

Report

A NOTE ON THE SIGNIFICANCE AND FUTURISTIC APPROACH OF THE NEWLY ESTABLISHED AMBER ANALYSIS AND PALAEOENTOMOLOGY LABORATORY AT BIRBAL SAHNI INSTITUTE OF PALAEOSCIENCES (BSIP), LUCKNOW

AMBER science is a highly significant and relatively novel field in palaeontology that can provide crucial insights into the distribution of life forms during the Indo–Asia collision. Amber, a type of fossilized resin secreted by various tropical and subtropical plant families, is preserved in sedimentary rocks that formed the bottom of an ancient deltaic system. During fossilization, the resin captures and preserves a wide range of biota within it. Over the years, numerous specimens of amber biota from around the world has been classified and studied extensively by entomologists, geologists and palaeontologists. More recently, Indian amber has attracted immense attention from these fields, both nationally and internationally (Source: Times of India, December 2nd, 2013).

Indian amber is globally unique as it is produced by the earliest sourced *Sal* trees. Amber is attributed to the first known discovery of Dammar–II resin, exuded from angiosperm trees of Dipterocarpaceae. This type of resin, in particular, has not been found anywhere else in the world beyond western India. Recent publications from Gujarat have reported remarkable inclusions in amber, ranging from arthropod fossils to stunning flowers and freshwater crustaceans, dating between 54 to 40 million years of age. These discoveries have contributed to our understanding of the area's rich palaeontological history. During this time, the Indian Plate was moving northward while experiencing a climate marked by hyperthermal events during the Eocene epoch. The diverse arthropod collection found within the Indian amber indicates a pattern of dispersal into and out of India, showing connections to Europe, Asia, and Gondwana. This suggests that India was an island subcontinent located at the equator during a period when the Earth underwent episodic thermal heating. The Eocene epoch witnessed significant biotic radiation, with many of the lineages present in amber, still existing today.

The Birbal Sahni Institute of Palaeosciences (BSIP) in Lucknow has recently established the Amber Analysis

and Palaeoentomology Laboratory, marking a significant advancement in the study of ancient ecosystems and biological diversity preserved in amber fossils. This new facility is dedicated to the examination and research of amber inclusions, with a particular focus on fossilized insects (palaeoentomology).

The laboratory aims to harness sophisticated analytical techniques to decipher the biological and ecological information preserved within amber. The establishment of this laboratory underscores the institute's commitment to expanding the frontiers of palaeosciences, offering researchers and scholars unparalleled access to cutting–edge resources for the study of prehistoric life.

The Amber Analysis and Palaeoentomology Laboratory functioning under the leadership of Dr. Hukam Singh is equipped with state–of–the–art microscopy and imaging systems, alongside analytical instruments essential for the detailed examination of amber specimens. This setup enables the precise identification of trapped biota in amber and the reconstruction of their habitats, providing insights into ancient biodiversity and environmental conditions. Furthermore, the laboratory's research initiatives are expected to contribute significantly to the understanding of biogeographical patterns and evolutionary processes. By analyzing the diverse inclusions found in amber from various geographical locations, researchers can trace the historical dispersal and adaptation of species. This knowledge is invaluable for reconstructing past ecosystems and understanding the dynamics of Earth's biosphere through geological time. BSIP, through the establishment of the Amber Analysis and Palaeoentomology Laboratory, reinforces its role as a leading institution in the field of palaeosciences.

This development not only enhances the research capabilities within India but also fosters international collaborations, positioning the institute at the forefront of global palaeontological research. Some fascinating strides in this direction are already made, particularly in the study of amber and its preserved fossil biota.

Establishing the Amber Laboratory is a significant step towards furthering research in this area with support from eminent scientist like Professor Ashok Sahni, Scientist Emeritus, Panjab University, Chandigarh and Professor M.G. Thakkar, Director, BSIP, who inaugurated this Amber Analysis and Palaeoentomology Laboratory on the Institute's Founder's Day–14th November, 2023. It was Professor Ashok



- (a–b) Inauguration Ceremony of Amber Analysis and Palaeoentomology Laboratory at BSIP, Lucknow.
 (c) Laboratory plaque unveiled at BSIP, Lucknow.
 (d) Light microscopy image of an isolated head of an ant (Formicidae).
 (e–f) Scanning Electron Microscopy (SEM) images of a cuticular fragment and mite.
 (g) Confocal Laser Scanning Microscopy (CLSM) image of palm pollen (*Longapertites retipilatus*) grain.

Sahni's vision that paved way for such kind of new research to be established in India and speaks a lot about the hidden fossil treasures in the Indian Lignites of Gujarat. Institute's Director, Prof. M.G. Thakkar has also been in the forefront and worked towards the establishment of the laboratory. The Laboratory is the result of more than ten years of earnest effort and dedication from Dr. Hukam Singh. To further examine the fascinating fossils trapped in Indian amber, Dr Singh and his team are working hard to build this new field of palaeosciences in India.

The first doctoral thesis, entitled 'Eocene arthropods in amber from the Kutch and Cambay Lignites, Gujarat, India: Their bearing on palaeoenvironments', has already

been compiled by Dr. Priya Agnihotri in the same year (December, 2023). The thesis deals with the systematics and environmental implications of Eocene arthropods preserved in amber nodules from the open-cast lignite mines of the Kutch and Cambay Basins in Gujarat. This type of thesis is the first comprehensive analysis of bulk-scale fossil arthropod assemblages from the Lignite Mines of Gujarat, comprising of fossil insects, arachnids and freshwater ostracods.

The Amber Analysis and Palaeoentomology Laboratory aims to foster collaboration among students and researchers from around the world. This collaboration will focus on studying the exceptional 3-dimensional preservation of fossil biota found in amber. Such preservation is crucial

for analyzing the palaeontological history of the unique biological diversity and their inter-specific associations within ecosystems that existed during the critical warming period in the history of the India–Asia collision.

In the coming years, the researchers at the laboratory will delve into various aspects of the preserved biota, including evolution, ecology, taphonomy, palaeogeographical distribution and microhabitat of insects, spiders, and freshwater crustaceans. By examining these factors, they can construct a holistic picture of an Eocene angiosperm mixed forest ecosystem.

Through these investigations, the laboratory endeavours to uncover insights into the environmental implications of past ecosystems, shedding light on their evolution and dynamics. This interdisciplinary approach promises to yield valuable contributions to our understanding of Earth's fossil history and the intricate relationships between biota and their environments.

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