mark was on this subject, with the origin of the Chiroptera as an example: "Most or at least many biologists have presented the appearance of the bats as something that must have been quite gradual. . . . Here is a sort of mental necessity to believe in imperceptibly gradual transformations. Nevertheless nature shows us that this is completely wrong. There is no such thing as a quarter of a bat, or a third of a bat, or a half bat, but all at once there appears a new type apt for flight." Bergounioux, Meléndez, and Piveteau made the same point with different examples.

On the level of microevolution Bergounioux, alone among the speakers, expressed a limited adherence to the synthetic theory and the importance of natural selection. Speaking of mastodonts in what is now Portugal he concluded that competition might have been especially severe there and that, ". . . taking into consideration the synthetic theory of evolution, which we consider less imperfect than the others, the smallest genetic variation might give a mutant individual a certain advantage in perpetuating itself and in adapting itself to the conditions in which it found itself."

These brief, freely translated quotations have not done justice to the full original text. They have perhaps given a hint as to its flavor, and if that flavor seems strange to some readers of this journal, well—that very fact is its great value.

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"The Palaeobotanist" is a young review published under the direction of the Birbal Sahni Institute of Palaeobotany at Lucknow. So far, three volumes have been issued, the first of which (1952) was devoted to the memory of the great scientist Birbal Sahni. The second volume is, in fact, the first to show the standing of the review. Its contributors are all Indian and most of them are disciples of Birbal Sahni. In this way and in another manner, the second volume constitutes a new homage to the noble personality of Birbal Sahni and is probably the one he would have liked the best.

The volume consists of 17 contributions. No satisfying summary accounts of their contents can be made as the papers are so various. They go into matters that concern algae, pteridophytes, gymnosperms, angiosperms treating of morphology with suggestions of evolution, theoretical and stratigraphical significance. On the other hand, the contributions deal with geological formations extended from Silurian up to Pleistocene. For that reason a few accounts only can be mentioned in a short report.

The majority of the papers are related with the classical flora of the Rajmahal Series of Bihar. The Rajmahal material contains both impressions and petrified specimens of peculiar interest.

In a clear review of the last twenty years activity, Dr. A. R. Rao [1] shows that new records of plants, in Rajmahals, have established that the flora resembles the Hope-Bay flora rather than that of the Madras Coast as formerly stated. He focuses attention on the fact that the Hope-Bay flora is unique in that it shows some affinities with the Jurassic flora of England on the one side, and with the Indian Jurassic flora on the other. It is therefore of interest to amplify researches along this line as it appears that their results may establish the existence of more closely related links between Indian and Western European flora during Jurrassic time. Among the most interesting data obtained from Rajmahal, the author mentions petrified megastrobilus, coniferous, leafy shoots, small three winged microspores with podocarpeous affinities. These records establish that the Podocarpaceae were much better represented in the Rajmahal flora than stated before. These facts are in conformity with the late Professor Birbal Sahni's suggestion that the Podocarpaceae may be discovered in the Mezozoic rocks of India, and Professor Florin's opinion that *Podocarpus* is definitely a southern genus. The authors test the validity of Florin's conception that from the Permian onwards, the conferous divided into two different groups, one of which had its roots in the northern hemisphere, while the other was markedly southern hemisphere group. This southern group was dominated by the Podocarpaceae.

A study by R. V. Sitholey and M. N. Bose [2]

[1] Rao, A. R., Some Observations on the Rajmahal Flora. Pp. 25–28.

[2] Sitholey, R. V., and M. N. Bose., *Williamsonia santalensis* sp. nov. A male fructification from the Rajmahal Series with remarks on the structure of *Ontheanthus polyandra* Ganju. Pp. 29–39.

focuses attention on peculiar features exhibited by a new species of Williamsonia: W. *Santalensis*. Despite the great resemblance shown with the Williamsonia, the new male fructification differs in possessing fertile linear complex appendages in place of the usual reniform synangia and in having an asymmetric and twisted development of the sterile upper part of the microsporophyll. For the authors these characters are of morphological value and allow the re-interpretation of the structure of the male flower *Ontheanthus polyandra* Ganju, hitherto considered as a unique type differing from the Bennettitales in several important features.

One contribution of M. N. Bose deals with Bennettitales. The paper [3] is a thorough study of 50 specimens of a new species of a stem of Bennettitales *Bucklandia Sahnii* that exhibits peculiar features in its anatomy, mode of branching and position of flowers. The early secondary wood of *B. Sahnii* differs from all the *Bucklandia* of whose anatomy is known in having scalariform tracheids. The branching habit of the new species resembles the mode of branching of *Wielandiella angustifolia* Nathorst in giving off two opposite lateral branches just below the point where flowers were borne. As a consequence of that branching habit, the position of the flower is terminal instead of being lateral. The new species is compared with stem genera belonging to Bennettitales, Cycadeoideas, living Cycads and a specimen formerly described *Homoxylon rajmahalense* which is now considered as a part of the secondary wood of a Bennettitalean stem.

The Pentoxyleae is a new group of Jurassic gymnosperms instituted by Sahni (1948) for isolated stems, leaves and female cones that have been correlated on the indirect but undoubted evidence provided by anatomical structure. As a consequence the group comprises several organ genera: *Pentoxylon, Nipaniophyllum, Carnoconites*. While reconstructing the vegetative parts, Sahni presumed that the flowers of Pentoxyleae were unisexual and borne at the ends of lateral dwarf shoots. The male flower described by Vishnu-Mittre [4] supports this view. *Sahnia nipaniensis* Vishnu-Mittre consists of filiform microsporophylls spirally branched, fused in the basal region to form a disc which surrounds a broad and conical receptacle. The sporangia are unilocular and borne at the ends of short branches of the sporophylls. Pollen grains are monocolpate and boat-shaped. In young flower the microsporophylls are surrounded by a whorl of deciduous bracts. The majority of these characters confirm the Bennettitalean general plan of the male flower. However, unlike the Bennettitales, the microsporophylls remain erect and are fertile to the tip; they are spirally branched and the branches are borne all around the main axis. As in modern Cycads, the sporanges are sac-like and unilocular, and the pollen grains are boat-shaped, with a single furrow. *Sahnia nipaniensis* is believed to belong to the Pentoxyleae on the basis of its apical position on dwarf lateral shoots, the similarity of these with the dwarf shoots of *Pentoxylon Sahnii* and some anatomical characters exactly similar to those of the stems and leaves known to belong to Pentoxyleae. At the same time the investigation of a new collection of *Carnoconites* (female cone) has made it possible to define more accurately the reconstruction of the *C. compactum* made by Birbal Sahni. The contribution of Vishnu-Mittre is of great interest, it adds an important fact to our knowledge of the fascinating Pentoxyleae which defy classification since the anatomy of their stems is unique, the vascular anatomy of their leaves truly cycadean, their seed attachment clearly Stachyospermes and their stomatal structure fundamentally Bennettitales.

Besides the Rajmahal Hills there is in India another basaltic area located in the Central Provinces, the well known Deccan Plateau, famous for the beautiful preservation of the plants embedded in the Deccan Intertrappean cherts (Early tertiary). A material consisting of stems, leaf-sheaths and roots of a palm is described in the paper of Professor B. Sahni and K. R. Surange.[5] Curiously enough, the fossil palm shares, to a certain extent, characters found in the related South American family *Cyclanthaceae* of which no fossil record is so far known. An unusual clumped habit is shown by a specimen that has revealed a main rhizome-like stem producing a pair of large buds which developed into new rhizomes, growing right and left of the main stem. The junior author considers these specimens as representative members of a palm which nevertheless is unlike any of the palms so far known, but show some resemblance with Cyclanthaceae. Among other features the compound nature of the bundle in the central part of the fossil stems is

[3] Bose, M. N., *Bucklandia Sahnii* sp. nov. from the jurassic of the Rajmahal Hills, Bihar. Pp. 41–49.

[4] Vishnu-Mittre, A male flower of the Pentoxyleae stem with stem with remarks on the structure of the female cones of the group. Pp. 75–84.

[5] Sahni, B., and K. R. Surange, On the structure and affinities of *Cyclanthodendron Sahnii* (Rode) Sahni and Surange from the Deccan Intertrappean series. Pp. 93–100.

considered as the most important evidence in favor of affinity with the Cyclanthaceae.

At present our knowledge of the Lower Gondwana plants comes mainly from impressions of the megaflora among which, however, fructifications are poorly represented. Therefore, it is interesting to see that megaspore analysis of two coal seams promises rich results as stated by the researches of K. R. Surange and P. N. Srivastava.[6] The Indian Lower Gondwana coal is usually considered to be formed from the Glossopteris flora which is poor in Lycopod records except *Bothrodendron* sp. Nevertheless, some Indian coal seams are exceptionally rich in megaspores. Nearly all of these show the characteristics of the genus *Triletes* Reinsch, as emended by Schopf which, generally, is considered of probable lycopod affinity. Thus it appears that lycopods must have existed in India despite the scarcity of their impressions. An interesting fact is that, before the extensive glaciation that occurred at the end of the Carboniferous period in the southern hemisphere, lycopod impressions were recorded in countries of Gondwana. It is significant that some of them at least were different from those found in the northern hemisphere, likewise some of the megaspores are distinct from the species of Europe and North America. "This strengthens Sahni's suggestion that the Lycopod of the Glossopteris floras evolved from pre-Gondwana Lycopodes of the southern hemisphere."

One step is made in our knowledge of *Walkomiella Indica,* a primitive conifer of uncertain systematic position: conifer or taxad created for leaf impressions found in the Pindra seam Lower Gondwana, and described by K. R. Surange and Prem Singh. Bulk macerations of coal of the same seam, made by the authors,[7] have yielded seeds still attached to small shoots the epidermal characters of which are identical with those of *Walkomiella Indica* leaves. Accordingly the authors are inclined to assign that female dwarf shoot to *W. Indica.* They also consider that there are indications that the plant bore loosely constructed cones of essentially the same type as in *Lebachia.*

[6] Surange, K. R., and P. N. Srivastava, Megaspore from the West Bokaro coalfield (Lower Gondwana) of Bihar. Pp. 9–17.

[7] Surange, K. R., and Singh Prem, The female dwarf shoot of *Walkomiella Indica,* a conifer from the Lower Gondwana of India. Pp. 5–8.

One short paper, left unfinished by the late Professor Birbal Sahni,[8] and completed by Professor T. M. Harris, F.R.S. of the University of Reading, England, deals with some psilophyte remains found in Silurian or Ordovician strata of Spiti, North-West Himalaya. Despite the poor state of preservation of the material, the potential importance of it is great, for it extends considerably the geographic dispersion of the Psilophytes. This widespread group of plants was known to occur in Silurian up to middle Devonian and in Canada, U. S. A., Europe and China. Were the poor allochtonous relics of Spiti increased in quantity and quality, they would focus attention on a fossiliferous geological horizon from which important revelations are to be expected.

Volume 12 of "The Paleobotanist" demonstrates that excellent results have been obtained by a keen team of workers and, at the same time, it affords undeniable evidence of the great and varied possibilities of Indian sedimentary rocks for palaeobotanical researches. It is significant that the whole material described has been collected in various provinces of India. While the Rajmahal Hills of Bihar and the cherts of the Deccan Intertrappean Series of the Central Provinces are favorite hunting ground for Indian palaeobotanists, the Gondwana formations represent another famous fossiliferous field. A good deal of attention has also been concentrated on Tertiary exposures located in South India in the vicinity of Pondichery, and increasing application in explorations is devoted to fossiliferous deposits of different geological ages of Kashmir, and of the foot hill of the Himalayas. Microfossil investigations of fossiliferous and apparently barren sediments have given excellent results, and have proved their usefulness for scientific and economic purposes.

Every reader interested in the past history of plants, their peculiar morphology and habit, and who is conscious of the important message that palaeobotany offers in regard to the evolution of the plant kingdom and of problems connected with it, should find in volume 12 of "The Palaeobotanist" a good deal of matter for thought.

Much of this volume has received the devoted help of Professor O. A. Hoeg, Professor of Oslo University, Norway, and, at that time, Director of the Birbal Sahni Institute of Palaeontology, Lucknow.

[8] Sahni, B., Note on some possible Psilophytic remains from Spiti, North-West Himalaya. Pp. 1–3.