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A Review on Paleobotanical Studies in India

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ABSTRACT: Birbal Sahni was an Indian botanist, educationalist and renowned geologist. Birbal Sahni was a scientist of great stature. His parents were Ruchi Ram Sahni and Ishar Devi. His father was an enthusiastic educationist, a great patriot and a devoted social worker. Sahni had very little money, but he had a great zeal for science and research. Birbal was an excellent teacher and believed in being a good researcher. He was a superb communicator for the subject of science at all levels. The work of Birbal Sahni has been acknowledged by anthropologists from all over the world.

Birbal Sahni made significant contributions to the field of plant taxonomy, ecology, evolution, and biogeography. His contribution to Palaeontology and biogeography is of great magnitude as it raised the standard of the disciplines in India. Palaeontology is the scientific study of ancient life on earth on the basis of fossilized evidence. It includes the study of:

- 1. Palaeobotany (study of prehistoric plants)
- 2. Palaeoecology (study of ancient ecosystems)
- 3. Palaeogeography (study of ancient writing)

Palaeobotany is a scientific discipline which studies ancient life forms by examining their fossilized remains. The biological information collected through identification, description, and classification of fossil plants contributes to the understanding of the evolution and extinction of plants and plant ecosystems, particularly the global change. Palaeobotany involves various fossil plant groups, including leaves (desiccated leaves), seeds, woody stems (e.g., petrified wood), fruits, spores, pollens and macrofossils of aquatic plants such as seaweeds.

Paleobotanists use fossils, chemical signatures and other evidence to reconstruct ancient plant life's appearance, growth and evolution.

KEYWORDS: paleobotany, review, India, Birbal Sahni, fossils, evolution, anthropologists, research

I. INTRODUCTION

Birbal Sahni made significant contributions to the study of Palaeobotany. He took a deep interest in the study of plants from his early childhood. He researched on the anatomy and morphology of the palaeozoic ferns and India's Gondwana formation's fossil plants. Birbal Sahni is acknowledged for his significant contribution to Palaeobotany all over the world. Sahni started the Institute of Palaeobotany at Lucknow,²¹ which was later on renamed as the Birbal Sahni Institute of Palaeobotany (BSIP) to acknowledge his efforts in the field Palaeobotany. This was the first Palaeobotany institute in India.¹ The Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow, is one of the most recognized institutions in Palaeobotany, Palaeoecology and allied disciplines. Its mandate is to explore and develop Palaeobotany as a science and provide facilities for research in all aspects of plant life in the geological past, including fossil fuels. The BSIP has been set up as an autonomous institute under the administrative control of the Department of Science. It combines traditional teaching of Palaeobotany with modern teaching facilities uniquely. ²The Institute is a pioneer in the field of Palaeobotany. The BSIP strives to attain excellence in R&D through a dedicated scientific team and innovative integrated ideas in basic and applied research. The BSIP seeks to interpret plant life evolution, geological processes involved, and environmental evolution through time in its broadest sense.Birbal Sahni was a great scientist and has contributed to various fields.²² He had a passion and keen interest in Palaeobotany.²⁰ He raised the standard of various disciplines and made his classic contributions to Palaeobotany. Palaeobotany studies and recovers plant remains from geological deposits, often in conjunction with paleontological and other earth-science techniques to determine the evolutionary history of vegetation and fossilized plants. Birbal Sahni received multiple awards and was appreciated for his work in various disciplines. He maintained his love for his work in the field of Palaeobotany until his death.³



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Palaeobotanical studies in India date back to the third decade of the nineteenth century. Since then there have been significant contributions of critical importance to Indian stratigraphy, of which, of course, the studies on Gondwana flora¹⁹ far outshine others. Sir Albert Charles Seward and Professor Birbal Sahni were the first to modernize the studies on Gondwana flora, and tributes are offered to both of them. Plant fossils from the earliest Cambrian to the Pleistocene have been recorded from various stratigraphic horizons in India, and studies on the same are to be intensified.⁴ Such studies have already helped in palaeoecological interpretations regarding the Gondwana Era and parts of the Tertiary period. Further studies are urgently needed to fill in the blanks in the reconstructed geological history. Application of palaeobotanical studies in the scientific exploration and development of coal, petroleum and diatomaceous earth has already attained much success in India and abroad.⁵ The scope of research in this domain is ever expanding, and the extension of such studies to the problems of exploration of phosphorites and gypsum may prove to be fruitful.²³ Future studies in palaeobotany in India could pay some more attention to the problems pertaining to the remnants of earliest psilophyton flora, microflora of the Gondwana formations, floral evidence on Permo-Triassic boundary and the search of micro-flora in the so-called unfossiliferous formations of the Himalava. A greater emphasis on the study of microflora or the Tertiary formations is due, and activities have accelerated in this direction. Simultaneously with these the history of evolution of plant life through the ages need to be reviewed with greater precision.⁶ This may have important implications in regard to planetary evolution. Modern researches in palaeobotany tend to be more botanically oriented. The geologists, in their search for evidences to reconstruct the history of the earth, are looking forward to ever increasing contributions from the palaeobotanists who may, therefore, devote some more time to the geological aspects of the fossil plants.7

II. DISCUSSION

Integration of palaeobotanical (spores, pollen, phytoliths and non-pollen palynomorphs) and organic geochemical proxies, such as stable isotopes of organic carbon (δ^{13} C) and *n*-alkanes, for studying the evolution and palaeoenvironmental conditions of an archaeological site are rare in India. The evolution of a protohistoric-historic site at Erenda, situated in the eastern coastal region of India, has been studied by using multiple palaeobotanical and organic geochemical proxies assisted with AMS radiocarbon dates.⁸ The excavated site lies above Late Pleistocene–Early Holocene Sijua Formation. The absence of anthropogenic evidence in the Sijua Formation likely indicates inhabitable conditions in nearshore/estuarine marshy conditions.¹⁸ The earliest human settlements at the excavation site begin during the first millennium BCE after the initiation of habitable conditions along the coast. The presence of fungal spores and the dominance of C₄ phytolith morphotypes indicate prevailing warm and humid climatic conditions and proximity to a freshwater body.⁹ The δ^{13} C signature and *n*-alkane composition indicate the use of C₄ grass for the construction of the mud and clay-built huts. The settlers most likely used to consume wild or domestic variety of rice, as evidenced by the presence of bilobate scooped morphotypes. The site was partly abandoned, covered with C₃ and C₄ vegetation and used as a dumping ground after 663 ± 92 BCE. This implies that people continued to live in the area but possibly moved to a nearby site while using the excavated site as refuse.¹⁰

III. RESULTS

A small assemblage of macro- and micro floral remains comprising fossil leaf impressions, silicified wood, spores, and pollen grains is reported from the Paleocene–lower Eocene Vagadkhol Formation (=Olpad Formation) exposed around Vagadkhol village in the Bharuch District of Gujarat, western India¹⁷. The fossil leaves are represented by five genera and six species, namely, Polyalthia palaeosimiarum (Annonaceae), Acronychia siwalica (Rutaceae), Terminalia patelii (Lythraceae), palaeocatapa and T. panandhroensis (Combretaceae), Lagerstroemia and а new species, Gardenia vagadkholia (Rubiaceae). The lone fossil wood has been attributed to a new species, Schleicheroxylon bharuchense (Sapindaceae). The palynological assemblage, consisting of pollen grains and spores, comprises eleven taxa with more or less equal representation of pteridophytes, gymnosperms, and angiosperms. Angiospermous pollen grains include a new species Palmidites magnus. Spores are mostly pteridophytic but some fungal spores were also recovered.¹¹ All the fossil species have been identified in the extant genera. The present day distribution of modern taxa comparable to the fossil assemblage recorded from the Vagadkhol area mostly indicate terrestrial lowland environment¹⁶. Low frequency of pollen of two highland temperate taxa (Pinaceae) in the assemblage suggests that they may have been transported from a distant source. The wood and leaf taxa in the fossil assemblage are suggestive of tropical moist or wet forest with some deciduousness during the Paleocene-early Eocene. The presence of many fungal taxa further suggests the prevalence of enough humidity at the time of sedimentation.¹²



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IV. CONCLUSIONS

It is lack of a legislation to conserve fossils. Hence, we are not able to preserve geological and palaeontological heritage of India. Look at China and the US. If a site is declared a natural fossil park in these two countries, you cannot carry out any excavation there without the approval of the government.¹³ We need to safeguard our palaeobotanical heritage, just like we do our archaeological heritage. The geochronology—the science of determining the age of rocks, fossils, and sediments—laboratory will be upgraded¹⁵. A palaeoclimate lab will be established at the institute. There are plans for an astrobiology laboratory under the 12th plan. We are going to be developing models for a mega project on palaeoclimate sanctioned by the Indian government. We are now using some of the latest techniques, such as clamp analysis, for our research.¹⁴

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