

# PROFESSOR BIRBAL SAHNI'S WORK ON THE PALAEOBOTANY OF THE ASSAM TERTIARIES

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A BRIEF record has already appeared (in *Palaeobotany in India*, VI, 1948) of the scientific results of the research work on the microflora of the Assam Tertiaries which was directed by Prof. Birbal Sahni in Lucknow and undertaken on behalf of the Burmah Oil Company. Our aim here is to recount the story of the development of the work, and to describe (from our side of this co-operation between pure and applied science) some problems that were involved and how they were overcome.

The Tertiary rocks of Assam, in which the oilfields and oil indications of India lie, present a very difficult problem in geological correlation; for they are singularly devoid of macrofossil remains and are composed of beds whose lithology is alternating and variable, with scarcely any obvious characteristic features. Added to this, they are, in general, very poorly exposed owing to a cover over the greater part of their extent of a thick soil-cap which supports dense jungle; it was consequently a matter of some concern to find independent data with which to check the conclusions reached in geological mapping in the field.

Correlation by micro-foraminifera was one obvious line of approach, but it was found that these microfossils are relatively scanty and sporadic in occurrence — partly no doubt through environmental conditions unfavourable to their development, and partly through the deep weathering and leaching associated with the Assam climate; nevertheless, some useful evidence has been obtained from the micro-foraminifera of limited ranges of rocks. Correlation by heavy mineral analysis proved very helpful, and was intensively developed over a number of years; but it has the drawback that, owing to the periodic nature of the frequency variations in the individual mineral species, it is often not possible to place a sample in the stratigraphic succession unless it is accompanied by a sequence of samples from a

long range of beds above and below it. This limitation is often immaterial, but there are cases (particularly in connection with the drilling of oil test wells) when it would be very useful to be able to determine with certainty the age of a single separate sample or of a few samples from a restricted range of a few hundred feet: a new technique which would yield this information would be very welcome, even if it were to give no detailed correlation.

Over a period of many years several of the Burmah Oil Company geologists had had occasional contacts with Prof. Birbal Sahni — meetings at scientific congresses or correspondence arising from the occasional discovery of fairly good specimens of macrobotanical fossils — whilst one of the present writers had had the privilege of staying with Prof. and Mrs. Sahni at their home in Lucknow, and the other had an opportunity of accompanying Prof. Sahni in the field. Some years ago Prof. Sahni suggested that a study of micro-botanical fossil-remains might give us the help we needed in our general problem, though he warned us that as there was no existing background for such work in India, fundamental and pioneer research would be required. He took a great interest in the possibilities of this work, and eventually consented to supervise a formal scheme of research on the subject at Lucknow, starting in 1943 with two research workers whose names are well known today: Dr. G. S. Puri and Dr. R. V. Sitholey.

The objectives of the work were wide and varied and the possible lines of attack were numerous, so there seemed good reason to hope that somewhere one line of research would encounter one of the several problems needing solution, and establish a working technique for regular practical application. The first step was to examine a number of Assam rock samples, from a variety of stratigraphic horizons, and see what their

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microfossil content might be. This was done, using the maceration technique well known to palaeobotanists.

It soon appeared that nearly all samples examined were encouragingly fossiliferous, most of them richly so; and that there was an immense variety of forms represented. This was in great contrast to the sparse nature of the micro-foraminifera. Since the material was so rich, it was decided to neglect (for the time being) the cuticle fragments whose examination would have been particularly time-consuming, and to concentrate on the spores and similar remains.

At this stage it was most instructive to the non-botanical observer to see how carefully Prof. Sahni approached the investigation, avoiding the drawing of conclusions until adequate data had been collected, and using as few assumptions as possible. One of the immediate problems was the classification and recording of the individual fossils; and (after a thorough review of the various systems that might be used) he decided that initially the individuals should be recorded by drawing and each given a number, a watch being kept for specimens that (a) were apparently identical with, and (b) had a near resemblance to, specimens previously examined. As the work progressed, these comparisons were facilitated by wall charts in which characteristic forms and allied types were arranged—still without making any assumptions.

The work was of necessity slow, on account of the embarrassingly huge number of fossils and the need to search with a very high power under the microscope; but Prof. Sahni very wisely would not let the work be hurried, at this fundamental stage, by any premature reduction in the amount of material examined from any one sample. Only very gradually was the number of slides examined (per sample) reduced, and only when it became clear that this could be done without danger of missing important evidence.

In the end, as has already been recorded elsewhere, there seemed to be definite evidence (though still only accepted provisionally, on account of the relatively small number of samples examined) that in each of the main stratigraphical groups certain types of fossil were characteristic and limited in vertical range. Further potentialities of subdivision were by no means absent, but

it would not be possible to establish them without examining a very much larger number of samples, a project which could be given future consideration.

At all events, the research had already proved that the application of palaeobotanical methods had definite possibilities in economic geology in Assam; and having established the framework, and having provided a knowledge of the technique required, he handed back the research to the Burmah Oil Company for the next stage of development and multiplication of data. We had looked forward to discussing with him in due course the results of this further work.

This account obviously merely summarizes the course actually taken by the research from among the different alternatives open at each stage, and does not touch upon the wide variety of possibilities considered. Prof. Sahni was a gifted teacher, and as such had the power to explain his reasoning so that even those without botanical knowledge could grasp the essentials of his conclusions: but it would be presumption in a non-botanist to attempt an exposition of them here.

Throughout all this work it was fascinating, to those of us who were associated from the side of application, to watch his skilled guidance of the research and his firm adherence to sound fundamental principles: and this observation is no belittlement of the capability of the actual research workers, themselves botanists of marked ability. But what made this co-operation additionally pleasurable, and the necessary visits to Lucknow so attractive, was Prof. Sahni's great personal charm and genuine consideration for others, not to mention his inexhaustible readiness to consider queries and explain his reasoning. This influence quite obviously spread itself throughout the whole department, and was no small factor in the harmonious atmosphere in which the research proceeded to a fruitful conclusion.

Many scientists all over the world have reason to feel the absence of Prof. Birbal Sahni, but there is one particular corner of India where, though few would expect a direct connection with the great figures of the world of botany, the passing of this able adviser and personal friend is felt with especial sadness and regret, and where his memory will long remain amongst workers in another branch of science.