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# Palaeobotany in India—the post-Sahni era in retrospect

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*'Fossil plants represent the debt that botany owes to geology.'*

–Birbal Sahni[1]

Science represents a spirit of inquiry and logical reasoning. It is not restricted to compartmentalization of thoughts, but involves an interaction of a chain of thoughts that ultimately integrate and produce logical conclusions. Professor Birbal Sahni[2] remarked, as early as 1936: 'In this age of specialization which inevitably tends to confine thought in compartments, one is apt to overlook or to underrate bearings of one branch of science upon another.'

The history of palaeobotanical observations in India dates back to the later part of the 18th century[3]. An overview of plant fossil researches in India shows that remarkable progress has been made in understanding plant history. During the initial phase of investigation, only stray and descriptive reports were published. Brongniart[4] described and illustrated *Glossopteris browniana* var. *indica* and *Glossopteris angustifolia* from the Raniganj Coalfield. Later researchers made significant contributions in recording and describing plant megafossils[5–7]. The first comprehensive investigation was by Oldham and Morris[8]; followed by Feistmantel[9–13] with a number of monographs; his observations and conclusions are still relevant.

The vision of Sahni and his remarkable contributions to plant fossil researches opened new vistas in Indian palaeobotany during the first half of the twentieth century. He made significant contributions to our understanding of Rajmahal and Deccan intertrappean floras, Permian floral provinces, continental drift, Himalayan uplift, etc. During the past four decades, Indian plant fossil researches have made noteworthy progress in the field of morphotaxonomy. During the last decade, particularly, the accrued data have been integrated to arrive at a meaningful interpretation of plant fossil records in relation to evolution, stratigraphy and palaeoecology. With the increased emphasis on pluridisciplinary approaches and a reasonable curb on far-fetched comparisons, more exact and useful results are forthcoming.

Plant fossils are nature's own archives where records of evolution of the biosphere during the last 3.5 billion years on earth are stored. Plant fossil data have a significant bearing on plant morphology, taxonomy, ecology, distribution, and evolution during different time slices. A synergistic approach helps in tracing phyletic lineages and deciphering past events in the biosphere and the geosphere. The distributional pattern of plant fossils in sedimentary rocks serves as a reliable parameter for correlation and dating of strata. The significance of interdisciplinary approach in coal and hydrocarbon exploration is too well known to be reemphasized. Thus, palaeobotany, to be of any value requires not only geological and botanical expertise but also data from other fields. Sahni[14] has rightly remarked that, to the geologist, the importance of a fossil plant centres on its value as an index of the age of a stratum, on the other hand the botanist regards it as a stage in the evolutionary history of the plant kingdom. The structure of the relic is a comparatively trivial matter to a geologist, but the name applied to a fossil is often a matter of real concern. He further emphasized that the best scientific results can be obtained only through the combination of both geological and botanical studies.

## Precambrian biology

Authentic records of Precambrian biota from India are comparatively few. During the last two decades there has been a spurt of publications. Most of these reports assign various affinities to both genuine microfossils and contaminants, the latter forming the bulk. The Precambrian biota comprises simple forms with little or no structural differentiation. Speaking about these life forms Sahni[15] said: 'They have managed to persist because of their simple structure and scanty needs which have made them hardy against the storms of vicissitude तृणानि नोन्मूलयति प्रभञ्जनः They can stand all sorts of extremes: of heat, of cold, of drought.'

The early prokaryotes formed organosedimentary structures called stromatolites. The oldest records of stromatolites in India are from the 3.2-billion-year (Gyr)-old Iron Ore Super Group in Orissa[16] and the > 2.6-Gyr-old Dharwar Super Group[17]. The inherent feature of Dharwar stromatolites is the occurrence of varied morphologies in Archaean sediments, viz. simple columns and branching forms. This indicates that stromatolitic morphologies typical of the Riphean epoch had appeared even as early as Archaean though they may have stabilized during the Riphean.

The Riphean sediments in India demonstrate a prolific development of stromatolites. Tiwari[18] and Raha[19] proposed to divide the stromatolite assemblage into several zones. They have shown that lateral extensions of these zones can be traced in the peninsular sediments of equivalent age.

The earliest record of microfossils from the Archaean sediments was made by Pichamuthu[20]. Later, Suresh[21,22] made further studies of these microfossils, providing geochemical proof of their biogenicity. During the recent past the Birbal Sahni Institute of Palaeobotany in collaboration with the National Geophysical Research Institute, Hyderabad, and the Bhabha Atomic Research Centre, Bombay, has made extensive efforts to understand the palaeofloristics of this era. The reported presence of sulphur bacteria[23], methanotrophs[17] and structurally mineralized filaments[24] comparable to *Phormidium* are part of this effort. These finds, along with reports of stromatolites[25,26], indicate extensive biogenic activity at the time [ > 2.6 billion years ago (Ga)] of deposition of the Dharwar sediments.

During the last two decades, the presence of globular and filamentous algae and acritarchs has been recorded from the Vindhyan and its subsurface equivalents[27–31]. The record of heterocyst[32] is important to understand the evolution of reproductive strategies in blue-green algae. Authentic microfossils have been reported from thin sections of chert from Vindhyans[33–35], Cuddapah[36], Krols[37,38], and inner sedimentary belts of Himalaya[39,40]. These finds have helped to understand the palaeoflorisics of the Proterozoic time. Acritarchs and vase-shaped microfossils may well represent earliest planktonic protists, but we still do not know how and when the transition from prokaryotes to eukaryotes took place. Concerted efforts are required to understand the distributional patterns of Precambrian morphotypes in time and space. This will not only help to elucidate their evolutionary significance but also the biostratigraphic potential.

Metaphytes, metazoan and problematic fossils of unknown affinity have also been reported from > 1000-million year (Myr)-old Lower Vindhyan sediments[41]. These finds need to be reassessed for their authenticity without being biased by the standards set by the finds from western Europe and Australia. It is quite possible that evolution of metaphytes and metazoa may not be isochronous throughout the world and in specific locales with proper ecological supports early experimentation could have occurred[42]. Thus intensive efforts are required to study palaeobiological activity during the Precambrian, a time during which prokaryote–eukaryote transition and evolution of metaphytes/metazoans took place.

## Gondwana

During the last four decades palaeobotanical researches were initially focused on recording and describing plant fossils from different Gondwana basins. A very large number of new taxa, both of mega- and microfossils, were instituted. In recent years this trend has been contained, many of the taxa have been recircumscribed and more are in the process of being critically reinvestigated. All this effort is aimed at identifying and recognizing only meaningful taxa. The definition of the Gondwana has undergone a major change during recent years. Discovery of marine animal fossils in the sediments underlying the coal formations in the Umaria Coalfied[43] opened up a new line of thinking. The occurrence of certain palynofossils such as leiosphaerids and acritarchs which indicate a marine or near-shore environment, in the Indian Gondwana, indicated the possibility that marine signatures were more frequent than earlier realized[44]. Occurrence of marine sediments in the Cretaceous of southern India is more a rule than an exception[45]. The Mesozoic plant beds in the Rajmahal, Kutch, Jaisalmer, Jabalpur and other basins were generally attributed a Jurassic age as the plant fossils were supposed to indicate a close comparison with the megaflora of Jurassic beds of Yorkshire. A recent reassessment[46] has shown that the Indian plant beds have a flora of Early Cretaceous age. Palynologically some of these beds are dated as Early Cretaceous[47]. The classical Rajmahal beds were also assigned Early Cretaceous age. Even the geochronometric data do not give absolute dates older than 105 Myr (Early Cretaceous) for the Rajmahal traps[48–50]. This clearly explains the utility of a multidisciplinary approach for sloving long-standing problems like the age correlation of Rajmahal Flora. Arkell's[51] contention that Jurassic sediments are not represented in the Peninsular basins has received cogent palaeobotanical support. Based on these observations, it was suggested that the lithoconcept of the Gondwana be redefined[45,52,53]. Recently, a new definition has been proposed[54] that refers the Gondwana to a group of basically terrestrial deposits, with occasional marine beds marked at the base by glacial deposits of earliest Permian age, and at the top by a major hiatus of post-Triassic age. The Upper Mesozoic sediments are excluded from the new concept of the Gondwana.

Sahni recognized the importance of palynological studies for correlation of Indian coal seams and called for an in-depth study of spores and cuticles of fossil plants, particularly, from the Lower Gondwana. In his opinion such a study could also throw light on the early traces of Glossopteris flora coexistent with the Lower Gondwana glaciation[55]. Virkki[56] reported winged pollen in Lower Gondwana rocks of India and Australia and opened new avenues in palynological research. After Potonie's short visit to India in 1959, palynological studies got a fresh impetus, and morphotaxonomy of pollen and spores involving binomial nomenclature was taken up[57–60]. Gradually palynological investigation shifted from morphotaxonomy to palynostratigraphy, though the lure of instituting new taxa did not diminish. Palynological studies have now covered almost all the coal basins in the country and are being used for correlation of sediments as well as for demarcating formation boundaries and time boundaries[61–63]. Investigations on megaspores have also not lagged behind. Started purely as a morphotaxonomic study[64], the study can also be used for wider correlations[65].

Efforts have also been made to understand the palaeoecology of the coal-forming plants and their impact on deciphering evolutionary tendencies. The leaf architecture, leaf epidermis, fine structure of the wood and ornamentation of spore-pollen that reflect plant–climate interaction have been studied. Most comprehensive have been the studies on the leaf genus *Glossopteris*[66] and the other organs attributed to it[67]. A reassessment of data on glossopterid fructifications has revealed that the group may comprise two families, Dictyopteridiumaceae and Eretmoniaceae[68]. Though the precursors of this group are not known, it probably arose through saltations initiated by the rigours of the glacigene event. Interesting finds of fossil 'seedlings' of a glossopterid plant are noteworthy[69,70].

Basically though the Gondwana flora of India has a characteristic composition, yet several northern forms have been identified from time to time. The question whether they are real migrants or are the result of parallel evolution/homoplasy is still vexing the minds of Indian palaeobotanists. Not doubt, most of the ferns have now been shown to be indigenous to Gondwana[71], but due to lack of fertile structures, the exact status of other remains is as yet not clear e.g., *Schizoneura*, *Sphenophyllum* and *Lobatannularia*. The recent report of ginkgopsid *Saportaea* from the Lower Permian of Rajmahal Hills[72] has added another aspect, because of its occurrence in both Cathaysian and Euramerican floras. If the palynotaxa are also taken into account, a close similarity will be found between different floristic provinces which will be difficult to explain with our present understanding of palaeopositions of the continents. Sahni[73] discussed the implication of homopositious floras and continental drift, and opined that detailed critical comparative studies will help to understand floristic provincialism. Recovery of reworked Permian palynofossils from the younger horizons and their implications in palaeobiogeography are well known. Recently a reworked *Dulhuntyispora* in Tertiary sediments of north-eastern India has been reported. Turbidity currents were possibly responsible for the reworking of this fossil along with Permian sediments from Australia to north-east India when India and Australia were juxtaposed[74].

Organic petrological investigation of the coal seams to understand their micropetrological, thermal and chemical characteristics and the impact of evolving floras and climate is another fascinating area of study that has been seriously taken up only in recent years. Organo-petrological investigations to find out the cause and effect of spontaneous combustion of coals in the coal mines of Raniganj and Jharia coalfields have helped to identify thermal and chemical processes responsible for it[75]. Recent investigations on Permian coals reveal vitric and fuso-vitric petrographic facies corresponding to Late and Early Permian time periods respectively[76]. Microspectrofluorimetric studies have helped in understanding the nature and type of reactive resins and other hydrocarbons[77]. Similarly, processes involved in the genesis of coals and associated sedimentary rocks and the effect of tectonic and igneous activities are also being investigated[78].

## Origin and diversification of flowering plants

To decode the time of the advent of angiosperms is one of the most fascinating areas of palaeobotanical studies. Many records have been published and discarded. In

India, the oldest record of angiosperms known so far is from the Upper Cretaceous sediments[79,80]. Pollen with angiospermoid characters have been recorded from the upper part of first intertrappean sediments of Rajmahal Formation which are Early Cretaceous in age[81]. Recent researches have also demonstrated that angiospermoid characters in the pollen wall structure appeared as early as Triassic[82]. Thus, the pre-Cretaceous origin of angiosperms still remains a potential possibility. The group definitely established by Late Cretaceous and rapidly evolved.

The Deccan Trap episode appears to have commenced in the Terminal Cretaceous and holds the key to understanding the Cretaceous–Tertiary (K–T) transition. The flora of the Deccan intertrappean sediments is represented by angiospermous woods, leaves, flowers and fruits, besides charophytes and marine algae. Recent studies[83] suggest near-synchroneity of the basal basaltic flows in the central, eastern and southern sectors of the Deccan province. New palynological data integrated with palaeontological and stratigraphical data help establish stratigraphic correlation between inland continental, marginal offshore and paralic marine sections in which the basalts themselves or their tuffaceous derivatives are encountered. Data derived from the Deccan intertrappeans do not indicate any evidence of mass extinction in the flora along the K–T boundary.

The $C^4$ and CAM (Crassulacean acid metabolism)-system plants probably evolved during the Cretaceous period as a response to atmospheric changes. The Cretaceous atmosphere, more rich in oxygen, could have favoured the evolution of $C^4$ systems because average global temperatures were higher and more uniform than at present. Efforts are on to find palaeobotanical evidences to exemplify $C^3$, $C^4$ and CAM-system plant evolution. Adaptations of plants to arid environments may not be well preserved in fossil records owing to preferential preservation. Isotope analysis may suggest changing relative frequencies of photosynthetic pathways through time in relation to atmospheric composition and temperature[84].

Floristics of the Deccan Intertrappean sediments are well known[85]. Besides several new finds, woods supposedly resembling *Eucalyptus*, *Tristania*, and the fruit *Callistemon–Melaleuca* have been recorded from beds near Shahpura. The identification of these plant fossils, if proved authentic, would possibly suggest that both Australia and India enjoyed more or less a similar climate probably due to their close geographical position[86]. This needs to be rechecked and explained.

From the Cuddalore Sandstone, south India, plant fossils representing several families of dicotyledons, Araceae and Podocarpaceae, suggesting a tropical evergreen climate, have been recorded. Some of these elements are presently distributed only in tropical evergreen forests of Malaysia[87] which suggest migration of plants from India to Malaysia during the Miocene epoch. The Neogene forests of Assam and Malaysia also had a number of common elements[88]. Recent palaeobotanical data from the Neogene of Kerala coast indicate prevalence of warm and excessive humid conditions all along the Kerala–Karnataka coast[89]. Disappearance of several evergreen plants from this region is an indication of gradual deterioration of evergreen forests of Western Ghats since post-Pliocene epoch[90]. Palynological study has revealed a brackish-water depositional environment during the Eocene–Early Miocene sequence of Alleppey District, Kerala[91].

Woods resembling *Entandophragma* (Meliaceae) from the Neogene sediments of Jaisalmer[92] and *Isoberlinia* from the Pliocene of Kutch suggest possible Indo-African connections. The Neogene vegetation of Rajasthan region also grew under tropical conditions with good amount of precipitation. In Gujarat, the sea limit possibly extended to the vicinity of Bharuch during the Eocene. Discovery of fossils of *Sonneratia* in the region[94] may suggest prevalence of coastal mangrove ecosystem.

The Palaeocene–Eocene palynoflora is known mainly from coal and lignite deposits of Meghalaya, Assam, Kutch, Cambay, Rajasthan and other basins. This palynoflora is fairly characterized by swamp dwellers. The Neogene sediments of India are predominantly rivérine deposits and the change in edaphic condition could have also led to the temporary disappearance of the swampy vegetation which dominated the Early Palaeogene. That is the likely explanation for the absence of *Spinozonocolpites–Nypa* during the Upper Palaeogene and Lower Neogene. It appears again in the Quaternary sediments of India[95] and *Nypa* is still extant in some parts of the Indian coastal areas such as Andamans and Sunderbans. This riverine depositional process might also explain the occurrence of Permian, Early Cretaceous and Palaeogene reworked pollen in the Neogene sediments[96–98]. The occurrence of these reworked pollen in younger sediments has been the reason for apparent extension of some of the Palaeogene taxa into the Neogene.

The tropical Tertiary sediments are replete with a diversity of pollen types; only some of them are useful as stratigraphical and ecological markers. Distributional anomalies of taxa in the east and west coast basins are presently being analysed for deciphering provincialism, endemism and migration patterns of vegetation in the subcontinent. It is of utmost importance to tag marker fossils and catalogue them with annotated stratigraphical and ecological notes. Such efforts have already been initiated[95,99] and are continuing.

The age of the Cuddalore Sandstone and associated lignite deposits has been a matter of controversy. It has been suggested that typical Eocene palynofossils recorded from the subsurface of the Cauvery Basin[100] occur in the Neyveli Lignite and the lower age limit of the Cuddalore Sandstone may extend to Eocene and the formation may be time transgressive. Recent palynological data suggest a Late Palaeocene to Eocene age for the Neyveli Lignite deposits. Such palynological investigations on Ratnagiri and Kerala lignites on the west coast and associated sediments are under way for correlation and palaeogeographical reconstructions[91,101].

An interdisciplinary study on the Siwalik sediments exposed in the Himalayan foothills and in Nepal involving plant micro- and megafossil data integrated with palaeomagnetic and stratigraphic data indicate semi-evergreen vegetation and freshwater swampy conditions of deposition[102–104].

## Phytoplankton biostratigraphy

The phytoplankton data, particularly on dinoflagellate cysts, diatoms and nannophytoplankton, are important for dating marine sediments and for deciphering ancient depositional environments. This aspect of study has proved useful in the search for oil. The Upper Mesozoic seas were inhabited by a group of plants *Pyrrophyta*—the dinoflagellates which appeared during pre-Mesozoic. The K–T sequences of Cauvery, Palar, Krishna–Godavari basins and northeast India have been critically evaluated for age assignments. Dinocyst-based biozonation schemes have been proposed for the surface and subsurface sequences of Cauvery and Palar basins[105–107]. Palaeoecological interpretations have been derived on the basis of relative ratios of chorate, proximochorate, proximate and cavate dinoflagellate cysts. No major extinctions are noted across the K–T boundary. Researches on nannoplankton (Chrysophyceae) and diatoms are being used to obtain high-resolution stratigraphy. The epicontinental Upper Palaeocene–Eocene sediments (Punjab Basin) in Himachal Pradesh have been investigated comprehensively and correlated[108–110].

## Organic matter studies

Studies on the organic matter reflect environmental regimes of deposition and as a source material of fossil hydrocarbons. Organic matter data have been used to interpret palaeoenvironments[111]. Palynostratigraphic, palaeoecologic and source-rock studies in various basins like Cauvery, Jaisalmer, Kutch, Krishna–Godavari, Mahanadi, Saurashtra, Tripura and Himalayan foothills widen the data base for hydrocarbon exploration. The source material for hydrocarbons is mainly the vegetal debris which includes phytoplankton, marine and terrestrial algae, as well as lipid-rich land-plant remains[112]. Integrated studies increase this new dimension to augment plant fossil researches Comparative study of sedimentary facies and accumulation of palynofossils and in Alleppey and Quilandy mudbanks and Vembanad Lake, Kerala, have been initiated in this direction[113]. While carrying out palynological and $^{14}C$ dating studies of gravity core from the seabed west of Narcondam Island in the Andaman Sea, fragments of pyrofusinite were found in abundance, which helped to postulate intermittent volcanic activity at Narcondam Island during 18,000–20,000 years before present (BP)[114]. Such organic matter studies integrated with other data help deduce a meaningful interpretation of palaeoecology. Ecological models depicting various depositional realms such as the hinterland or the upland representing the erosional plain, flood plain, coastal plain, including the lower deltaic plain and estuary lagoon and coastal swamp; sandy beach and barrier island; mangrove and back mangrove representing the depositional plain and marine realm exemplify occurrence of various characteristic palynoassemblages[115].

## Quaternary vegetational patterns

Study of palaeoclimate and phytogeography of the Quaternary period involves a synergistic approach that derives data from meteorology, oceanography, geophysics, geochemistry, archaeobotany, palynology, tree-ring analysis, stratigraphy, etc. Climatic changes have a direct bearing on the evolution of the biosphere, evolution of man and his cultures. Palaeoclimatic research documents changes in floral development, sedimentological indices and geomorphological parameters as a consequence of atmospheric variations.

Useful data, particularly those based on palynological studies, have been collected on the Quaternary climate of Kashmir[116–117], Himachal Pradesh[118–120], Rajasthan[121], hills of Uttar Pradesh[122] and Tamil Nadu[123]. Most of the data are qualitative in nature.

A three-fold vegetational change has been unravelled in Kashmir, which indicates periods of increasing warmth, maximum warmth, and decreasing warmth, i.e. cool–warm–cool phases. A cyclicity of these changes is noticed, particularly in the Karewa deposits covering the time slice between 0.3 and 3.8 Myr BP[124].

Palynogical studies have shown that Sat Tal in Naini Tal, which presently comprises seven closely situated water-filled depressions, or mini-lakes, initially was a single water body or lake.

Palynostratigraphical investigations of profiles from Central Himalaya have shown that the Kathmandu Valley was studded with lakes and marshes 40,000 years BP and even earlier, a condition which probably continued till the end of the last Glacial period[125]. The cold and dry climate that followed caused reduction in numbers and shrinkage in size of lakes and marshes, consequently resulting in expansion of grasslands.

Palynological studies on Quaternary sediments of the Rajasthan desert show that the area had extremely arid conditions and strong winds around 20,000 years BP[121]. In the Didwana area, the land was largely covered with steppes between 20,000 and 13,000 years BP. The area probably had a much weakened summer monsoon but comparatively higher winter precipitation. During 9000–6000 years BP there was an apparent increase in precipitation.

Palynostratigraphical studies have revealed that during the not very remote past the Shola forests were much widely distributed in the Nilgiri–Silent Valley region. The gradual recession of the Shola forest started around 7000 years BP. Now the very survival of these forests is threatened by anthropogenic factors. The fast depletion of thick mangrove forests is also attributable to anthropogenic factors[126].

Tree-ring studies offer an opportunity for extending the spatial coverage of high-resolution information specially useful in studying decadal to century-scale climatic variations[127,128]. These studies provide information about the glacial–interglacial phases of the recent past and their probable feedback links to the monsoon climate.

## Archaeobotany

Archaeobotany is one of the areas of multidisciplinary research and contributes directly to the knowledge of evolution of economic, social and pastoral practices. The Birbal Sahni Institute of Palaeobotany has in recent years played a very vital role in helping the archaeologists and the ethnobotanists.

From Neolithic levels of seventh to sixth millennium BC at Koldihwa near Allahabad, grains of wild and cultivated rice have been identified. This is the earliest record of cultivation of rice in the world[129]. Finger millet has been found at Hallur in Karnataka and dated to around 1800 BC[130]. Signatures of viticulture by the Harappans of Rohira in Punjab have been found in the form of grape seeds and vine-stem charcoals. The Harappans who populated the area around 2300–2000 BC also maintained ornamental plants and grew vegetable crops[131,132]. Cultivation of drug-yielding plants is noticed at 1000–200 BC in the Ghaghra Valley[133].

## Geochronometry

Radiocarbon dating of Quaternary deposits and archaeobotanical remains is another area that helps in correlation of sedimentary sequences. Dating of land sediments, peat deposits and miliolites helps in interpreting past vegetational changes in a precise geochronological framework. Likewise, dating of coastal sediments, deep-sea sediment cores and algal limestones gives geochronometric dates that contribute to understanding past sea levels[134,135], palaeoclimates and rate of deposition. Fission-track dating of various igneous materials, i.e. Kyanite, Beryl and an authegenic sedimentary material Glauconite, etc. is proving very useful for geological correlation[136,137]. In recent years, the potassium–argon (K–Ar) dating method is being used to find out absolute ages of sedimentary and igneous rocks.

## Conclusions

New dimensions in plant fossil researches—among others, DNA in a Miocene leaf[138], and a red alga from the Proterozoic carbonates[139]—have opened new avenues for interdisciplinary research. It is high time that palaeobotanical researches make an impact on related branches of science as well as draw information and increasingly interact with other branches of science. The compartments that were erected between major sciences are crumbling today and there has been a free flow of ideas. The wider perspective of study as conceived by Sahni is only possible through a holistic approach. New avenues like cladistics, taphonomy, biodegradation of organic matter, coalification studies and evolutionary lineages envisage the tremendous potential of palaeobotany. Exploring new challenges enhances the relevance of palaeobotany in understanding earth processes and the causes and effects of the developmental pattern of floras during the earth's history.


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... taking the present flora of the earth as an individual organism, botanists can scarcely afford to study it simply as it exists today for they would thus obtain at best a sectional view. To the noble science of geology, then, we owe a veritable 'Time Machine' with which, although we cannot follow Dr H. G. Wells into the realm of the Future, we can at least obtain a glimpse into a romantic past.

*–Birbal Sahni*

That more and more palaeobotanical work is nowadays being undertaken by men who are primarily geologists is a fact much to be welcomed, for they are in a better position to study the floras in their natural occurrences than are the palaeobotanists, whose activities are only too often confined to the laboratory.

*–Birbal Sahni*