7. Bernstein-Workshop am 5. März 2015
im Rahmen der Deutschen Entomologentagung 2015 in Frankfurt

Chair: Wilfried Wichard

Kurzfassungen

Keynote

State of the art in the research on fossil resin in the World

DANY AZAR
Dany Azar, Lebanese University, Fanar, Lebanon, E-mail: azar@mnhn.fr

Amber (or fossil resin), a wonderful warm and shimmering material, with the colour of sun and gold, has seduced humans since ever and this fact is documented since at least the Neolithic. It has been priced over ages for its beauty and gemological qualities. The amber got its names in different languages and civilizations after its physical and chemical properties. A lot of mythologies provide explanations on its formation and most of them give it an origin related with divinities; but amber in reality is a fossil vegetal resin. If today this reality is no more a secret to anyone, determining the exact botanical origin of amber is still a great challenge to the scientific community.

Amber is renowned as being a splendid material for the fascinating conservation of biological inclusions in their minute 3-dimentional details. It is a gold mine for the palaeontologists as it contains a variety of biological inclusions in pristine conditions. Till the last five years the study of biological inclusions in amber was only made by traditional optical microscopy; but today with the drastic advance in science, a great step toward the future has been made, especially with the use of new tools of exploration and imaging, even in opaque material. These tools are represented by the X-ray synchrotron tomography or even with the new generation of micro CT-Scanners that begin to be more and more precise and available.

Keynote

Insects in Burmese amber

ANDREW ROSS
Andrew Ross, National Museum of Scotland, Department of Natural Sciences, Edinburgh, Great Britain
E-mail: A.Ross@nms.ac.uk

Burmese amber contains the highest diversity of insects out of all the Cretaceous ambers. There are 26 orders and 206 families recorded and 252 described species, of which 211 have been named in the past 15 years. The number of families is about half of all known insect families living at that time.

Burmese amber was originally considered to be Miocene and even in the early 1990s was considered to be Eocene. The discovery of Cretaceous taxa in the mid-1990s led to the idea that the amber was much older. Then came discussions about which stage it was from based on ammonites, palynomorphs and volcanic zircon crystals, which indicated that the amber was earliest Cenomanian (99 Ma).

However, the zircon dates only provide an age for when the bed was deposited, not when the amber first exuded as resin and trapped the insects. Same pieces of Burmese amber are rounded and have the borings of pholadid bivalves all the way around. This demonstrates some of the amber was hard and rolling around in the sea before it was buried by sediment. This indicates the amber is older than the bed in which it was deposited.

The percentage of extinct families from Burmese amber {15%) is a close match to the percentage of extinct insect families known from the Albian, as opposed to those known from the Cenomanian (-10%). This and the pholadid borings suggest that the insects in Burmese amber are more likely to be Albian rather than Cenomanian in age.

Bruchomyiinae (Diptera, Psychodidae) - state of the art

RÜDIGER WAGNER
Rüdiger Wagner, Universität Kassel, Kassel, Deutschland, E-mail: ruediger.wagner@uni-kassel.de

A sister-group relationship of Psychodidae and Tanyderidae has been supposed since long and becomes increasingly probable. In retrospective it is not surprising that in the 1920ies Bruchomyiinae was treated a subfamily of Tanyderidae. However, knowledge on Bruchomyiinae increased particularly during the last years. Meanwhile more than 50 extant species have been described and finally arranged in a number of new named genera with well distinguished distribution areas in the Afrotropical, Neotropical, Oriental and Oceania bioregions. However, relation between extant and extinct taxa remains unclear. The oldest amber taxon known is a new species from Burmese Amber that already displays most characteristics of the subfamily. Baltic amber contains a surprising high number of taxa - some still undescribed – representing different 'species groups' or evolutionary lines. The only species that with confidence can be included in one of the extant genera is *N. scheveni* from Dominican Amber, member of a genus named in the near future that comprises species from northern parts of the Neotropics and southern limit of the Nearctic. Baltic Amber species indicate several evolutionary lines with different shape of tergite 9. One undescribed species is difficult to include either in Bruchomyiinae or Tanyderidae.

Die Familie Nevrorthidae (Neuroptera) im Baltischen Bernstein

WILFRIED WICHARD
Wilfried Wichard, Universität Köln, Institut für Biologie, Köln, Deutschland, E-mail: Wichard@uni-koeln.de

Im Baltischen Bernstein sind bislang folgende 6 Nevrorthidae-Arten nachgewiesen: *Rophalis relicta, Palaeoneurorthus bifurcates, Palaeoneurorthus groehni, Palaeoneurorthus hoffeinsorum, Electroneurothus malickyi, Proberotha prisca.* Neue Nevrorthiden-Funde machen wahrscheinlich, dass weitere Arten hinzukommen. Das Vorkommen im Baltischen Bernstein wird aus paläobiogeographischer Sicht mit den subtropischen, rezenten Spezies im Mittelmeerraum, in Südostasien und an der Südostküste Australiens verglichen und diskutiert.

Bizarre Tanzfliegen - die Gattung *Ragas* im Baltischen Bernstein

C. HOFTEINS & B.J. SINCLAIR
Christei Hofteins, Arbeitskreis Bernstein, Hamburg, Deutschland, E-mail: chw.hoffeins@googlemail.com

Vertreter der Gattung *Ragas* (Diptera: Empididae) sind kleine Tanzfliegen, die nicht häufig in Rezentsammlungen anzutreffen sind, ebenso gehören fossile Belege zu den Raritäten.

Ragas wird definiert durch stachelartige Behaarung der Postgena, vorderen Coxen und Trochanter und ein gekrümmtes Labrum. Sechs rezente Arten weltweit sind bekannt, die Aktivität der Imagines liegt in den Wintermonaten, sie fliegen über Baumstümpfen und bilden keine Schwärme. Eine erste von MEUNIER (1908) aus dem Baltischen Bernstein als *Ragas generosa* beschriebene Inkluse weist keine der *Ragas*-typischen Merkmale auf und gehört in ein unbeschriebenes Taxon. Obwohl Inklusen, die *Ragas* zugeordnet werden und innerhalb der Tanzfliegen selten gefunden werden, erbrachte eine Untersuchung von nur 19 Exemplaren eine überraschende Artenvielfalt: *R. baltica, R. electrica, R. eocenica, R. succinea,* und *R. ulrichi.* Eine kürzlich entdeckte weitere Art zeigt neben der *Ragas*-typischen Bedornung eine ungewöhnliche Ausprägung der Postgena, welche bisher unter den Empididen nicht bekannt ist.

Literatur: SINCLAIR, B. J. & HOFFEINS, C. 2013: New fossil species of Ragas Walker (Diptera: Empididae) in Baltic amber (Tertiary, Eocene). - Bonn zoological Bulletin 62 (1): 92–99.

Diptera and the taphonomy of amber

F. STEBNER, M.M. SOLORZANO KRAEMER, D.BICKEL & J. RUST
Frauke Stebner, Steinmann Insti tut, Bonn, Deutschland, E-mail: frauke.stebner@uni-bonn.de

Diptera are the most common group as amber inclusions, thus the best taxon to study amber taphonomy. We might regard sticky tree resin, the precursor to amber, as a type of biotic "trap" that records the flora, fauna, and debris that are accidently stuck and entrapped. Diptera are abundant in amber because so many taxa are associated with tree trunks, thereby increasing their chance of becoming accidently entombed as inclusions. Using tree trunk sticky traps as an amber analogue, we can study the taphonomy of recent tree trunk associated faunas and compare this to amber faunas. The present work aims to review key questions about taphonomic biases and filters of the fossilization processes in amber. The project is supported by German Science Foundation (DFG) SO 894 3/1 and the Spanish Ministry of Economy and Competitiveness GL2011-23948 AMBARES 2012-2014.

Palaeobiogeography and Palaeoecology of Nematocera from Early Eocene Indian amber

F. STEBNER & J. RUST
Frauke Stebner, Steinmann Institut, Bonn, Deutschland, E-mail: frauke.stebner@uni-bonn.de

India's peculiar and highly diverse biota combined with its unique geodynamical history has generated much interest in the patterns and processes that might have shaped the current distribution of India's flora and fauna and their biogeographic relationships. Several different theories concerning India' s geological history have been established but none of these models provides satisfying answers to questions about the origin of Indian and Asian biodiversity. A recently discovered fossiliferous amber deposit from the Early Eocene of India for the first time provides the opportunity to study fossils of the most species rich group of terrestrial organisms - the insects - to investigate India' s geological history and get insight in a terrestrial ecosystem in tropical latitudes at the beginning of the Early Eocene Climatic Optimum. The present project focuses on Nematocera which are represented by more than 500 specimens from eleven families and thus comprise the most common and diverse inclusions in this amber. First analyses of selected taxa reveal high potential for biogeographic and ecological studies. The psychodine subfamily Sycoracinae for example - which is represented by five specimens in Indian amber - is generally rare in the fossil record and has only a few disjunct distributed extant species, none of which known from India. A fungus gnat in Indian amber reveals affinities to the lygistorrhinid genus *Palaeognoriste* from Eocene Baltic amber as weil as several taxa of Ceratopogonidae show relationships to Baltic amber specimens. Additionally, almost all nematoceran groups in Indian amber include taxa of ecological importance in terms of feeding or habitat requirements, like the aquatic larvae of Chaoboridae and Chironomidae or the blood feeding Corethrellidae and Sycoracinae.

Synchrotron X-ray microtomography of fossil wasps in amber

T. VAN DE KAMP, T. DOS SANTOS ROLO, T. BAUMBACH & L. KROGMANN
Thomas van de Kamp, Karlsruher Institut für Technologie, Eggenstein-Leopoldshafen, Deutschland,
E-mail: thomas.vandekamp@kit.edu

Synchrotron-based X-ray microtomography (SR-µCT) facilitates three-dimensional visualization of non-translucent, millimeter-sized samples. As a non-destructive imaging technique, it is already established as an important tool for entomologists to examine insect morphology. A particular appealing application is the examination of fossil insects in amber. The ability to picture three-dimensional specimens without reflections and distracting particles is of great value for taxonomic studies on extinct species. The resulting "virtual insects" can be made widely accessible to the scientific community, a clear benefit especially in the case of valuable type material that may become lost or degraded in storage over time. Several tomographic scans of fossil hymenoptera were lately performed at the ANKA Synchrotron Radiation Facility of Karlsruhe Institute of Technology. Samples

included various species of Ichneumonoidea and Chalcidoidea enclosed in different types of amber from Cretaceous, Eocene and Miocene deposits. The investigations showed that amber inclusions often consist merely of an imprint of the original insect. In some cases, however, anatomical characters are remarkably well preserved, which may provide new insights into phylogenetic relationships.

Detailed like amber. Synchrotron X-ray microtomography reveals extraordinary internal preservation of 30 million old insects from fissure fillings

H. SCHMIED, A.H. SCHWERMANN, T. VAN DE KAMP, T. DAS SANTOS ROLO & T. BAUMBACH
Heiko Schmied, INRES, Abteilung für Tierökologie, Bonn, Deutschland, E-mail: schmied@uni-bonn.de

Amber is almost exclusively the source of three dimensional arthropod fossils, which conserves many details of the animals. But often only the outer surface of the body is preserved like an "insect wallpaper" which does not exhibit internal structures. A little known source of three dimensional insect fossils are fissure fillings. The Lagerstätte of Quercy (France) is one example of rapid mineralization that can happen in a very phosphorus-rich environment. This locality is mainly known for remains of mammals and other terrestrial vertebrates, but some fossils of a wide range of arthropods were also found. Many different arthropod taxa of Myriapoda, Blattodea, Ensifera, Lepidoptera, Coleoptera, Diptera and Hymenoptera were firstly noted in the 19th century. Detailed descriptions were given by Handschin (1944). A first reinvestigation by synchrotron X-ray microtomography revealed extraordinary well-preserved internal and genital structures of an extinct Clown beetle (*Onthophilus intermedius,* Histeridae). The 30-reconstructions show a very detailed view on the genital and intern organs of a 30 million old insect and demonstrate the potential of this underestimated form of non-amber preservation.

Poster:
Chironomidae in Early Eocene Cambay amber from India

V. BARANOV & F. STEBNER
Viktor Baranov, Leibniz Institut für Gewässerökologie und Binnenfischerei, Berlin, Deutschland, E-mail: baranowiktor@gmail.com

As in many other amber deposits Chironomidae are the most common dipteran inclusions in Indian amber. 140 fossils belonging to four subfamilies have been discovered so far, including the oldest known Tanytarsini, two mandibulate females and one gynandromorph specimen.

Poster:
Documentation methods for arthropods in amber

Marie K. Hörnig, Carolin Haug and Joachim T. Haug
M. Hörnig, Ernst-Moritz-Arndt-University of Greifswald, Zoological Institute and Museum, Greifswald, Germany;
E-mail: Marie.Hoernig@gmx.net
C. Haug & J. Haug, LMU Munich, Biocenter, Department of Biology II and GeoBio-Center, Planegg-Martinsried, Germany.

Amber inclusions are great sources to investigate morphology of extinct species, as the enclosed animals often fossilised in nearly life-like conditions. Therefore, they are an important resource to reconstruct, for example, palaeo-ecosystems or evolutionary scenarios of various lineages. Yet, inclusions in amber are often difficult to document because of reflexions, concavities, convexities, fissures, disturbing structures such as gases, liquids, or other objects. We present here different methods, which can help to overcome the mentioned limitations (at least partially) and provide the maximum information. We also discuss advantages and disadvantages of the different techniques.

1) White-light-based methods, which include micro- and macro-photography. Consistently sharp high-resolution images can be generated by doing several adjacent image stacks (composite

imaging), which are then processed with different software (open access in most cases). By using cross-polarised light, reflections are reduced and colour contrast is increased. The main advantage of this method is that it is applicable for a larger sample size. Also information about the three-dimensionality of structures can be captured by stereo images (physical or virtual). With micro-photography it is possible to gather very small details.

2) Fluorescence-based methods (also combined with composite imaging) are very useful to reduce reflections and can increase the contrast of certain structures (though quite differently to white light), but provide no colour information. They are also applicable for larger sample size and allow to resolve very fine details.
3) X-ray based methods, such as µCT, allow to create a virtual model of an inclusion. Also concealed or inner structures can thereby be accessible. The main disadvantage of these methods is that they are rarely accessible and expensive and therefore only usable for a small sample size. Very fine details are often less easy to resolve because of the comparably low contrast between cuticle and amber.

Not every approach is useful for every specimen as all methods have different advantages and disadvantages. Indeed, a combination of different methods allows to gain comprehensive information about each fossil organism.