Calcutta and Institute of Science, Nagpur.

New arrivals were displayed in the Library on every Monday.

## XV. MUSEUM

**Exhibition Halls**

(1) Total number of specimens displayed in both Geological and Botanical Halls. 920

(2) Two show cases of Oil department having various exhibits and one model of Oil exploration showing a drill through an anticline were added in the Museum.

(3) Displays of coal, Archaeobotany and Quaternary Palynology were completely changed and made upto date.

(4) Two show-cases in the Botany Hall showing oldest rock samples available on earth were renovated.

(5) The model geological relief map of India together with adjacent countries, displayed in the geological hall of the Museum, was re-coloured and the lighting arrangement was set right.

**Fossil Store-room**

| | |
|---|---|
| Catalogued specimens as on 31-3-1971 | 41,035 |
| Specimens from foreign countries as on 31-3-1971 | 978 |
| Number of type and figured specimens as on 31-3-1971 | 986 |
| Number of figured slides as on 31-3-1971 | 4,222 |
| Number of figured negatives as on 31-3-1971 | 2,996 |

A total number of 1,359 localities in the various parts of the country have been traversed by the Institute staff for the collection of fossil material.

Total samples acquired during the year under report department-wise :

| | |
|---|---|
| Palaeozoic specimens | 1,600 |
| Mesozoic specimens | 2,521 |
| Tertiary specimens | 1,316 |
| Coal samples | 969 |
| Oil samples | 605 |
| Quaternary samples | Nil. |

The resolution of the Museum Advisory Committee regarding weeding of fossils is being implemented.

Duplicate specimens, 16 in number, were presented to the T.N.B. Degree College, Bhagalpur University.

## XVI. HERBARIUM

### Woods

| | |
|---|---|
| Addition of wood samples during the year | 140 (in duplicate set) |
| Total number of wood samples as on 31.3.71 (including wood samples for exchange) | 2,327 |
| Total number of wood slides as on 31.3.71 | 1,644 |
| Other slides | 4,632 |

### Fruits & Seeds

| | |
|---|---|
| Addition of fruits and seeds specimens during the year. | 8 |
| Total number of fruits and seeds as on 31.3.71. | 626 |

### Herbarium Specimens

| | |
|---|---|
| Addition of plant specimens during the year. | 4,166 |
| Total number of plant specimens as on 31.3.71. | 8,723 |

### Pollen Slides

| | |
|---|---|
| Addition of pollen slides during the year. | Nil |
| Total number of pollen slides present as on 31.3.71. | 7,540 |

### General

During the period of this year, Herbarium Advisory Committee was formed under the Chairmanship of the Director. The recommenda-

tions of the Committee are being implemented. As recommended by the Advisory Committee, rearrangement of wood slides, wood and plant specimens was completed. Preserved fruits and seeds and wood slides presented by Prof. K. N. Kaul in the year 1969-70 were arranged and listed. Wood samples received from Malaysia were catalogued and arranged. Checking of index cards (genera wise) starting from A and putting the numbers of slides on the back side of index cards upto D was completed for documentation purposes. About thirty wood samples were trimmed and cut into sections to make permanent slides. Identification of fruits, seeds and plant specimens was done.

During the rearrangement of plant specimens poisoning and repairing of specimens was carried out.

Dr. A. R. H. Martin, a visiting scientist consulted the Herbarium in connection with his research work and presented about 20 plant specimens collected by him from Simla in February. Three specimens of polliniferous material and fruits and seeds were also presented to the herbarium which were collected by him from Khajuraho (M. P.)

Dr. H. A. Khan joined on 23rd March as Curator in the Herbarium. He presented 4 samples of seeds to the Herbarium which were collected from Shahabad (Hardoi)

## XVII. BUILDING

Apart from general maintenance, the following constructions were completed during the year :

Kitchen for Visiting Scientist rooms.

Glazing of the Veranda on the east side of the administrative building for providing space to the staff.

Construction of a water channel from the Tube well.

Distempering of the laboratories which could not be completed last year was started towards the end of the financial year.

### Garden

A good number of plants was acquired for the Institute's garden either through donations (507) or by purchases. (198)

Special decorations of the Institute's campus was made during the annual function.

About 100 roses have been propagated in the Institute's campus by means of budding.

## XVIII. VISITORS

**Distinguished persons**

| | |
|---|---|
| Dr. & Mrs. G. O. W. Kremp,<br>University of Arizona,<br>Tucson, Arizona, U.S.A. | 12.7.70 |
| Dr. J. M. Dickins,<br>Palaeontologist,<br>Bureau of Naturul Resources,<br>Geology and Geophysics of<br>Commonwealth, Canberra,<br>Australia. | 11.8.70 |
| Jain Thoruton,<br>Imperial College, London. | 4.9.70 |
| Dr. V. K. R. V. Rao,<br>Union Minister of Education,<br>New Delhi. | 14.11.70 |
| C. E. Raben,<br>Geol. Institute, Moscow. | 19.11.70 |
| N. M. Chumakov,<br>Geol. Institute, Moscow. | 19.11.70 |
| Dr. W. I. Chalychev,<br>Geol. Inst. Syktyvkar,<br>Komi A. S. S. R., U.S.S.R. | 23.11.70 |
| K. Faegri,<br>Norway, Bergen. | 1.1.71 |
| Col. Vakil Singh,<br>Dy. Chief Engineer, M. E. S. Lucknow. | 6.2.71 |
| Col. M. S. Brar,<br>HQ. Central Command, Lucknow. | 6.2.71 |

| | |
|---|---|
| Mr. Ishwar Chandra,<br>Director General, Employment<br>and Training, Govt. of India. | 12.2.71 |
| Mr. S. N. Acharya,<br>Director, Training & Employment,<br>Govt. of U. P., Lucknow. | 12.2.71 |
| Dr. & Mrs. Louis Dupree,<br>Kabul, Afghanistan. | 15.2.71 |
| Dr. & Mrs. A.R.H. Martin<br>University of Sydney, Australia. | 15.2.71 |

**Educational and other Institutions**

Students and teachers of the following institutions visited the Museum and the Institute :

Department of Botany, Utkal University.
Department of Botany, Cotton College, Gauhati.
Institute of Science, Bombay.
Department of Botany, Presidency College, Calcutta.
Department of Botany, Sophia College, Ajmer.
Department of Botany, Gauhati University.
Department of Botany, Poona University.
Department of Museology, Calcutta University.
Department of Botany, C.M. College, Darbhanga.
Department of Botany, Vidarbha Mahavidyalaya, Amravati.

## XIX. THE GOVERNING BODY & THE FINANCE COMMITTEE

### THE GOVERNING BODY

**Chairman**

Professor T. S. Sadasivan,
Director,
Centre for Advanced Studies in Mycology &
Plant Pathology, University Botany Laboratory,
Madras-5.

**Members**

Mrs. Savitri Sahni,
686, Birbal Sahni Marg,
Lucknow (For her life time)

Dr. R. V. Sitholey,
Assistant Director,
National Botanic Gardens,
Lucknow.

Professor S. C. Agarwala,
Head of the Botany Department,
Lucknow University,
Lucknow.

Dr. S. K. Mukherjee,
Director,
Botanical Survey of India,
Calcutta-13.

Professor A. G. Jhingran,
Head of the Geology Department,
Delhi University,
Delhi.

Mr. M. S. Balasundram,
Director-General,
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Professor D. D. Pant,
Head of the Botany Department,
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Director,
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Lucknow (Member-Secretary).

Mr. R. K. Khare,
Registrar,
Birbal Sahni Institute of Palaeobotany,
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Professor T. S. Sadasivan,
Director,
Centre for Advanced Studies in Mycology &
Plant Pathology, Univ. Botany Laboratory,
Madras-5.

### Members

Professor S. C. Agarwala,
Head of the Botany Department,
Lucknow University, Lucknow.

Professor K. R. Surange,
Director,
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**Director**

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**Department of Quaternary Palaeobotany**

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Miss Asha Khandelwal, M. Sc. (Research Scholar)

**Department of Oil Palynology**

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Dr. K. P. Jain, M. Sc., Ph. D.
Dr. R. K. Kar, M. Sc., Ph. D.
Mr. R. Y. Singh, M. Sc. (Research Scholar)
Mr. R. K. Saxena, M. Sc. (Research Scholar)

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Mr. R. K. Khare (Registrar)
Mr. V. P. Gulati (Deputy Registrar)
Mr. S. D. Mehtani (Office Assistant)
Mr. S. K. Suri (Stenographer)
Mr. S. P. Chadha (P. A. to Director)
Mrs. P. K. Srivastava (Receptionist)
Mr. H. S. Srivastava (U. D. C.)
Mr. Bhagwan Singh (U. D. C.)
Mr. Ramesh Chandra (L. D. C.)
Mr. I. J. Mehra (Steno-typist)
Mr. I. J. S. Bedi (Steno-typist)
Mr. Ayodhya Nath (Steno-typist)

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Mr. S. B. Verma (Accountant)
Mr. T. N. Shukla (U. D. C.)
Mr. B. K. Jain (U. D. C.)
Mr. I. J. Mehra (L. D. C.) upto 2-3-71
Mr. N. N. Joshi (L. D. C.)

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Mr. N. N. Moitra (Publication Incharge)

## LIBRARY

Mr. J. N. Nigam (Library Assistant)

## MUSEUM

Mr. T. S. Mohan Shanker (Museum Assistant)
Mr. N. C. Saxena (Junior Museum Assistant)

## HERBARIUM

Dr. H. A. Khan, M. Sc., Ph. D. (Curator) from 23-3-71
Mr. G. P. Srivastava (Herbarium Incharge)
Mr. J. C. Srivastava (Herbarium Assistant)

## LABORATORY SERVICES

Mr. R. C. Gupta (Junior Technical Assistant)
Miss Asha Bharadwaj ,,
Miss M. Chowdhury ,,
Miss Indra Kumari ,,
Mr. H. N. Boral ,,
Mr. Rajbir Singh ,,
Mr. D. C. Joshi (Junior Technical Assistant)
(Scheme "Palynological Studies from Oil India Ltd.)
Mr. N. K. Khasnavis (Laboratory Assistant)

## PHOTOGRAPHY & DRAWING

Mr. M. N. Takru (Artist)

Mr. B. N. Bose (Photographer) upto 20-4-70

Mr. P. C. Roy (Photographer) from 3-2-71

## XXI. BUDGET 1970-71

| Head | Actual Expenditure (Rupees in Lakhs appx.) |
|---|---|
| **1. PLAN** | |
| **(i) Recurring** | |
| Pay of Officers | 0.168 |
| Dearness Pay of Officers | 0.005 |
| Pay of Establishment | 0.015 |
| Dearness Pay of Establishment | 0.008 |
| P. F. Contributions | 0.013 |
| Allowances & Honoraria | 0.027 |
| Contingencies | 0.209 |
| Maintenance | 0.014 |
| | 0.459 |
| **(ii) Capital** | |
| Apparatus & Equipment | 0.036 |
| Services Ancillary to Research | 0.111 |
| Building & Garden | 0.058 |
| Furniture & Other requirements | 0.045 |
| | 0.250 |

## 2. NON-PLAN

### Recurring

| | |
|---|---|
| Pay of Officers | 1.835 |
| Dearness Pay of Officers | 0.155 |
| Pay of Establishment | 1.438 |
| Dearness of Establishment | 0.629 |
| Provident Fund Contribution | 0.339 |
| Allowances & Honoraria | 0.931 |
| Contingencies | 0.989 |
| Maintenance | 0.049 |
| Chemicals & apparatus | 0.165 |
| | 6.530 |