A LOWER TRIASSIC PALYNOASSEMBLAGE FROM BUDHARAM AREA, GODAVARI GRABEN, ANDHRA PRADESH

Budharam Area forms the north-western extension of the Chinnur Belt on the eastern margin of the Godavari Graben. The present bore-hole GBR7 investigated here was drilled near Budharam up to 272.50 m. The sedimentary sequence from top consists of coarse grained ferruginous, gritty sandstone underlain by alternation of green clays and coarse to medium grained greenish sandstone. A thick band of carbonaceous shale is present between 206-214 m which has yielded the present palynoassemblage described here. The sediments below this consists of grey clay alternating with coarse to medium-grained gritty, slightly greenish sandstones (Table 1).

Table 1—Lithological succession in bore-hole GBR 7, Budharam Area, Godavari Graben (Andhra Pradesh)

Depth from surface (meters)	Lithology	Remarks
0—61.00	Coarse-grained, gritty ferruginous sandstone	
61.00—92.00	Grey brown clay	
92.00—135.00	Coarse-grained ferruginous sandstone	
135.00—139.00	Green clay in cross bedded greenish sandstone	
139.00—165.00	Coarse to medium-grained greenish sandstone	
165.00—180.50	Green clay	
180.50—182.00	Coarse to medium-grained sandstone	
182.00—192.00	Green clay	
192.00—198.00	Coarse to medium-grained sandstone, cross bedded at places	
198.00—206.00	Medium-grained sandstone	
206.00—214.00	Carbonaceous shale	Panchet palynoassemblage
214.00—217.75	Medium-grained sandstone	
217.75—225.15	Grey clay, shale in sandstone	
225.15—232.25	Sandstone	
232.25—235.00	Carbonaceous shale	
235.00—241.25	Grey clay	
241.25—249.75	Coarse-grained sandstone	
249.75—249.90	Carbonaceous shale	
249.90—251.75	Grey clay	
251.75—265.00	Coarse-grained sandstone	
265.00—265.30	Grey clay	
265.30—266.50	Coarse-grained sandstone	
266.50—272.50	Grey clay	

The assemblage present between 206-214 m shows the dominance of *Striatopodocarpites* (24%) and *Faunipollenites* (14%). The subdominance is formed by *Lundbladispora* (14%) and *Densoisporites* (9%). In addition to these *Falcisporites* (4%) and *Klausipollenites* (3%) are also noteworthy. *Verrucosisporites*, *Lunatisporites*, *Alisporites* and *Inaperturopollenites* are rare but occur consistently. *Densipollenites* (1%) and *Crescentipollenites* (3%) also occur in low percentages. The total dominance is formed by striated disaccate pollen grains (43%) while the subdominance is attained equally by nonstriate disaccate pollen (23%) and cavate-cingulate spores (23%).

The present assemblage is comparable to Assemblage I in bore-hole NCRD6 from Dishergarh-Asansol region in Raniganj Coalfield (Bharadwaj & Tiwari, 1977) in view of similar presence of *Lundbladispora* and *Densoisporites*. However, the latter assemblage differs in having greater percentages of *Verrucosisporites*, *Klausipollenites* and *Lunatisporites*. *Playfordiaspora* present in bore-hole NCRD6 has not been observed in bore-hole GBR7.

The Assemblage V marked by the dominance of *Lundbladispora* in bore-hole RAD2 in East Raniganj Coalfield (Singh & Tiwari, 1982) is also comparable but contains greater percentage of *Lunatisporites*. The assemblage in bore-hole RAD5 (Group IIC-510 m) from East Raniganj Coalfield (Tiwari & Singh, 1983) bears a close resemblance with the present assemblage in view of higher percentage of *Lundbladispora*. The palynoassemblages encountered in bore-hole RAD11 from East Raniganj Coalfield (Singh, 1984—Assemblage II) contain greater percentage of *Callumispora* and very low amount of striate disaccate pollen grains and thus its comparability with bore-hole GBR7 assemblage is very limited. The palynoassemblages of the Panchet Formation synthesised by Tiwari and Singh (1986) shows that *Lundbladispora—Densoisporites* Assemblage (P IV A) forms the youngest assemblage with changing frequency of *Lunatisporites*. The striate disaccate pollen decline successively.

The palynoassemblage observed in bore-hole GBR7 contains greater percentage of striate disaccate pollen indicating an older aspect to the palynoflora as compared to the assemblages from Damodar Basin mentioned above. Nevertheless, the subdominance of cingulate-cavate spores alongwith *Falcisporites*, *Klausipollenites*, *Lunatisporites*, etc. suggest definite presence of a palynoflora equivalent to that known from the Late Panchet Formation of India. Thus, the present study records that sediments equivalent to the Panchet Formation, which are as yet not known, are also present in Godavari Graben.

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VISTAS IN INDIAN PALAEOBOTANY—A REPORT

A Symposium *"VISTAS IN INDIAN PALAEOBOTANY"* was jointly organised by the Birbal Sahni Institute of Palaeobotany and Indian Association of Palynostratigraphers, at the Birbal Sahni Institute of Palaeobotany, Lucknow from November 14-16, 1988.

Research papers were contributed on the focal theme notably on the problems of *origin and antiquity of life, fossil fuels, source rock palynology, morphology, taxonomy, evolutionary trends, reconstruction of past vegetations, palaeoenvironments, chemistry of fossil woods, plant remains from pre-and proto-historic times and data retrieval and system analyses.*

Microfossils comparable to Upper Proterozoic records are reported from Nainital Synform, Kumaon Himalaya. Microbiota of Suket Shales (Vindhya Supergroup) suggest an age that is younger than available K-Ar dates (1400±Ma). Evidence of metaphyte/metazoans indicates shelf-like marine setting during Vindhyan sedimentation.

Study of Permian floras of India has brought to light new types of seed and pollen-sac bearing branched organs associated with ginkgoalean leaves. Dominance of *Glossopteris* and other associated taxa is reported from Barakar Formation of Talcher Coalfield, where the *Gangamopteris-Noggerathiopsis* complex is absent, unlike typical Barakar megafloral assemblage known so far.

The age of fossiliferous bed exposed on the left bank of Gopad River near Nidhpur Village, Sidhi District, Madhya Pradesh, has been a matter of controversy. Predominance of glossopterid leaves and lack of indubitable *Dicroidium* leaves have been taken to suggest a latest Permian age; *per contra* Triassic affinity is put forth on several other evidence, such as palynofloral pattern and geological setting of the area. The quick and sharp change-over from striate-disaccate to taeniate phase in the upper part of Middle Member of Kamthi Formation Godavari Basin indicates a palynological break. Interestingly this Permian-Triassic transition shows closer affinity with that of Salt Range and Madagascar rather than Damodar Valley. The Gondwanic palynofloral reflection in Tethys Himalaya and southern China is suggested. The increasing palynological homogeneity during post Permian times as evidenced by global incidence of striate-taeniate and nonstriate-bisaccate pollen is considered to be indicative of warming climatic trends.

The palynological evidences gathered from the eastern side of Brahmani River Section of the hitherto considered Talchir Formation in the Talcher Coalfield of Orissa suggest the presence of Jurassic/Lower Cretaceous sediments in the graben.

New plant megafossil evidence from Dubrajpur Formation exposed at Khatangi Hills, Rajmahal Basin; Golapalli beds, Andhra Pradesh and Athgarh Formation, Mahanandi Basin suggests Lower Cretaceous age assignment. Comparative morphologies of Bennettitalean fructifications and *Cordainthus* prove closer affinities.

Tracing the evolution of angiospermid pollen characters, it is interpreted that infratectal interstitium (TEM) in certain gymnosperms is columellate, manifesting grades of complexity. It is suggested that angiospermid pollen characters exemplified during Triassic were lost (due to extinction?) and reappeared in the Lower Cretaceous. Data to bridge this gap is wanting.

Reconstruction of idealised vegetational scenarios around Nagpur, Chhindwara and Shahpur on the basis of available information on Deccan Intertrappean flora depicts a

tropical evergreen to semi-evergreen forest similar to present day forests of Western Ghats. Additions to the Deccan Intertrappean flora have been made through documentation of podocarpaceous ovules, pseudostem and arecoid palm fruit from Mohgaonkalan.

Studies of Neogene palynofloras and fossil woods from Quilon and Ratnagiri areas suggest prevalence of somewhat equable tropical humid climate with heavy rainfall all along the Kerala Coast during Neogene times. The record of Palaeocene-Eocene palynological succession in subsurface of Neyveli and Kerala Coast is a significant finding adding new knowledge to the stratigraphy of the east and west coast of India.

Attempts have been made to summarise available palaeobotanical and palynological data from Tertiary sequences of Himalayan region. The data has been utilized to reconstruct vegetational pattern of the terrain during Palaeogene-Neogene times. Tertiary sequences of Assam, Meghalaya, Nagaland and other areas in north-east India have continued to attract attention of palaeobotanists and palynologists for past few decades. Studies of Neogene fossil woods from Assam and Nagaland suggest a close phytogeographical link during that period between Indian subcontinent and South-East Asia. Palynological investigations of surface and subsurface Palaeogene-Neogene sequences of Assam are utilized for building up a broad biostratigraphic framework.

A concentrated interdisciplinary effort involving palaeobotanists, vertebrate palaeontologists, sedimentologists, and specialists in palaeomagnetism is being made to study the Siwalik of Nepal. Palaeobotanical evidences have been brought forward to suggest a humid tropical climate during Lower Middle Siwalik with evergreen to semi-evergreen floral pattern in lower part, changing into predominantly deciduous forest in younger horizons. Pollen succession of these deposits suggests a palaeoecological set up with fresh-water swampy environment of lower part, gradually replacing upwards to low-lands habitat.

Palynological analysis of an organic clay encountered almost at present day MSL in a well on South Kanara coastal plain suggests its deposition in a mangrove setting and helps in monitoring Late Pleistocene sea level changes. The C^{14} dates older than 40,000 yrs BP given to this level coincide with warm interstade during Wurmian glacial-even which was characterised by lowered sea level.

Palynological analysis of Late Holocene subsurface material from Coondapur area, Karnataka reveals constant presence of well-developed mangrove forest reflecting a lagoonal environment. The cause of absence of mangrove from the site today is land reclamation and indiscriminate felling of wood. The past history of sholas in South Indian montane reveals that the shola forest is almost on the verge of extinction and dire preventive measures are required to save it. Attempts have been made to reconstruct the vegetational history of mangroves in the Chilka Lake. Organic petrological investigations have suggested that high representation of resinite maceral probably makes Raniganj coals more susceptible to spontaneous combustion. Biopetrological study of Tertiary coals from Assam, Nagaland and Meghalaya indicates that these coals are rich in liptinitic contents and, therefore, also form good source for hydrocarbons. High incidence of such material also suggests better suitability for hydrogenation liquifaction.

Effect of acetylbromide on fossil wood from Karewa sediments indicated that the percentage of acetylbromide soluble matter of fossil woods decreases from 100 per cent in modern to 12 per cent in Pliocene woods suggesting increasing humification during the past four million years. Presence of amino acids, fats, organic acids, phenols and flavonoids is indicated in fossil woods from Palana lignite, on the basis of paper chromatography test.

New reports of plant megafossils from Lower Cretaceous of East Coast of India were made. Morphological and taxonomical aspects of certain fossil leaf genera were discussed.

Dendroclimatological analysis of deodar trees from Joshimath, U. P. indicate close relationship between ring-width chronology and average monthly precipitation and maximum temperature.

Morphological and taxonomic aspects of GV Types dinoflagellate cysts recovered were critically analysed necessitating creation of a new dinocyst taxon from Turonian sediments of Cauvery Basin.

Institute-University Interaction

A dialogue took place between the University teachers and the Sahni Institute scientists participating in the Symposium to formulate a working plan to promote the science of Palaeobotany in the country. Dr. B. S. Venkatachala, Director, Birbal Sahni Institute of Palaeobotany presented the frame-work document for the proposed interaction which stated that Palaeobotany has undergone much change in its contents and character and more stress is now laid on analytical and interpretative aspects. The existing curriculum should now be reviewed to develop one which takes into consideration the continuous in flow of new data. The current topics, like palaeogeography, palaeoecology, biostratigraphy, evolution, migration of floras etc., must be introduced in the curriculum.

Presiding over the meeting, Professor H. Y. Mohan Ram, Botany Department, Delhi University suggested that an ideal syllabus must be evolved and advance courses should be provided which can cover most of the elementary courses and special courses in Palaeobotany. It was unanimously agreed upon that the gap between research and teaching should be minimised, and well documented authentic teaching material should be produced. The aim can be achieved by collective efforts of the Universities and the Sahni Institute. A group was constituted to undertake preparation of a revised Curriculum.

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