

AN HISTORICAL OUTLINE OF INDIAN PALAEOBOTANY

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EARLY HISTORY

THE history of Indian palaeobotany can be traced as far back as 1828 when Adolphe Brongniart described a few fossil plants from this country in his well known *Prodrome* and the encyclopaedic *Histoire des végétaux fossiles*. The next available record is the figures of some fossils included by J. F. Royle in his *Illustrations of the Botany and Other Branches of Natural History of the Himalaya Mountains*. These fossils were later re-examined by E. A. N. Arber (1901) who also described some Lower Gondwana plants from India in his monograph on the *Glossopteris* flora published in 1905. Numerous references to fossil plants are contained in the earlier volumes of the *Journal of the Asiatic Society of Bengal*, while some also occur in European journals like the *Quarterly Journal of the Geological Society of London* and the *Geological Magazine*. However, most of our knowledge of the earlier history of Indian palaeobotany is derived from the publications of the Geological Survey of India which was founded in the middle of the nineteenth century.

The first publication of the Survey to include descriptions and figures of some Indian plant fossils was McClelland's *Report of the Geological Survey of India for the Session 1848-49*. Ever since then, palaeobotanical material from all over the country started accumulating in the collections of the Survey as a result of its ceaseless activity. The material could be divided into two broad groups, one belonging to the Gondwana system and the other to post-Gondwana or Tertiary and post-Tertiary age.

So much material of the Gondwana Flora had been collected in the early days that by 1886 four volumes of a monumental work entitled the *Fossil Flora of the Gondwana System* were published (OLDHAM & MORRIS, 1863; FEISTMANTEL, 1876-86), mainly due to the untiring labours of Ottokar Feistmantel. The collections that formed the basis of this work were made by the

Geological Survey in different parts of peninsular India. Subsequently, additions to these collections were made not only from the peninsular but also from the extra-peninsular India. Noetling in 1902 found a Lower Gondwana locality near Srinagar, Kashmir, from where important collections were made by Hayden and Middlemiss. Middlemiss also discovered a number of other localities in Kashmir containing plants of the Palaeozoic age.

With the increase in the knowledge of fossil plants and the many additions to the Gondwana material after the completion of Feistmantel's work, it was realized that his descriptions and interpretations needed revision. This was done in Europe chiefly by Professor Zeiller at Paris (ZEILLER, 1902) and by Professor Seward at Cambridge, who, in collaboration with Professor Sahni, published a revision of the more important Indian Gondwana plants (SEWARD & SAHNI, 1920).

Besides the Gondwana fossils, large collections of Tertiary and post-Tertiary plants were also added to the collections of the Geological Survey of India. Numerous references to these are found scattered in the *Records and Memoirs of the Geological Survey* from the earliest volume onwards but no detailed work on them was carried out. They included petrified woods and impressions of leaves, fruits and seeds. They came from the Karewa deposits of Kashmir (GODWIN-AUSTEN, 1864) and from the Tertiary beds of Punjab, Sind, Baluchistan (H. B. MEDLICOTT, 1864; FEISTMANTEL, 1882; PILGRIM, 1908), Assam and Bombay Presidency (WYNNE, 1868, 1869; W. T. BLANFORD, 1872). In the Central Provinces (now known as Madhya Pradesh) petrified plants of the Deccan Intertrappean series were collected during the middle of the last century chiefly by Christian missionaries, medical men and military officers in the service of the East India Company. Among these men Stephen Hislop was the most outstanding contributor. Unfortunately some of his interesting material can no longer be traced.

REVIVAL AND ORGANIZATION OF INDIAN PALAEOBOTANY IN THE PRESENT CENTURY

After the retirement of Feistmantel in 1885, palaeobotanical research in India came to an end, and plant fossils collected by the Geological Survey were sent to Europe for investigation. The revival of the science took place on the return of Professor B. Sahni from Cambridge in 1919. Inspired by his teacher, Sir Albert Seward, he took up palaeobotanical research in India with great enthusiasm. In fact, the progress of palaeobotany in India in the present century is entirely due to him. In his presidential address to the Botany Section of the Eighth Indian Science Congress, he reviewed all the work in Indian palaeobotany prior to the year 1921. From then onwards his life was devoted wholly to the development of palaeobotany in this country. Lucknow, where his name attracted students from all parts of India, became a famous centre of palaeobotanical study. Before Professor Sahni the plant fossils in India were studied more from a geological point of view, as evidences in the stratigraphy of sedimentary rocks. He pursued their study also from a botanical angle to gain knowledge of their structure and the light they threw on the problems of evolution in the plant kingdom. In addition to describing a large number of new fossil plants chiefly from the Rajmahal hills and the Deccan Intertrappeans, he made important observations on the palaeogeographical and geological questions such as Permo-Carboniferous life provinces, Wegener's theory of continental drift, Himalayan uplift and the eastward opening of the Himalayan geosyncline. He brought forth important evidence of plant fossils in favour of the Tertiary age of the Deccan Intertrappean beds. His last and a very significant contribution was the discovery of a new group of gymnosperms named "Pentoxyleae" based on plant remains from the Rajmahal series*.

Committee of Palaeobotany in India — The advances in Indian Palaeobotany from 1921 to 1938 were reviewed by Professor Sahni in his presidential address to the Botany Section of the 25th Indian Science Congress at Calcutta (SAHNI, 1938). About this time

the number of active workers in palaeobotany had increased so much that their activities needed co-ordination. This was done in 1939 by the formation of a Committee of Indian Palaeobotanists with Professor Sahni as the convener. The committee started publishing a periodical report entitled *Palaeobotany in India* of which the first number appeared in 1940. The latest report, No. VIII of the series, appeared in 1953.

The Palaeobotanical Society and the Birbal Sahni Institute of Palaeobotany — As early as 1929 Professor Sahni wanted to place palaeobotanical research in India on an organized basis, and to establish a museum of fossil plants at a suitable centre. He approached the Government of India for financial aid but without success. Ultimately he decided to start this project with his own private resources. On 19 May 1946 with seven other members of the Committee of Indian Palaeobotanists he founded a Palaeobotanical Society. On 3 June a trust bearing that name was created to which Professor and Mrs. Sahni donated their private funds and immovable property, a reference library and fossil collections. The trust was charged with the foundation of a research institute having a broad international outlook for carrying on original research in fossil botany. By a resolution passed on 10 September 1946 the Governing Body of the Society established an Institute of Palaeobotany with Professor Sahni as its Honorary Director. The foundation-stone of the new building of the Institute was laid on 3 April 1949 by Shri Jawaharlal Nehru, Prime Minister of India and Minister for Scientific Research. Only a week later Professor Sahni had a severe heart attack, and breathed his last on 10 April 1949. Ever since then the Institute, aptly known after its founder as Birbal Sahni Institute of Palaeobotany, is being looked after by Mrs. Savitri Sahni, co-founder and President of the Palaeobotanical Society. It is the most active centre of palaeobotanical research in the country.

The Palaeobotanist — One of Professor Sahni's aims in founding the Institute was publication of a journal of palaeobotany. Unfortunately he could not live to see it done. After his death the Institute started publishing a journal called *The Palaeobotanist* of which the first issue appeared in 1952 in the form of Sahni Memorial Volume.

*A bibliography of Professor Sahni's publications is given in *The Palaeobotanist*, Vol. I (Birbal Sahni Memorial Volume), pp. 56-59, 1952.

RECENT STUDIES

Morphological Aspect — From the phyto-morphological viewpoint, palaeobotanical research in India at present embraces several horizons from the Carboniferous to the Pleistocene. In the Palaeozoic and Mesozoic, the fossils studied are from the Gondwanas. Until recently there was not much information available about the Lower Gondwana *Glossopteris* flora of India. As a result of intensive search numerous impressions and compression of leaves and fructifications have been collected and are being studied at Birbal Sahni Institute of Palaeobotany. One of the best-known floras of India is the Jurassic of Rajmahal Hills. Still, the fresh material collected from these beds is furnishing new data and adding to our knowledge of this flora. Calcareous algae have been described from the uppermost Cretaceous beds in South India and from the early Tertiary beds from several other places. Excepting the rich flora from the Deccan Intertrappean series not much is known about the Tertiary floras of India, but it is receiving greater attention of the workers. Petrified woods have been collected and studied from South India. Woods and leaf-impressions are also collected and partly studied from Assam. New leaf-bearing localities are reported in the Siwalik system. A rich flora has been described from the Pleistocene of Kashmir. There are not many sub-Recent deposits of palaeobotanical interest in India, but attempts are being made to investigate the few peat deposits reported from the Nilgiri Hills and the Gangetic delta.

Plant Microfossils — In 1937, under Professor Sahni's guidance, Miss C. Virkki (now Mrs. K. Jacob) examined the microfossils in some lower Gondwana rocks of India and Australia. This resulted in important observations and may be regarded as the beginning of micropalaeobotanical studies in India. The study of plant microfossils was employed by the Burmah Oil Company

(India) Limited, with a view to correlating the Tertiary beds of Assam associated with oil-bearing strata. The work was carried out at Lucknow under the guidance of Professor Sahni during the years 1943 to 1946. In 1943 Professor Sahni examined microfossils from the Saline Series of the Salt Range, Punjab. On the evidence of the microfossils, he regarded the age of the Saline Series to be Tertiary. Microfossil examination was also taken up in a scheme for the Measurement of Geological Time sponsored by the Council of Scientific & Industrial Research. This work was started in 1947 under Professor Sahni and is being continued at the Institute. A number of workers at other places in India are also engaged in the study of microfossils.

Palaeobotany of Coal — The first microscopic examination of Indian coal was carried out about thirty years ago by Lomax. In 1932 Banerji published the results of a detailed examination of some Gondwana and Tertiary coals from India. Besides examining thin microscopic sections he also macerated the specimens and studied their microfossil contents. The importance of microfossil examination in the correlation of coal seams in India was indicated by Professor Sahni in 1940. Since then Chatterjee, Sen and Ghosh have studied microfossils from coal seams of various ages. This work was also started at Birbal Sahni Institute of Palaeobotany in 1949. Since 1952 a systematic survey of Indian coals has begun at the Institute under a scheme "Palaeobotanical Investigations of Indian Coals" sponsored by the Council of Scientific & Industrial Research.

Palynology — In India palynology is in its nascent stage. Although the importance of this study in India was pointed out by Professor Sahni in 1948, it has been possible to start systematic work on Indian pollen only since June 1953. It is being carried on at the Institute under a scheme financed by the Council of Scientific & Industrial Research.

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