25TH ANNIVERSARY OF
MUSEUM OF AMBER INCLUSIONS
UNIVERSITY OF GDAŃSK

Fossil Record in Resins and Sediments

BOOK OF ABSTRACTS

UNIVERSITY OF GDAŃSK
23-26 MAY, 2023

FossilRRS Conference

Fossil Record in Resins and Sediments

25th Anniversary
of Museum of Amber Inclusions
University of Gdańsk

BOOK OF ABSTRACTS

University of Gdańsk, Faculty of Biology
Gdańsk, POLAND
May 23 - 26 2023

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WELCOME

The Museum of Amber Inclusions University of Gdańsk is pleased to invite you to celebrate its 25th anniversary and attend the conference *Fossil Record in Resins and Sediments*, which will be held in Gdańsk, Poland, from 23rd-26th May 2023.

Twenty-five years ago, the natural history collection of amber and inclusions, started from modest beginnings – scientific collection of the Diptera inclusions of Professor Ryszard Szadziewski. What revolutionised the collection was the donation of 50 kg of raw Baltic amber, which completely changed the view on amber, its inclusions and its amber taphocoenosis. The uniqueness of the scientific collection of the Museum of Amber Inclusions is in its positioning within the structures of the University. We are not a collection of specimens, musealia that cannot be touched, but a collection where amber is the basis of scientific discovery and research. Twenty-five years ago, we were at the point when interest in inclusions was developing, and the amber market was growing, and we were present at the Amberif Fair, among the amber workers and collectors, at the centre of the amber (and inclusions) fever. The scientific backbone of the Museum is its collection, research facilities and friends among scientists. The flesh is a collaboration with amber workers, collectors and enthusiasts of amber and inclusions. The blood is the circulation of information, data, ideas, and opinions.

New technologies allow us to look more and more closely into worlds hidden millions of years ago in the solidifying drops of resins. It is the 21st century and we are discovering new pages written in the books of amber, its inclusions and its deposits, but also in the stone books of palaeontology. We will not be able to answer more and more questions on our own – cooperation, exchange of information and experience of geologists, palaeontologists and biologists is needed.

The Conference, which is being held at the University of Gdańsk and supported by the Ministry of Education and Science, will offer an outstanding scientific programme thanks to the participants. It is an opportunity to share the current state of knowledge, new working hypotheses, to debate new findings and new tools, to discuss and find new interpretations of existing data and opinions.

It is with great pleasure that we invite all of you in the spring of 2023 to this Conference, we encourage scientific openness, warm discussions, collaboration, and a shared reading of palaeobiology in fossil resins and sediments. We trust that your stay in Gdańsk – the World Capital of Amber and Museum of Amber Inclusions will be a memorable opportunity for both professional and personal satisfaction.

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INTERNATIONAL PALAEOENTOMOLOGICAL SOCIETY

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palaeobiological conference

23-26 May 2023

Gdańsk, Poland

ABSTRACTS

FOSSIL RESINS OF THE WORLD, WORLDS OF FOSSIL RESINS

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Natural resins (fossil or modern) are caustobioliths, belonging to the liptobiolites group. Fossil resins are plant secondary metabolites, plant secretions, products of the defence mechanisms of both coniferous and angiosperm trees. These exudates have hardened over time and can be found in coals, fossilized wood, or other sedimentary rocks. Fossil resins, chemically speaking, being water-insoluble complex mixtures of organic compounds such as terpenes, terpenoids and their derivatives, and/or phenolic secondary compounds, liquid and sticky at the beginning, solidify by polymerization. Among the many types of fossil resins, the most noteworthy, both biologically and geologically, are the various types of amber. The secretion of the resin and its hardening occurred under atmospheric conditions, under the environmental conditions of the deposit, and within the deposits. The preservation of resins as fossils depends on how quickly they were buried and isolated from oxygen, sunlight and biological conditions, along with other factors that cause them to biodegrade. Over millions of years, fossilized resins have undergone diagenetic and catagenetic processes. Despite chemical changes, fossil resins also retain chemical traces of the source plants and environments in which they were originally secreted. Fossilized, resinous substances are found in sedimentary rocks from the late Devonian to the Cenozoic[1]. Occurring in various locations around the World, fossil resins, which can be physically and chemically classified as amber[2] are incorporated in geological strata spanning in age from the Carboniferous to the Cenozoic[1,3]. Over the past 25 years of research, fossilized resins, generally thought to be rare across the fossil record and mostly occurring in small quantities, have proven to be a worldwide rather than a local phenomenon.

Deposits in which fossil resins are preserved occur all over the World, and many varieties are recognized; the fossil resins recognized are amber are also not rare; the most interesting are those that contain inclusions. The inclusion is any remain entrapped in amber during its fossilization and diagenesis[1,4]. This term is often narrowed down to numerous, often delicate organic remains entombed in fossil resin. These are usually three-dimensionally preserved, with surface and structural details retained, and most of them are at least roughly conserved in vital aspect and before significant decomposition. Even the tiniest inclusion can play a role in drawing a picture of past environments. Knowledge and understanding of the deposits, fossilized resins and their inclusions, the combination of these provides a unique insight into the ecosystems of the past and is key to predicting the consequences of ongoing biotic crisis.

Several ‘amber bursts’ were identified in the fossil record[2], the first fossil resin that can be classified physico-chemically as amber (Class Ic) is from the Carboniferous of Illinois. However, no inclusions have yet been identified in this resin. The first amber with inclusions is from the early Late Triassic (Carnian, 237-228.4 Mya), a period probably less than 1 million years old and coinciding with the ‘Carnian Pluvial Episode’, i.e. a global

and rapid climate change[5] resulting in rapid floristic changes[6]. The second 'burst' in fossil resins and ambers preservation has occurred during the Cretaceous. It comprises the oldest deposits so far with a large amount of inclusions – Barremian Lebanese amber[7], the inclusions-rich resins from Albian–Cenomanian deposits of France[8], Spain[9] and northern Myanmar[10]. These fossilized resins cover a significant portion of the Cretaceous Terrestrial Revolution[11]. Late Cretaceous resins are also notable and inclusiferous, e.g. Raritan amber from New Jersey[12] and Canadian amber[13], ambers from Taimyr[14], central Myanmar[15] or France[16]. Paleogene deposits have yielded the first fossil resins originating from angiosperm trees and containing inclusions – amber of Oise in France[17], and Cambay in India[18]. However, majority of known Paleogene fossil resins with inclusions are derived from gymnosperm trees. This 'burst' is best exemplified by fossil resins collectively known as 'Baltic amber'[19], but with numerous other resins reported[20]. The last 'burst' in fossil resins is documented by Miocene deposits, the most famous are resins from Dominican Republic[21] and Mexico[22], originating from angiosperms, but new finds are emerging, e.g. in China[23], Vietnam[24], Ethiopia[25] or in New Zealand[26].

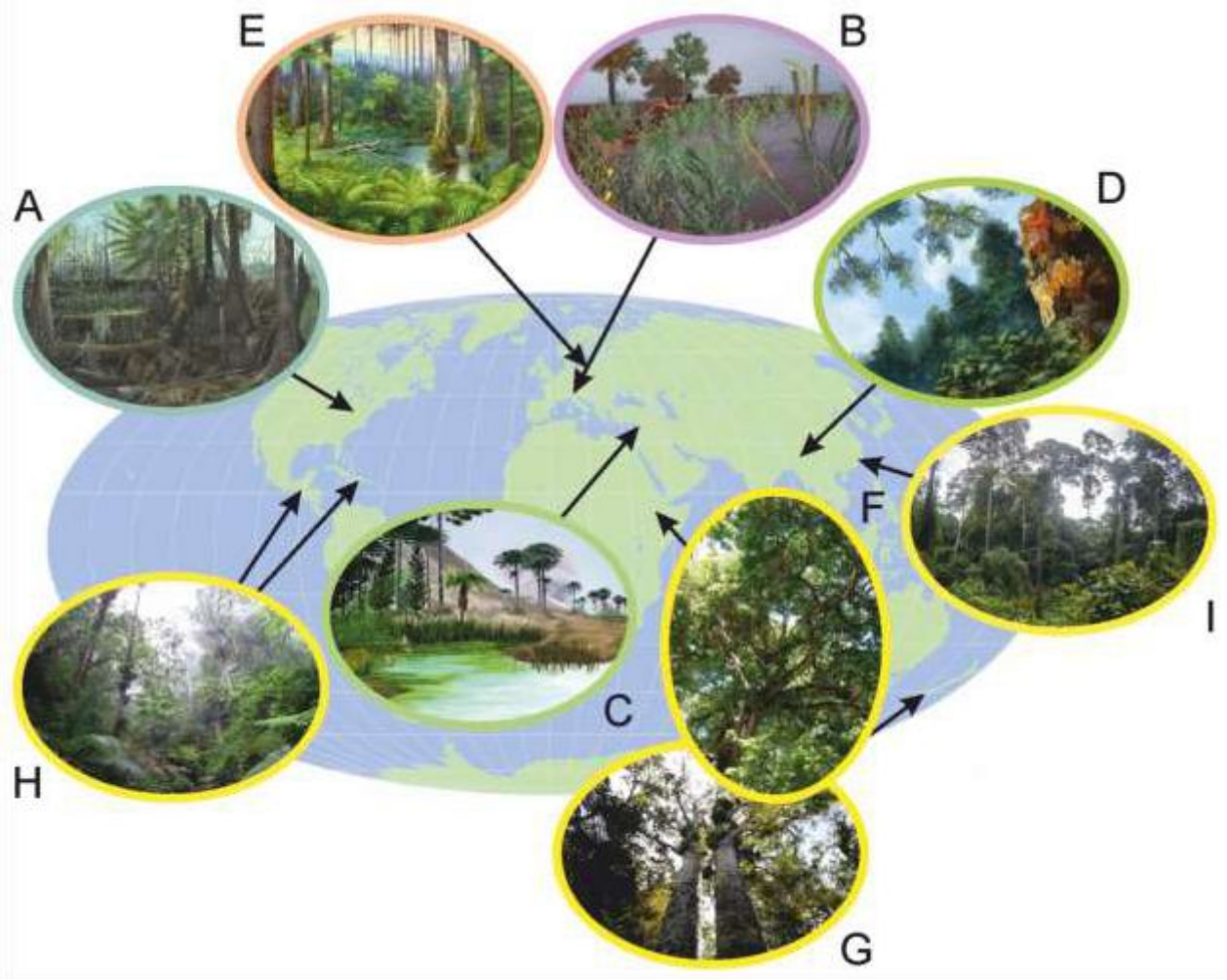

Fig. 1. Distribution of assorted fossil resins deposits. A – Carboniferous, Mississippian, Illinois; B – Triassic, Carnian, The Dolomites; C – Lower Cretaceous, Barremian, Lebanon; D – 'mid-Cretaceous', Kachin; E – Eocene, Gulf of Gdańsk; F – Amhara, Ethiopia; G – Otago, New Zealand; H – Mexican and Dominican amber; I – Zhangpu, China.

Fossil resins from different periods and regions are rich sources of inclusions, representing new extinct species and yielding important insights into the evolution of various organisms in the dimension of time. Evolutionary transitions can be well-documented by fossil resins inclusions, and inclusions can reveal anatomical transformations and the age of appearance of structural features. Inclusions contribute to understanding the phylogeny, biology, and biogeography of animals, fungi and plants. Fossil resins and inclusions embedded in them are of capital importance for dating molecular affinity trees. Reconstructing evolutionary processes that occurred in the distant past benefits from integrating molecular and morphological information from extant and fossil taxa, with total-evidence analyses[27].

Another major potential of fossilized resins and entombed inclusions is the documentation of faunal, floristic and climatic shifts. This plethora of new discoveries, new research, and reinterpretations of existing data significantly impact how we view fossil resins deposits. Many of the newly discovered sites are accurately dated, and sometimes, the botanical origin of fossilized resin is also known. Renewed interest in fossilized resins is now resulting in attempts to use them as proxies for reconstructing palaeoenvironmental conditions, reconstructing palaeoecosystems. Inclusions of all types, bioinclusions as tiny arthropods, other animals and their fragments, plants and their fragments, fungal hyphae, spores, pollen and other microinclusions, inorganic inclusions, ichnofossils related to fossil amber – all these data are essential to understand and reconstruct palaeohabitats, their conditions and functioning.

The fossil record is notoriously imperfect and biased in representation, the fossil record of resins and inclusions in the fossil resins, however, can bring some hope in the interpretation of evolutionary and environmental changes. Fossil resins have witnessed major global changes, the resins themselves, together with inclusions in the resins, were formed at various moments in the history of the Earth and documented the World at that time. The resins and the inclusions encapsulated in them are microworlds and witnesses of the Earth's past biotas.

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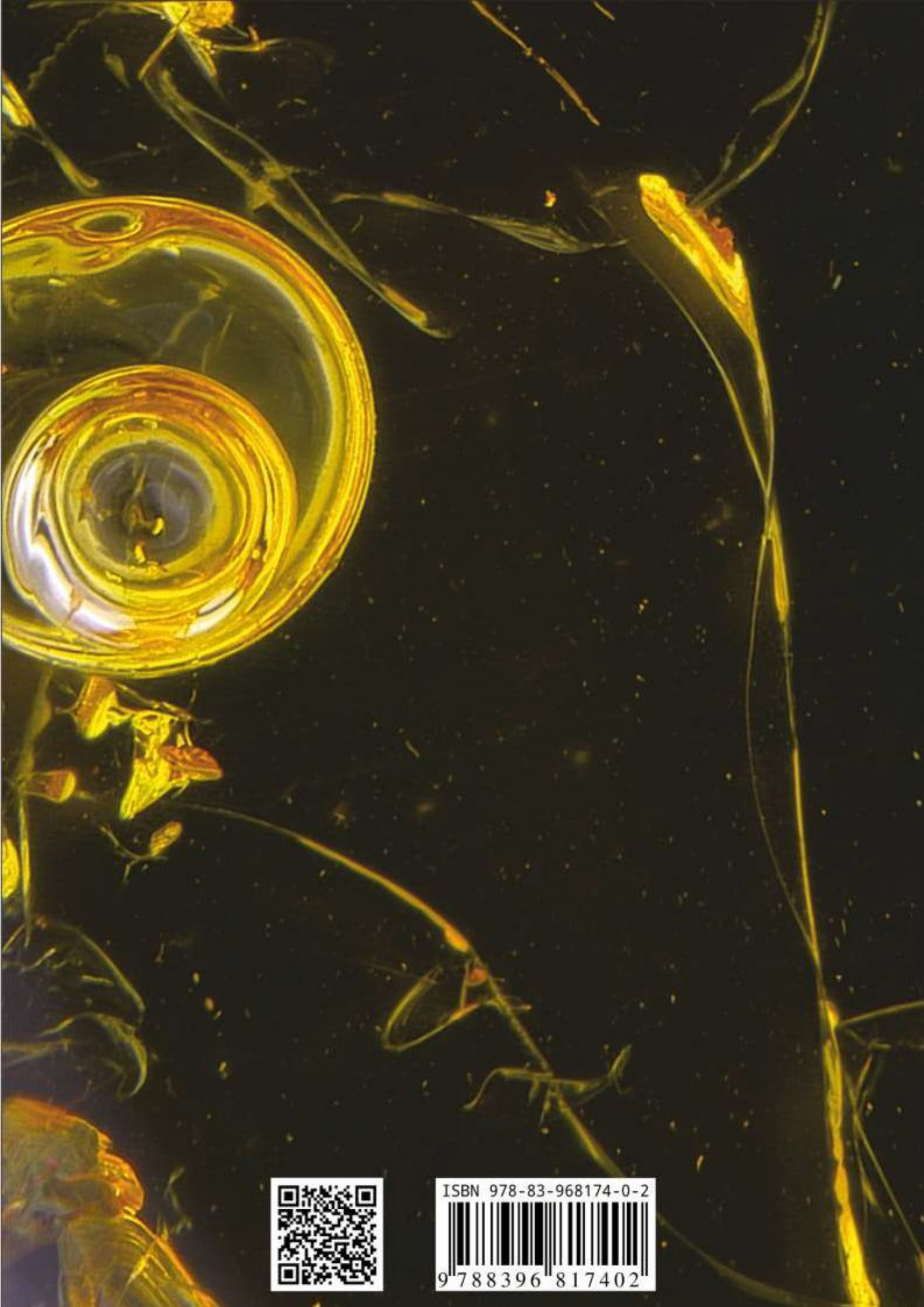

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