

SEMINAR ON PALAEOPALYNOLOGY AND INDIAN STRATIGRAPHY*

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The relatively rapid strides, of late, in applied palynology caused by the exploration of oil, natural gas and coal in India together with slowly accumulating descriptive data on the subject for the past two decades prompted Prof. A. K. Ghosh and his organizer-colleagues to hold a Seminar on Palaeopalynology and Indian Stratigraphy. The main objective for holding such a seminar was to bring together all the applied workers on palynology as applied to Indian Stratigraphy to assess the progress achieved so far on the subject through deliberations and discussions on scientific papers presented at the seminar and to adopt some concrete resolutions at the end of the session for the further progress of the subject in academic institutions and professional organizations. To quote from the inaugural address given by Director-General, Geological Survey of India, 'this is the first Seminar of its kind in India'.

Sponsored by the University Grants Commission, the seminar was organized by the Botany Department of Calcutta University in co-operation with Geological Survey of India, Bose Institute and Oil India Ltd. The seminar was inaugurated by Shri M. S. Balasundaram, Director-General, G.S.I. and Shri A. B. Das Gupta, the well-known geologist and now, Managing Director, Oil India Ltd., addressed the gathering as the Chief Guest while Dr. P. K. Bose, Acting Vice-Chancellor of Calcutta University took the Chair in the inaugural session.

In both the inaugural address and the address by the Chief Guest, the role of palynology in the working out of the Indian stratigraphy, past environment and paleogeography has been deservingly stressed. The Director-General, G.S.I. has ably dealt with a comprehensive survey of the development of the science in India since Chinna Virkki's work on Gondwana palyno-stratigraphy of India and Australia in 1937. The address contains an introductory remark on the subject, its application in coal and petroleum industries, its usefulness as a handy tool in the biostratigraphic classification of the Paleozoic, Mesozoic and Cenozoic sediments of India, its contribution to the knowledge of the evolution of different plant groups, its role in the reconstruction of past environments and concludes with seven immediate problems to be tackled in future in the field of Palaeopalynology. The address by the Chief Guest makes more pointed references to the growth, usefulness, difficulties and further scope of palaeopalynology in Indian stratigraphy. He has particularly mentioned the valuable and indispensable help of palynology in deciphering the geology of Tertiary successions of Assam and Bengal. Three very valuable suggestions have been offered in his address —(1) the major working groups on palaeopalynology should meet together to evolve a common nomenclature to solve the problem of nomenclature which is very much confusing at this stage of work, (2) in the line of the density of vertical and lateral coverage of samples done for heavy mineral analysis of Assam Tertiaries, a palynological framework would be

*Held on February 23-27, 1971 under the auspices of the Calcutta University at the Geological Survey of India, Calcutta.

prepared which would enable us to use climatic cycles for correlation, rather than specific forms, (3) this sort of work should be initiated in the areas where conventional fossils, heavy minerals and other techniques do not provide adequate assistance, e.g., detailed correlation within the Barails, Girujan, Dhekiajulis/Dihings, further subgroupings of Eocene rocks in the southern Shillong Plateau etc.

The papers contributed for the Seminar were grouped under five sections—viz., Purana* (4 papers), Gondwana (13 papers), Mesozoic (11 papers), Tertiary (10 papers) and Quaternary (12 papers). Besides, two special lectures of general interest—one on common frontiers of palaeopalynology and biochemistry by Prof. S. P. Sen of Kalyani University and the other on life in the early days of evolution by Prof. J. J. Ghosh of Calcutta University featured the Seminar.

In the Purana session, it was interesting to note the pre-Cambrian microfossils in the form of acritarchs, blue-green algae, fungi and cuticular remains from Mysore dated between 2450 m.y. (the oldest so far known) and 550 m.y. The palynology of the Vindhya and their equivalents appears to have thrown considerable light on the age and correlation of this group of rocks in different parts of India. The age is considered to range from Cambrian to Ordovician, the latter age raising a controversy over the evolution of early vascular plants in one of the papers. The assemblage includes algae, fungi and a variety of associated phytoplanktons.

A few review papers such as 'Lower Gondwana microfloristics' or 'Coal palynology in retrospect', or 'Lower Gondwana Palynology and related problems', a few papers on palaeopalynology of coal seams or of some particular horizons of Lower Gondwana such as Barren Measures, Raniganj Stage and a few ones devoted to palyno-petrographical investigations of coal seams and their bearing on stratigraphy constitute the Gondwana session of the Seminar. The existence of distinct phases rich in pteridophytic spores or gymnospermous pollen grains in the Lower Gondwana coal-shale sequence is revealed in one of the papers, which is correlated with climatic fluctuations and the nature of the flora at various stratigraphic levels. An integrated approach involving palynological, petrological and chemical methods is envisaged in a paper for the correlation of a group of coal seams. Raniganj and Panchet rocks, Lower Karharbari rocks have been differentiated on palynological evidences. Palynological evidences establish the existence of Upper Gondwana rocks (with continued succession to rocks of Pleistocene age) in the subcrop sediments near Durgapur, West Bengal. In the palyno-petrography articles, a definite collatable relation is shown to exist between the microlithotypes and miospore contents of the Lower Gondwana coals of India.

In the Mesozoic session, the subjects covered ranges from descriptive palynology of a particular formation through the deduction of age on a formation based on palynological evidence to the bio-stratigraphy of the parts of Mesozoic sequences, the latter deserving special mention. The Cretaceous-Paleocene bio-stratigraphic correlation based on algal flora between the Bagh group of rocks and the type Cretaceous rocks of Trichinopoly appears to be an important contribution. Another paper reports for the first time fossil algae from the Wadhwan Sandstone of Kathiawar and demands equivalency to the Bagh Beds of Narbada Valley. The comparison of the palynological assemblage of Lathi Formation of Jaisalmer with that of the Salt Range and a deduction of Liassic age for the subcrop sample of the formation is the content in one of the papers. Demarcation between Upper Jurassic and Lower Cretaceous on the basis of cryptogamic spores alone of Kutch sediments is stimulating for the

*The sections were presided over by Shri M. V. A. Sastry, Director, Geological Survey of India (Purana); Drs. D. C. Bharadwaj, M. N. Bose and Vishnu Mittre, Assistant Directors, Birbal Sahni Institute of Palaeobotany, Lucknow, (Gondwana, Mesozoic and Quaternary sections respectively) and Shri V. V. Sastri, Joint Director, Institute of Petroleum Exploration, Oil & Natural Gas Commission, Dehra Dun (Tertiary).

stratigraphers. It is interesting to note the extended distribution of several plant microfossil types to West Africa as revealed in a paper dealing with plant microfossils from the Cretaceous and Paleocene of Nigeria. A significant contribution in the Mesozoic stratigraphic palynology is the recognition of three palynological zones, viz., *Callialasporites segmentatus* Zone of Upper Jurassic, *Microcachrydites antarcticus* Zone of Neocomian and *Coptospora cauveriana* Zone of Aptian-Lr. Albian ages in the subcrop sediments of Cauvery Basin. A review has been made on the distinctive spore-pollen forms of the Lower Cretaceous sediments of India belonging to Jabalpur, Umia and Tiruchirapalli stages.

The Tertiary session contains relatively a good number of important contributions devoted to the palynological bio-stratigraphy of the paleogene Tertiaries of different parts of India. It is heartening to note in this Seminar that the spores and pollen are not lagging much behind the other long-reputed traditional animal microfossils like foraminifera. Recognition of seven distinct palynological assemblage zones in the subcrop Cretaceous-Tertiary sediments of Bengal Basin and their correlation with the rock units of the area seem to be a valuable contribution. Inferences based on palynological evidences on the paleotectonics and paleogeography of the area are certainly pointers to the extensive usefulness of palynology in stratigraphy. Palynology of the paleogenes of Garo Hills leads to reaffirm the presence of Barails in the foothill sediments of the region. In the subcrop sediments of the Cauvery Basin, three main palynological zones with four subzones have been identified. In one of the papers, a critical analysis of the palynological data of the Lower Eocene sediments of India as a whole has been attempted and it is claimed that there are certain palynological marker elements and 'morphological species' in the lower Eocene sediments of India, which could be profitably used in the age determination and in local or regional correlation. Microflora of Intertrappean and Lameta Formations of India distinctly shows the preponderance of tricolpates in the former and that of monocolpates in the latter, indicating with certainty the advent of angiosperms during Intertrappean time, rather than during the Lametas. On the basis of algal microflora, a Paleocene age is suggested for the Niniyurs of the type area. Descriptive and revision work on spores and pollen of Neyveli and Warkali lignite respectively constitute the subject matters of two other papers. A paper on nannofossil of general interest with reference to their occurrence and usefulness in Assam and Pondicherry regions (Cret.-Paleocene) also features this session.

The Quaternary Session contains two papers of general interest. One of the papers deals with the potentiality and more comprehensively the problems of Quaternary pollen analysis in India in contrast to those obtaining in North Europe. In the other paper also, problems and future prospects of Quaternary palynology of India are outlined with particular emphasis on the reorientation of our investigation in the light of modern trends in this branch of palynology and also, on the need for intensification of stratigraphical-investigations involving the pollen analyses. These reflections in both the papers would certainly be very helpful for many workers, particularly the beginners, in this branch of science. There are quite a few articles on pollen morphological studies of some of the families and genera such as Bombacaceae, a few Centrospermous families, Heliantheae and Anthemideae, Phrymaceae, *Heliotropium* etc. Some of these studies have led to the palynotaxonomical assertions, others being descriptive in nature. It is also interesting to note the Late Quaternary palynological assemblage of Rasauli Pond of Varanasi District, the recent counterpart of some of which are found to be missing from the surrounding area. Pollen analysis of a few Quaternary deposits of Lower Bengal Basin appears to be a good contribution reflecting on the mangrove vegetation, vegetational history, paleogeography and past environment of the area of investigation. It is also interesting to note the distribution of mangrove elements, particularly *Heritiera*, in the past and present Sunderbans.