Keynote presentations abstracts

Sic transit gloria mundi: When bad things happen to good bugs

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Origination and extinction, the 'Alpha and Omega' of Evolution, are the principal factors shaping biological diversity through time and yet the latter is often ignored in phylogenetic studies of insects. Extinct lineages play a dramatic role in revising our concepts of genealogical relationships and the evolution of major biological phenomena. These forgotten extinct clades or grades often rewrite our understanding of biogeographic patterns, timing of episodes of diversification, correlated biological/geological events, and other macroevolutionary trends. Examples are provided throughout the long history of insects of the importance of studying insect fossils, particularly those preserved with such high fidelity in amber, for resolving long-standing questions in entomology. In each example, the need for further integration of paleontological evidence into modern phylogenetic research on insects is emphasized.

Strashila: amphibious fly in the Jurassic

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Strashilids have been the most perplexing of fossil insects from the Jurassic of Russia and China (Rasnitsyn 1992; Vršanský et al. 2010). Only a few males were reported from the Late Jurassic of Russia (Rasnitsyn 1992) and Middle Jurassic of China (Vršanský et al. 2010), and accordingly knowledge of these enigmatic insects has been extremely limited. They were widely considered as ectoparasites on pterosaurs or feathered dinosaurs based on the putative presence of piercing and sucking mouthparts and hind tibio-basitarsal pincers purportedly used to fix onto the host's hairs or feathers (Rasnitsyn 1992; Vršanský et al. 2010; Labandeira 2002;. Grimaldi & Engel 2005; Gao et al. 2012; Poinar 2012). While definitive Middle Jurassic ectoparasites (fleas) on vertebrates were recently reported from the Daohugou outcrops (Gao et al. 2012; Huang et al. 2012), earlier speculation regarding strashilids as terrestrial ectoparasites can be rejected by an alternative hypothesis stemming from the discovery of hitherto unknown large membranous wings and females of *Strashila*, in two cases preserved *in copula*.

Male: head prognathous; a pair of large ovate compound eyes located anterior-dorsally on head, with nearly one hundred hexagonal facets visible; two dorsal ocelli present; antenna relatively short, three-segmented, scape and pedicel large, flagellum apparently composed of an elongate basal section and the rest annulated section subdivided into circa 10 subsegments; mouthparts reduced, with a small labellum; thorax always apterous; fore wing very large (7.0 mm long, 3.1 mm wide), membranous, armed with numerous long marginal setae, veins faint and strongly reduced; coxae large, separated; trochanter relatively elongate, fused with femur; fore and mid legs homonomous, tarsi five-segmented, slender, basitarsus long, bearing a row of small denticles on inner side and apex, second tarsomere obliquely inserted; a pair of small pretarsal claws present, strongly curved, sharply pointed; hind legs specialized as large chelas, femur and tibia huge, tibial process powerful, basitarsus largest, slightly tapered, forming a chela with tibial process; abdomen cylindrical, with nine visible sternites, sternites 1−7 associated with a pair of lateral appendages, interpreted as vestigial gill; tracheal system formed by two main longitudinal latero-dorsal trunks on both sides, with transverse connectives between them forming segmentary loops, and with spiracles branching on them; terminalia directed dorsally, tergite VIII armed with a rounded antero-lateral processes; male genitalia with a pair of separate elongate gonocoxites articulated on postero-lateral side of tergite IX, and bearing a distinct one-segmented gonostylus with apical relatively rectilinear hook.

Female: cephalic structure of female same as male; tibia much thinner than male, basitarsus armed with a few small apical denticles, second tarsomere inserted on first in typical orientation; abdominal segmentation poorly visible, segment VIII prominent, as long as wide, tergite IX transverse; female genitalia small as a cerci-like structure.

The new analyze on morphology of strashilids from Daohugou, revealing dramatically different conclusions, namely strashilids are highly specialized flies (Diptera), bearing large membranous wings, with significant sexual dimorphism of the hind legs and abdominal extensions. Their attribution to an extinct order Vršanský et al. 2010) is unsupported, and the lineage being synonymized with the true flies. Strashilids resemble in major morphological and behavioural features the Recent, relict, aquatic fly family Nymphomyiidae. Their ontogeny is distinguished by the persistence in adult males of larval abdominal respiratory gills, representing a unique case of paedomorphism among endopterygote insects. Adult strashilids were likely aquatic or amphibious (Huang et al. 2013), shedding their wings after emergence and mating in the water.

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Twisting pathways of the Hemiptera evolution

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The Hemiptera is the insect order of the Paraneoptera lineage. Classification of Hemiptera reached the modern stage through a long way of evolutionary (sometimes revolutionary) changes. The Hemiptera subdivides into six suborders: Paleorrhyncha, Sternorrhyncha, Fulgoromorpha, Cicadomorpha, Coleorrhyncha and Heteroptera, with nearly 290 recognized extinct and extant families. The synapomorphies of the Hemiptera are: mouthparts developed into suctorial beak, with two pairs of mandibular and maxillary stylets lying in a long, grooved labium; maxillary; labial palps lost; wing with vein ScP fused with vein RA distally and vein MA fused with RP.

The origins of the Hemiptera must be searched in the Carboniferous plexus together with the early Psocodea and Thripida, as is suggested also by molecular data. The scarce Carboniferous fossils which could be related to early Hemiptera need more attention. The first doubtless Hemiptera comes from the Permian. These are represented by paraphyletic assemblage grouped as family 'Archescytinidae' within suborder Paleorrhyncha. Believed to be ancestral for the other hemipterans, 'Archescytinidae' seems to be however quite specialized, especially regarding the structure of the head and ovipositor. Together with the last Archescytinidae, in the late Permian, the rich and diverse Sternorrhyncha and Cicadomorpha, and not numerous Fulgoromorpha are present. This suggests much earlier drifting apart of major hemipteran lineages, representing different morphological traits. Permo-Triassic extinction event wiped out some groups and 'skewed' the evolutionary traits of the others. Within the Sternorrhyncha the Protopsyllididae survived, the fossils of stem-group Aphidomorpha are known since the Middle Triassic, but the primary radiation of the Coccidomorpha remained concealed. Some Permian groups of Cicadomorpha became extinct, the others evolved rapidly during the Triassic, presenting high variability and morphological disparity. The Triassic brought the important shift in the feeding behavior of the Hemiptera – at this time one of the specialized lineages of the Cicadomorpha became scavenging and predatory, and transform into the Heteroptera, in the beginning semiaquatic and aquatic ones. It must be pointed that this shift was very probably related with neoteny. At the same time, the other cicadomorphan lineage gave rise to early Coleorrhyncha. The other cicadomorpha group shifted from phloem-feeding to xylem-feeding. The other environmental and biotic challenges led to complications in life cycles and development of distinct sexual dimorphism in sternorrhynchous lineages. The development of new evolutionary traits is observed in all hemipteran lineages in the Jurassic and early Cretaceous, as response to new life conditions. The Mid Cretaceous Terrestrial Revolution affected all lineages of the Hemiptera. Some of them became extinct, e.g. Palaeontinidae, a lot of new families appeared, for shorter or longer time, also new types of nymphs, free-living and jumping appeared among Clypeata cicadomorphans and Fulgoromorpha. Post-crisis times seem to be the source of recent diversity of the Hemiptera. The subsequent climatic, environmental and biotic changes during the Palaeogene and Neogene resulted in high rate of diversification and specialization among surviving hemipteran lineages.

The long, twisted and complicated evolutionary history of the Hemiptera lineages is the source of obstacles in reconstructions and understanding of their relationships.

Digital palaeoentomology: WTF?

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The technologies change faster than we can adopt them. Does it mean we have to be conservative and stick to the ways we have always worked? I think not. Today we have a unique opportunity to create and integrated research environment. This includes open access to datasets and publications, community driven taxonomic databases integrated with publication tools, modern research instruments and social networking.

Microorganisms in amber and their use in understanding terrestrial palaeoecosystems

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The discovery of amber inclusions is important for tracing the evolutionary history of lineages with otherwise poor fossil records through time, and also for elucidating the diversity of terrestrial palaeoecosystems. Preservation in amber is renowned for its microscopic fidelity, including cells and organelles. This sometimes excellent preservation at cellular and ultrastructural level is not restricted to inclusions of arthropods and plants. Even minute soft-bodied microorganisms are preserved in great detail and they occur in virtually all fossil resins, from the Triassic to the Miocene. The variety of microorganisms preserved in ambers ranges from micrometre-sized prokaryotic cells and minute unicellular eukaryotes to filamentous algae, extensive fungal mycelia and mushrooms reaching several millimetres in size. Thus, ambers provide unique windows to the state of evolution of microbial communities in the Triassic, Cretaceous and Eocene to Miocene. Numerous amber occurrences in the Cretaceous provide global access to microbiocoenoses during a time with massive changes of terrestrial ecosystems in the course of angiosperm evolution and the replacement of gymnosperm-dominated forests. Study of microinclusions in amber may significantly contribute to understanding these changes in Cretaceous forests since amber preserved microbial communities from the forest floor (including mycorrhizae) as well as those from tree bark and from the canopy. Evaluation of microorganisms preserved in amber contradicts previous notion of a general 'evolutionary stasis' in microbial coenoses since the Cretaceous. Recent studies rather reveal that some lineages are more stable in their morphology than others and that the composition of the microcoenoses has changed since the Mesozoic. Some important and abundant modern groups of microorganisms are obviously absent until the Early Cretaceous in non-marine habitats. For example, there is no record of Homobasidiomycetes before angiosperms occur. Diatoms are not recorded before the Maastrichtian from non-marine habitats and limnetic siliceous testate amoebae are unknown until the Eocene. This indicates that Mesozoic microcoenoses were distinguished from Paleogene ones by their composition of main groups of organisms as well as by their trophic interactions. By reviewing the fossil record of microorganisms in amber, it is obvious that some microfossils are much more common than others. Bacterial and fungal inclusions, for example, are among the most abundant microinclusions in ambers whereas terrestrial and aquatic unicellular eukaryotes are exceedingly rare. This phenomenon is due to the

ability of some bacteria and fungi to continue growing inside liquid resin after embedding which predestines them for abundant preservation in amber. Some representatives of the Mycocaliciales (Ascomycota) are even exclusively found growing on resins and other plant exudates. Despite the abundance of fungal inclusions in any amber, the vast majority of these fossils remains undeterminable due to the absence of diagnostic features in sterile mycelia. Exceptions are rare morphologically determinable anamorphic and teleomorphic stages of the Ascomycota and Basidiomycota. These relatively few fossils, however, provide valuable calibration points for molecular phylogenies of extant lineages and allow the estimation of the whole Phanerozoic history of the respective lineages.

Abstracts of oral presentations

Boring beetles are not necessarily dull

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Today, ommatine beetles are a rare and relict basal group associated with wood and found in Australia (*Omma* Newman) and South America (*Tetraphalerus* Waterhouse) if the tetraphalerines are included. They appear to have been more diverse in the mid-Mesozoic with well-preserved compressions and impressions from the volcanic lakes of northeastern China and other localities (such as in the lithographic limestones of Spain). Disarticulated remains are also widespread as in the Purbeck-Wealden of southern England and early Jurassic of Western Australia. The fossil fauna includes the extinct genus *Cionocoleus* Ren, considered to be related to *Omma* (an ommatin), and *Brochocoleus* Hong, representing a more basal tribe, the brochocoleins. Both genera are reported from the northern hemisphere (Eurasia). Another extinct tribe, the notocupedins, is more extensive including *Notocupes* Ponomarenko and the 'form genus' *Zygadenia* Handlirsch in both northern and southern hemispheres. *Zygadenia* elytra from the Wealden preserve colour patterns and comparison with *Omma* suggests that some were cryptic whereas others were mimetically aposematic.

Figure 1. *Cionocoleus jepsoni* Jarzembowski et al., elytron, fluvio-lagoonal Purbeck Limestone Group, southern England (left); *Cionocoleus magicus* Ren, impression, volcano-lacustrine Yixian Formation, northeastern China (right).

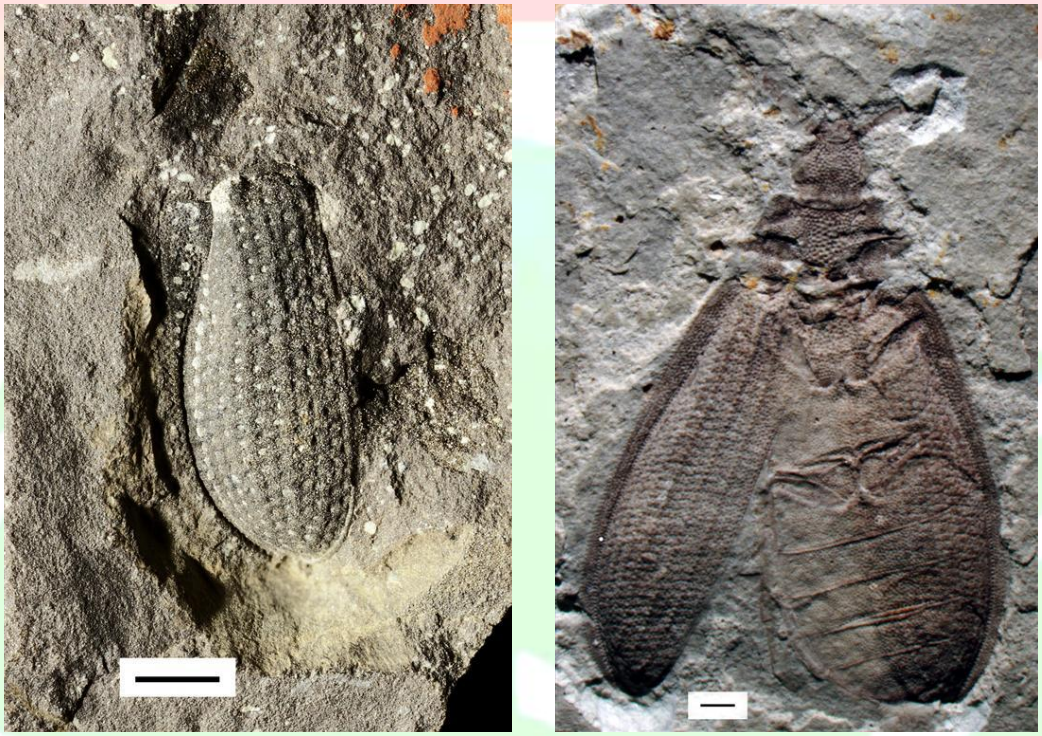

Figure 2. *Brochocoleus tobini* Jarzembowski et al., fluvio-lagoonal Weald Clay Group, southern England (left); *Brochocoleus impressus* (Ren), Yixian Formation, China (right).

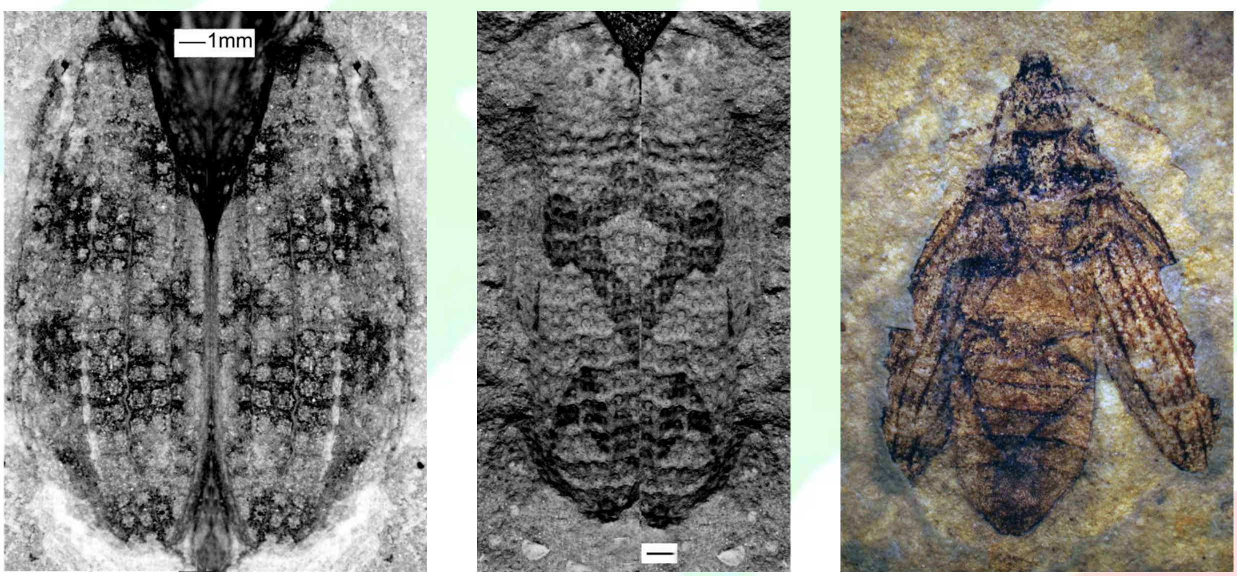

Figure 3. *Zygadenia* patterned elytra, Weald Clay Group (left, centre); *Notocupes* Yixian Formation, China (right).

Mesozoic rove beetles from northeastern China (Coleoptera: Staphylinidae)

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With over 58,000 described species placed in 32 extant subfamilies, the beetle family Staphylinidae is the largest beetle family in animal kindom and occurs worldwide. Recntly described Mesozoic fossils from northeastrn China, including more than 500 impression fossils from the Middle Jurassic Daohugou biota (Jiulongshan Formation at Daohugou, Ningcheng County, Inner Mongolia; ~165 Ma), the Early Cretaceous Jehol biota (Huangbanjigou and Liutiaogou of Beipiao City, Liaoning Province and Ningcheng County, Inner Mongolia, respectively; ~125 Ma), and the Lower Cretaceous Lushanfen Formation (western Beijing), represent 11 extant subfamilies. Of them, six subfamilies (Apateticinae, Glypholomatinae, Olisthaerinae, Omaliinae, Tachyporinae and Trigonurinae) are known from the Daohugou biota; six subfamilies (Aleocharinae, Omaliinae, Oxyporinae, Oxytelinae, Staphylininae and Tachyporinae) from the Jehol biota; and three subfanilies (Megalopsidiinae, Oxytelinae and Staphylininae) from Lushangfen Formation. More importantly, Apateticinae, Glypholomatinae and Megalopsidiinae stand for the first fossil record in the world; Aleocharinae, Tachyporinae (from Daohugou) and Trigonurinae represent the oldest fossil record for the subfamily. The findings suggest that some now narrowly distributed groups were much more widespread than previously thought. These fossils contribute significantly to understanding the origin and early evolution of some staphylinid subfamilies.

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First record of Eulichadidae from the Jurassic of China and the early radiation of Elateriformia (Coleoptera)

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The small recent coleopteran family Eulichadidae comprises large, strongly patterned beetles most of which are found in eastern Asia and some in North America. The phylogenetic relationship of the Eulichadidae with the rest of the Elateriformia families has been debated for the past one hundred years since they were first described. It is believed that the first eulichadids originated in the early Jurassic, branching from the Superfamily Byrrhoidea, and the rest of the Elateriformia and thus occupy a somewhat intermediate position, but there no reliable proof of this so far.

Modern Eulichadidae cluster with a number of elateriform families: Callirhipidae, Psephenidae, Cneoglossidae, Chelonariidae and Ptylodactylidae and therefore have very specific diagnostic features which are almost always missing in the fossil material. Recent collecting by the authors produced two complete specimens belonging to one species from the Middle Jurassic lake deposits of Daohugou in northeastern China possessing all major morphological characters of Eulichadidae. All eulichadid beetles are distinguished by the mandibular shape with tapered scoop-like apex, well-defined molar area and prostheca, together with a weakly developed frontoclypeal head suture; all these characters are clearly visible on fossils from Daohugou, together with longitudinally punctate elytral rows with peculiar and contrasting transverse hairy stripes. The new finds, however, differ from other eulichadid genera *Eulichas* and *Stenocolus* in having a mesoventrite with an undeveloped median pit and therefore a weak pro-mesoventrite interlocking mechanism, and should be assigned to a new genus.

Finds of Eulichadidae in Daohugou prove their contemporary existence with the family Lasiosynidae whose representatives are very abundant at the same locality and supposed to be the closest relatives of Eulichadidae~~,~~ but have more plesiomorphic characters, such as fully developed head sutures, elytra with striae, and wide, rectangular columellae; thus their divergence is much earlier.

Early Pennsylvanian Odonatoptera from the Xiaheyan locality (Ningxia, China): new material, taxa, and perspectives

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The odonatopteran fauna from the Xiaheyan locality (Ningxia, China; Early Pennsylvanian) is reviewed, including several taxonomic and nomenclatural adjustments. The species *Shenzhousia qilianshanensis* Zhang & Hong, 2006 in Zhang et al. (2006), *Oligotypus huangheensis* (Ren et al., 2008), *Tupus orientalis* (Zhang, Hong & Su, 2012 in Su et al. (2012)), and *Erasipterella jini* (Zhang, Hong & Su, 2012 in Su et al. (2012)) are re-described based on abundant material. In addition the new species *Aseripterella sinensis* n. gen. et sp. and *Sylphalula laliquei* n. gen. et sp. are described. The 'strong oblique distal' cross-vein, located in the area between RA and RP is found to occur more extensively than previously expected. It is believed to be a structure distinct from the subnodal cross-vein, and therefore deserves to be referred to by a distinct name (viz. 'postsubnodal cross-vein'). Odonatoptera from the Xiaheyan locality cover a broad range of sizes. Factors that could have promoted the evolution of large-sized Odonatoptera are briefly reviewed. The permissive conditions prevailing during the Pennsylvanian, and the existence of an elaborated food web, are emphasized as putative positive factors. The new taxonomic treatment suggests that genera documented in the Lower Permian, such as *Shenzhousia* and *Oligotypus*, stem from the early Pennsylvanian, and implies a high resilience of these taxa when facing the Pennsylvanian–Permian environmental perturbations.

The appearance of beetles in the suborders Polyphaga and Adephaga in the geological record

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Until recently, it was believed that the advanced beetle suborders Polyphaga and Adephaga appeared in the geological record only at the end of the Triassic. At the present time, the study of numerous localities around the Permian-Triassic boundary shows that this assertion was wrong and these beetles had already appeared by the end of the Permian. Some rather complete specimens were found which allows us to attribute them to these suborders. They are from a series of localities, separated by short time gaps, which also let us reconstruct a sequence of evolutionary events during this time interval, on the basis of the most abundant beetle remains - isolated elytra.

The most ancient locality, from which beetles probably related to these suborders are known, is the Yinping locality in the south of China. The age of this locality is estimated as Upper Capitanian. In this locality, a beetle belonging to the Polyphaga, or their closest ancestors, was found and a beetle very similar to Hydroadephaga. There are no such beetles in European Russian and Siberian localities of the same age; they appear only in the Upper Vyatkian and Erynakovian deposits, which are usually believed to be of the same age as the Changxingian. The assumption could be made that higher beetles have a southern hemispheric origination, as many contemporaneous tetrapods.

In both the terminal Permian deposits of European Russia and intertrappean deposits of Siberia, Polyphaga are dominant and cupedoid Archostemata are not found at all. Thus in the Babiy Kamen` locality in the Kuznetsk Basin with 78 specimens, there are approximately 25 species, among which are Ademosynidae, Schizophoridae, Triaplidae, Trachypachidae, possible Haliploidea, Staphylinoidea, Elateroidea, Hydrophilidae and Byrrhidae. In the intertappean deposits of the Tungus Basin were found more than 300 beetle specimens, represented by Ademosynidae, Schizophoridae, Triaplidae, Trachypachidae, possible Myxophaga, Elateroidea, Hydrophiloidae and Byrrhidae. The latter was also found in the Mongolian locality of Yaman Us, which is of similar age.

Tuzoia: large bivalved arthropods from Cambrian of China

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Tuzoia, a kind of large bivalved arthropods have been world-widely described from the Cambrian. Their soft parts are poorly known. The carapace characterized by a straight hinge line, a reticulate pattern on the surface, a lateral ridge bearing a spiny frill, and various spines around the margin. They are important contents for the Cambrian Guanshan fauna with at least three different forms, *Tuzoia sinensis*, *T. tylodesa*, and an undescribed new species. In recent years, the distribution of *T. sinensis* has been widely discovered from several Cambrian localities of the Mantou Formation at North China such as Liaoning, Shandong, Henan, and Hebei provinces. The appearance of *Tuzoia* may serve as a pointer for searching the Burgess-shale type fauna in North China platform due to its relatively highly mineralized carapace. The newly discovered bivalved arthropod from the early Cambrian Chengjiang fauna display the valves armed with a lateral ridge, with smooth surface, and poorly developed marginal spines. It is probably a pioneer representative of *Tuzoia* and relatively resembles the undescribed new type of *Tuzoia* from the Guanshan fauna.

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Conundrum of 'Cixiidae-like' planthoppers (Hemiptera: Fulgoromorpha)

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The early planthoppers were not very diverse and they are currently grouped within a two families Coleoscytidae (Permian) and Surijokocixiidae (Permian-Triassic). For the Jurassic times two families are currently recognized Qiyangiricaniidae and 'Fulgoridiidae', the latter is paraphyletic and in need of urgent revision. Together with number of extinct and recent families these are grouped in superfamily Fulgoroidea. The group of families believed to be 'basal' among the Fulgoroidea was given the informal name as 'Cixiidae-like' families. The name was derived from the common (but not strictly justified) opinion that Cixiidae are the most ancient group of still present planthoppers.

This view is under question – Cixiidae appears to be paraphyletic, similarly as most of the families grouped within 'Cixiidae-like' group. The range and limits of the oldest family placed in this group, i.e. Jurassic 'Fulgoridiidae' are not clear. There are at least three distinct morphological groups within 'Fulgoridiidae', but the knowledge of this group is very far from complete. The recent families Kinnaridae and Meenoplidae were postulated to be put together within a single family. The monophyly of Cixiidae is challenged by molecular and morphological studies. The placement of Delphacidae, the family believed as sister-group of Cixiidae, within the 'Cixiidae-like' group seems to be well substantiated, but the relationships with Cixiidae, and other families placed in the group are not resolved. Another group of families postulated to be placed in 'Cixiidae-like' are Achilidae, Achilixiidae and Derbidae. The relationships within this group of families are still under debate, and their placement in the 'Cixiidae-like' group also could be challenged. Regarding the fossil record, the oldest crown-group Cixiidae are known from the Palaeocene, the oldest Delphacidae from the Eocene, Achilidae from the early Cretaceous, crown group Derbidae from the Eocene. Together with these, the early Cretaceous fossils placed in stem-group Cixiidae and a number of the others are known. These are representatives of Cretaceous families: Lalacidae, Mimarachnidae, Perforissidae, Neazoniidae, and a few, deserving familial status, fossil groups from the Cretaceous and Palaeogene. Interestingly, the high morphological disparity of the Cretaceous "Cixiidae-like' groups seems to be a result of Cretaceous Terrestrial Revolution. Mid-Cretaceous is regarded as a period of environmental change and biotic crisis. The new biotic and environmental challenges and opportunities were responsible for triggering rapid diversification of the Cretaceous planthoppers. The early Eocene extinct family discovered in France, probably was the last remnant of Cretaceous explosive radiation of ‘Cixiidae-like’ planthoppers. The results of these (r)evolutionary processes hinder the understanding of ‘Cixiidae-like’ groups.

The new findings give a unique chance to provide new insights into evolution and relationships of the group, allowing to test and/or complete hypotheses only based on recent forms. Re-exploration of the basal evolution of the group with a comparative analysis of characters shared by all ‘Cixiidae-like’ groups is necessary.

Review of Early Cretaceous insect faunas from China

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Abundant insects were described from the Lower Cretaceous of China during the past 30 years, but few studies are focused on their geological settings, especially the definite geological ages. Herein we reviewed these Early Cretaceous insect-bearing localities, and presented the updated geological ages of these fossil layers based on isotopic dating results and stratigraphic investigations. The most famous fossil insect assemblage in China is the Jehol insect fauna, occurring in 3 horizons: the Dabeigou Formation (ca. 135–130 Ma; late Valanginian–Hauterivian), the Yixian Formation (ca. 130–122 Ma; Barremian–early Aptian), and the lower Jiufotang Formation (ca. 122–?120 Ma; middle Aptian). These insects are mainly recorded from southern Inner Mongolia Autonomous Region, northern Hebei and western Liaoning provinces.

The Jiuquan Basin in Gansu Province of northwestern China also yields abundant Early Cretaceous insects. The deposits are divided into three formations: 1 Chijinpu (Chijinbao) Formation (early Aptian); 2 Xiagou Formation (late Aptian or late Aptian–early Albian); 3 Zhonggou Formation (Albian). Earlier insect collections were mainly from the Chijinpu Formation, represented by abundant *Ephemeropsis trisetalis* Eichwald. Very recently, plenty of fossil insects from the Zhonggou Formation have been collected, including caddisfly cases, adults of dragonfly (probably *Hemeroscopus baissicus* Pritykina), and *Coptoclava* larvae. The Laiyang Formation in eastern Shandong Province preserves plenty of *Mesolygaeus laiyangensis* Ping and *Coptoclava longipoda* Ping, and its geological age equals to that of the Jiufotang Formation (middle Aptian). The Lushangfen Formation in western Beijing City is the late Aptian–early Albian in geological age. The Dalazi Formation (Albian) in eastern Jilin Province yields many angiosperm fossils and abundant *Coptoclava* sp., which is bigger than the typical *Coptoclava longipoda*. Only two Early Cretaceous formations in South China yield plenty of insects. The Shouchang Formation in western Zhejiang Province yields abundant Coptoclavidae, and its age is probably same as that of the Yixian Formation. The other is the Shixi Formation in in eastern Jiangxi Province. Its geological age remains unclear, and is probably slightly younger than that of the Yixian Formation.

Impressions and carbonaceous compressions occur in all fossil insect deposits included in this study. Pyritized insect fossils were observed for the first time within lacustrine deposits with volcanogenic sediments (the Dabeigou and Yixian formations).

These insect faunas, almost spanning the entire Early Cretaceous (from Valanginian to Albian), provide important windows to understand the macroevolutionary history of insects and to explore the co-evolutionary process between insects and flowering plants.

Fossil Perspectives on the Evolution of Insect Diversity

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A key contribution of palaeontology has been the elucidation of macroevolutionary patterns and processes through deep time, with fossils providing the only direct temporal evidence of how life has responded to a variety of forces. Thus, palaeontology may provide important information on the extinction crisis facing the biosphere today, and its likely consequences.

Hexapods comprise over 50% of described species. Explaining why this group dominates terrestrial biodiversity is a major challenge. We present a new dataset of hexapod fossil family ranges compiled from published literature up to the end of 2009. Between four and five hundred families have been added to the hexapod fossil record since previous compilations were published in the early 1990s. Despite this, the broad pattern of described richness through time remains similar, with described richness increasing steadily through geological history and a shift in dominant taxa after the Palaeozoic. However, after detrending, described richness is not well correlated with the earlier datasets, indicating significant changes in shorter term patterns. Corrections for rock record and sampling effort change some of the patterns seen. The adjusted time series identify several features of the fossil record of insects as possible artefacts, such as high Carboniferous richness, a Cretaceous plateau, and a late Eocene jump in richness. Other features seem more robust, such as a Permian rise and peak, high turnover at the end of the Permian, and a Late Jurassic rise.

The growth rate of hexapod family richness appears to have significantly slowed through time, and short term increases in hexapod richness, after adjustment for sampling bias, tend to reduce future origination, consistent with density-dependent processes. Increases in plant family richness are associated with higher hexapod extinction and lower family richness. Several potential abiotic drivers are identified, though the important drivers are different before and after adjusting for sampling bias in the hexapod record. In unadjusted data, higher richness is associated with periods of low temperature, high atmospheric oxygen concentrations, and seas rich in organic nutrients, whilst after adjusting for sampling bias, high richness is associated with high sea levels, and high marine productivity.

Tests on the origination and extinction rates of subgroups of hexapods suggest that the origin of wings represented a major macroevolutionary event, which led to greater faunal turnover. The Holometabola have achieved their present high family richness not by great increases in the average rates of origination but by a significant decrease in extinction rates relative to their sister clade, the Paraneoptera.

Tracing affinities of ice crawlers, stoneflies, earwigs and webspinners

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A destiny, privilege, and burden of a paleontologist is to trace biodiversity into depth of the fossil record. The main input of paleontology into taxonomy and phylogeny occurs due to tracing affinities of taxa when we follow lacunas (hiatuses) in diversity of the character and in this way we outline taxa and their interconnections. Following this approach and seeking for synapomorphies of the resulted taxa, we gain information about ancestry of the extant insect orders of debatable affinities and obtained some significant results. Among these, the living ice crawlers (Grylloblattidae) are found traceable down toward the Carboniferous Eoblattidae via extinct Blattogryllidae – Megakhosaridae – Daldubidae – Cacurgidae. Similarly, the Permian stoneflies show clear transition to Tillyardembiidae and further to the Carboniferous Spanioderidae. The living earwigs have been reliably connected to the Jurassic Protodiplatidae by Vishniakova (1980): we can trace them deeper in time toward the Permian Bardacoleidae and further, via a new family (in press) and Tillyardembiidae, to Spanioderidae, that is, toward the common root with stoneflies. The least advanced living webspinners (Clothodidae) and their Jurassic precursors Sinembiidae show distinct venational synapomorphies to the Early Permian *Ideliopsis* Carpenter (Cacurgidae) which indicates a further transition toward Eoblattidae via Carboniferous *Cacurgus* Handlirsh from same family as *Ideliopsis*. This forms a common ancestry with Grylloblattidae. However, this inference is not unquestionable, for the order Grylloblattida is putatively synapomorphic in having pterothoracic segments bearing the midsternal suture, which is absent from the webspinners. The contradiction revealed needs further research to be resolved.

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Fossils and phylogeny of Staphylinidae, the largest group of organisms

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With more than 58,000 described species, the rove beetles (Coleoptera: Staphylinidae) comprise the largest, presumably monophyletic family of organisms that is abundant or predominant in most of the cryptic terrestrial habitats. Comprehension of such hyperdiversity in contemporary and historical perspectives requires an ability to trace the rove beetle "tree of life" from tens of thousands of its uppermost branches (recent species) down to its root (a hypothetical common ancestor). Most of the notable attempts to do so were based on the examination of recent species only. However, given a relatively old age (Late Triassic) and deduced high rate of extinction for some lineages of the family, it is impossible to grasp a phylogenetic signal without some consideration of those extinct taxa. As a result, we are still lacking an adequate phylogenetic scheme for the family as a whole. Very recent impressive advances in the study of the fossil record for Staphylinidae on the one hand, and in the development of methods for the phylogenetic analysis on the other hand, open new opportunities for a breakthrough in the subject. A new level of understanding of the rove beetle evolution, and thus a robust base for their systematics, can be achieved by combining all newly available data (morphology of recent and fossil species, DNA sequences of recent species) in one comprehensive analysis. The talk reviews these recent descriptive and methodological advances, targets the most critical issues of the Staphylinidae phylogeny to be resolved, and outlines a future research program aiming a time-calibrated tree of life for rove beetles.

Analysis of cockroach wing areas

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Variability of studied fossil and living cockroaches shown independence of forewing areas on number of veins. Variability of forewings areas was also much higher and less stable than vein number. In contrast, the average number of veins among studied species correlates with the average areas, which is not reflected in the variability trends. Study of insect areas and their variability as informative source of data should thus become comprised in descriptions.

The tribe *Leuctrini* stat. n. and the taxon *Leuctraptera* tax. n. erected to accommodate a fossil stonefly

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A new fossil stonefly specimen is described based on a single specimen from Hrútagil (Mókollsdalur, Iceland; Skarðsströnd-Mókollsdalur Formation; Tortonian, Miocene, 8-9 Myo). In hind wing, the occurrence of a fusion of MP with CuA (through the mp-cua cross-vein) indicates close relationships with a number of extant genera belonging to the Leuctrinae, including *Leuctra* Stephens, 1835, *Despaxia* Ricker, 1943, and *Moselia* Ricker, 1943, among others (as opposed to plesiotypic condition, viz. absence of fusion, observed in species of the Leuctrinae genera *Perlomyia* Banks, 1906, *Paraleuctra* Hanson, 1941, and *Zealeuctra* Ricker, 1952, among others). Further investigations of the affinities of the fossil specimen are impeded by a lack of data on the morphology of its genitalia. Two nomenclatural approaches are applied to accommodate this specimen. Under the ICZN-governed approach, the specimen is assigned to the tribe *Leuctrini* stat. n., and the corresponding species can be referred to as 'gen. and sp. indet.', which provides no indication on its affinities. Under the cladotypic approach, the specimen is assigned to the taxon *Leuctraptera* tax. n., itself defined based on the occurrence of the MP + CuA fusion; the corresponding species can be referred to as '*Leuctraptera* sp.'. This case exemplifies the advantages of combinations including taxonomic addresses and Lanham's species names (i.e. from which the genus rank is expelled) in terms of information retrieval, in particular for fossil material belonging to stem-groups.

A new Early Triassic fossil insect locality from Western Australia

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A recent investigation within the northern Perth Basin of Western Australia has revealed a new Early Triassic fossil locality within the uppermost Permian to Middle Triassic Kockatea Shale.

The fossiliferous horizon consists of pale mudstone to fine-grained sandstone. Although the outcrops sit directly on basement, they are correlated to the middle part of the Kockatea Shale as seen in petroleum wells further south in the basin. In these same wells, the middle section of the formation was identified as within the *K. saeptatus* spore-pollen zone of Dolby & Balme (1976), which has long been considered indicative of the early Olenekian in Western Australia. Elsewhere in the region, exposures of the Kockatea Shale have yielded a lower Olenekian (Smithian) fauna, including ammonoids, nautiloids, and bivalves (Skwarko & Kummel 1974). More recently, late Changhsingian and early Olenekian conodonts were recovered from the unit (Metcalfe et al. 2008). Work is presently underway to directly date the new assemblage using ammonoids and spore-pollen from the fossil bed.

To date, work on the site has been preliminary, consisting of two short (one day each) fieldtrips in late 2012. All fossil material recovered from the site is presently housed and managed at the School of Earth and Environment, University of Western Australia, Perth, although the collection will eventually be stored at the Western Australian Museum, Perth. Longer collection trips are planned for late 2013.

Despite this short history of investigation, a rich fossil assemblage has been recovered from the site, including ceratite ammonoids, bivalves, fish plates, foraminifera, megaspores, both complete and partial vertebrate jaws, and numerous arthropods. Spinicaudatans (‘conchostracans’) are the most commonly recovered arthropods to date, although crustaceans (?isopods) and insects (including a partial cockroach tegmen) have also been collected. Based on this fauna, the Kockatea Shale at this locality is interpreted as a marginal marine or lagoonal deposit.

Fossil conservation has proven a concern, with the horizon’s fine mudstone drying and flaking over time, eventually degrading the fossil material. During drying, ?gypsum also forms on the surface of the samples, and appears to hasten fossil destruction. A viable method of preserving these fossils has yet to be devised.

The Kockatea discovery is the second fossil insect site recorded from West Australia, following the Lower Jurassic Mintaja insect locality, also within the Perth Basin. The site is also the second Australian Lower Triassic insect find, after insect remains were found within coprolites in the Arcadia Formation of southeastern Queensland (Northwood 2005). The Kockatea arthropods are considered older than those from Arcadia, and it is hoped they will provide a unique and intriguing insight into faunal recovery following the Permian–Triassic mass extinction.

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The lacewing fauna from the Karatau locality (Upper Jurassic, Kazakhstan)

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Karatau is a common name for several outcrops of Karabastau formation along the Big Karatau mountain range in South Kazachstan. The age of Karabastau formation is Kimmeridgian to Oxfordian, Upper Jurassic. More than 18,000 fossil insect specimens were found in this locality, including about 550 lacewings. This makes Karatau the most important source of knowledge about Upper Jurassic Neuroptera among all known localities of this age. Karatau insects were buried in the deposits of the saline lake, and the size dispersion of Karatau lacewings (from small berothids with 3-mm wings to large kalligrammatids with 100-mm wings) demonstrates that there are presented nearly all Neuroptera, which inhabited the shores of this lake.

46 new species of Neuroptera were described from Karatau during the last 90 year, mainly in the works of Panfilov (1968, 1980), but a considerable part of the collection remains unstudied. Lacewings from Karatau belong to at least 15 families: Osmylopsychopidae and Brongniartiellidae, Berothidae, Limaiidae, Kalligrammatidae, Nymphidae, Osmylidae, Ithonidae, Polystoechotidae, Mesochrysopidae, Mantispidae, Rachiberothidae, Hemerobiidae, Panfiloviidae, Grammolingiidae (arranged in the order of decreasing). In addition, the presense of Coniopterygidae was mentioned by Meinander (1975). The dominant genus in Karatau is *Mesypochrysa* Martynov, 1927 (Limaiidae, the sister group of modern Chrysopidae): nearly 10% of all findings belong to it. *Mesypochrysa* had worldwide distribution during Middle Jurassic-Lower Cretaceous. Berothids, one of the most numerous group of Karatau lacewings, are the earliest known modern-like representatives of the family (other early Berothidae, excluding archaic *Sinosmylites* Hong, 1983, are known only from Lower Cretaceous). Mantispids are represented by the extinct subfamily Mesithoninae, which also were found in the Middle Jurassic (Daohugou, China) and in the Lower Cretaceous (Yixian formation, China and Baissa, Russia). The representatives of Kempininae, recent subfamily of Osmylidae, which now has a typical Gondwana distribution, is present in Karatau. This is one of the numerous examples of former widespread distributions of austral insects.

Lacewing fauna of Karatau most resembles lacewings of Daohugou (such genera as *Epiosmylus* Panfilov, 1980, *Jurakempynus* Wang et al., 2011, *Aristenymphes* Panfilov, 1980 (= *Protoaristenymphes* Nel et Henrotay, 1994) were found in both localities), but also related with lacewings from Solnhofen (Upper Jurassic, Germany).

Beetle Body fossils and new elytra from the Upper Permian of New South Wales

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Permian beetle body fossils tend to be rare, most descriptions in the literature being based upon elytra only. The Australian Museum collection from the Belmont Insect Bed contains a number of beetle body fossils, in addition to several which have been collected in recent years and are also deposited in the Museum. A few of the body fossils have attached elytra, so it has been possible to relate several bodies to known species. Other elytra attached specimens can be identified to family level, and are currently undecribed. New isolated elytra are also illustrated, extending the range of Upper Permian families in Australia from Permosynidae and Rhombocoleidae, to now include the other four known Upper Permian families Asiocoleidae, Permocupedidae, Taldycupedidae and Schizocoleidae.

Discovery of Palaeodictyoptera immature stages from sphero-sideritic concretions in Upper Carboniferous of Poland

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The extinct order Palaeodictyoptera represents a widely diverse and specialized group of Paleozoic insects and for a long time they were considered an oldest group of winged insects as *Delitzschala bitterfeldensis* from the early Late Carboniferous (early Namurian A). The palaeodictyopterid immature stages have been reported by number of authors as e.g., Carpenter and Richardson (1971), Sharov (1971), Kukalová-Peck (1978) and others from Upper Carboniferous deposits of Europe, North America, and Russia. Wootton (1972) provided hypothetical reconstructions of the immature wing venation of two larvae from UK (*Rochdalia parkeri* Woodward, 1913 and *Idioptilus onisciformis* Wootton, 1972), which, in his opinion, did not show adaptations to aquatic life. Our findings of several palaeodictyopteran nymphs from the Upper Silesian Coal Basin (Poland, Upper Carboniferous: Langsettian), as well as reexamination of the Wootton’s specimens, enabled us to provide further details on their morphology.

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Paoliida: new data on enigmatic Late Paleozoic insect group

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Paoliida is an insect group of highly controversial composition and equally controversial affinities. Herein we consider the Paoliida as an undisputed neopteran clade. Based on comprehensive reinvestigations we propose a new delimitation of the insect order Paoliida sensu nov. New diagnoses of order Paoliida and family Paoliidae are provided after re-examination of the type material. *Protoblattinopsis stubblefieldi* is reinterpreted as a hind wing having highly specialized cubito-anal structures functionally analogous to the anal loop structure of the hind wing of the Mesozoic Isophlebioidea (Odonatoptera). Furthermore, a new paoliid taxon is described from the Upper Carboniferous (Langsettian) sphero-sideritic concretion of Poland supplementing the previous taxa from the Upper Silesian Coal Basin.

Paoliids display relatively high abundance with surprisingly low morphological diversity in comparison to the other groups of neopteran insects well diversified from the Duckmantian/Bolsovian (Pennsylvanian).

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The entomofauna of the Upper Carboniferous from the Souss Basin, Morocco

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The Upper Carboniferous fossil sites of El Menizla and Oued Issene formations are best known for the Souss Basin locality in the High Atlas Mountains, Morocco. These formations yield to a hundred of specimens, belonging to the order Blattoidea. The Souss Basin assemblage is similar to that described from Europe. The discovered entomofauna, especially that belonging to the family Spiloblattinidae, and more precisely to the species *Spiloblattina pygmaea* at this locality, indicates late Pennsylvanian (Stephanian B) age, and provides important information to better understanding the environmental change and biotic conditions that have occurred in the northern Gondwana continent by that time.

Trapping bias in sampling arthropods, including Mexican amber

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All entomological traps have a capturing bias, amber as a trap is not an exception. Amber is a complex entomological trap since its formation leads to the enclosure of organisms from various habitats. Thus, understanding the biases of the amber trap is of high relevance to establish statements about evolution of paleodiversity in tropical realms and reconstructions of former environments.

Within the framework of a DFG (German Research Foundation) project, the recent fauna from *Hymenaea courbaril L* and *Bursera simaruba* and the fossil fauna from *H. mexicana* are investigated. *Hymenaea courbaril* L is a canopy tree of tropical and subtropical forests, widely distributed from south Mexico, throughout the Caribbean region, to south-central Brazil. It is the closest related tree in Central America to *H. mexicana*, which is the origin plant of Mexican amber. The also resin producing tree *Bursera simaruba* is well distributed in mangrove forests. Three collection trips to a mangrove region located at the Pacific coast of southern Mexico were conducted. The specific site was chosen because floral composition, climate and geographic location are very similar to the former Mexican amber forest.

Aim of the present work is to answer key questions about taphonomic biases and filters of fossilization processes of the former faunas of the Miocene Mexican amber forest.

Additionally, the development of the arthropod diversity in the region is analyzed by comparison of the recent and fossil arthropod fauna from Chiapas, Mexico.

Palaeoenvironmental and palaeoecological implications from body fossils and ovipositions of Odonata from the Eocene of Patagonia, Argentina

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Odonata are beginning to be well recorded in the Eocene of Patagonia. They are represented by body fossils and traces. Ovipositions are recorded in Río Pichileufú (Lutetian: 47.7 Ma; Río Negro province) and Laguna del Hunco (Ypresian: 52.2 Ma; Chubut province), nymphs in Confluencia (Ypresian?; Río Negro), and adults (wings) in Laguna del Hunco. The absence of different stages in given localities could depend on different factors as environmental, taphonomical and/or sampling bias. Laguna del Hunco is well sampled and absence of nymphs seems to depend on taphonomical factors since there are other preimaginal aquatic inhabitants of the lake as Trichoptera nymph cases. Confluencia is not well sampled and adults could be absent due to a sampling bias. The nymphs of Confluencia indicate a water body with low flux of energy. Ovipositions in Laguna del Hunco and Río Pichileufú are made on terrestrial leaves of bushes and trees and have three different morphologies. Leaves are interpreted to be alive when oviposition was done as they show tissue reactions associated to the injuries. Wrinkled wings of LH are interpreted to be signals of predation probably by birds or mammals.

A New Technique for the Preparation of small-sized Amber Samples with Application to Mites

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Small preparations are necessary to receive high-resolution morphological data on minute amber inclusions like mites, tiny insects, pollen, fungi etc. For mites, observations from four to six sides are often necessary for an accurate identification and systematic description. The main difficulty of such preparation is that human hand is not precise enough for holding and manipulating minute objects. Miniaturization of tools and use of holders of different kinds is necessary. I am describing tools and protocol for routine preparation of voluminous (observable from more than two sides) amber samples of sub-millimeter size, including artificial resin embedding after vacuum treatment, trimming, grinding, and preparation for light microscopy under immersion oil. This protocol is being developed by myself and colleagues since the year 2009 and is successfully applied for preparing inclusions of mites from different kinds and ages of fossil resin. A review of received results in paleontology of amber mite inclusions is provided along with a discussion on the conservation problems raised by small size of pieces. Storage in water with thymol (preservative) is suggested, although long-time observation is yet needed to be conclusive.

New tools, new characters: the contribution of MNHN X-ray tomography CT Scan in the study of fossil hexapods

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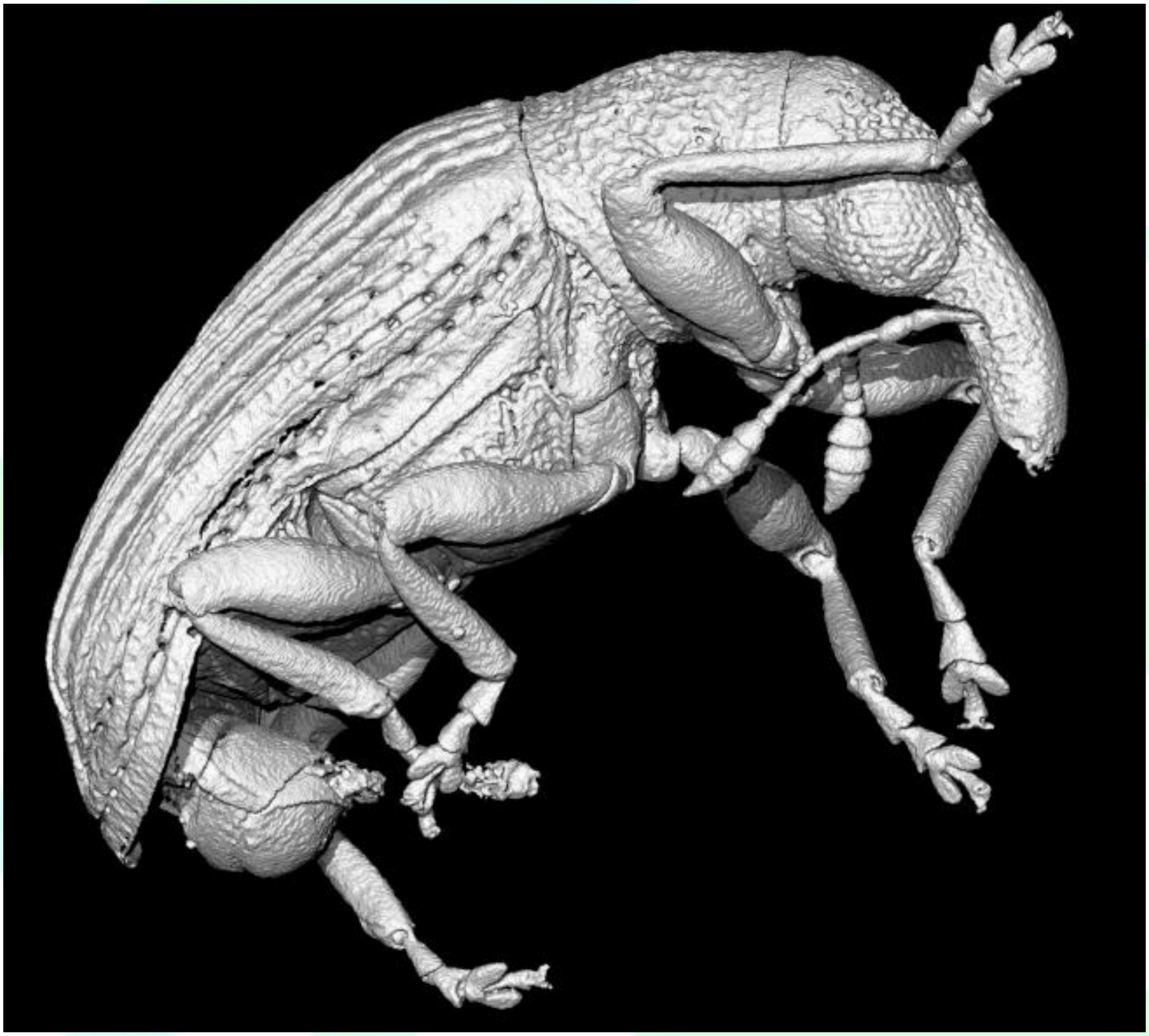
The Museum national d'Histoire naturelle, Paris, France, recently acquired a high-resolution CT scan, a v|tome|x L240-180 from GE Sensing and Inspection Technologies phoenix|x-ray, it consist of two interchangeable tubes, a X-Ray 240kV/320W microfocus directional tube, 1µm detail detectability, and a X-Ray 180KV/15W nanofocus transmission tube, 0.5µm detail detectability, as well as a movable detector formed by a 2024^2 pixels (200 microns pixel pitch) matrix, as a MNHN UMS 2700 AST-RX platform equipment, with unique performance capabilities and applications for the natural science field. We present some recent results of X-ray tomography analyses of fossil insects from the MNHN collections performed on this equipment, which represent technical and scientific challenges by the great variety of geological and taphonomic situations, viz. insect inclusions in Mesozoic and Cenozoic amber, to preserved in 3D epigenized 'mummies' from the Cretaceous Crato formation, or Carboniferous nodules from Montceau-les-Mines, etc. These results are compared to those obtained with more powerful tools such as synchrotron beamlines (ESRF, Soleil, Diamond, etc.). The compromise between accessibility, technical performances of AST-RX equipement and acquisition results, is a major breakthrough when searching new characters, necessary for robust phylogenetic reconstructions, dating, and palaeobiological studies including extant comparisons. It will allow important methodological advances in the field (non-invasive exploratory studies, screening of amber in its matrix, studies of syninclusions, etc.). Some further analyses will always need access to synchrotron light ('operational' definition equal to or less than one micron, difficult to obtain depending on the material with CT scan). CT scan analysis are a prerequisite for optimising the access to the very expensive synchrotron light beamlines, to get better performances for the paleoentomologists community.



Biting midges (Diptera, Ceratopogonidae) in the Late Eocene Rovno amber: syninclusions tell us about autecology and synecology in an ancient forest

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Sontag and Szadziewski (2011) consider fauna of biting midges as similar in Klesov and Gdansk Bay amber. Unlike their results, we have found ceratopogonid assemblages in various Late Eocene ambers to be nearly as different as those of ants (Dlussky & Rasnitsyn 2009). They are equally indicative of geographically different sources of the respective ambers. Most similar are biting midges in Rovno and Skandinavian amber, as the presence of *Leptoconops*, opulence of *Eohelea* and of *Meunierohelea* suggests*. Eohelea sinuosa* appears to be the most numerous species of biting midge in Rovno amber. We demonstrated that extinct Ceratopogonini with reduced plume (*Eohelea, Gedanohelea)* are found en masse as syninclusions of both males and females in one and the same piece of amber. As many as 63% of all Rovno amber *Eohelea* are found in the both-sexes syninclusions, and share of *Eohelea* and *Gedanohelea* is 3 times as high as that of all remaining Ceratopogonidae in such syninclusions. This suggests substrate mating of *Eohelea* and *Gedanohelea* unlike the air mating of the biting midges with plumose male antenna.

In the Late Eocene, *Leptoconops* is recorded in the Rovno and Danish ambers only. *L. rovnensis* Sontag & Szadziewski, 2011 has long cerci (Sontag & Szadziewski 2011) suggesting oviposition into saline sandy soil which evidently occurred adjacent the amber forests. Rovno amber is generally rather poor in aquatic insects comparing the Baltic one (Perkovsky et al. 2010a; Zelentsov et al. 2012), so the saline soil could be indicative of dry climate. Supporting this inference is the record of *Cryptophagus harenus* Lyubarsky & Perkovsky, 2012 from group unknown in the Baltic amber and now characteristic of steppes and deserts. The tribe Protomicroidini Antropov (Crabronidae), the highest ranked endemic taxon in Rovno, is close to Oxybelini, also characteristic of arid biotopes.

Co-occurrence of biting midges with other insects in syninclusions in Rovno amber sheds light on biocenotic structure of the amber forest. Some 2.5 thousand pieces of unselected Rovno amber are studied for their contents of syninclusia depending on amber piece weight class and taxonomic position of syninclusion components. Unlike previous publications (Perkovsky et al. 2010b, 2012), ceratopogonid components enter analysis as genera or genus groups rather than as an entire taxon. This approach changes the resulting pattern drastically, so as two previous correlative pleiades found to include biting midges, the air-plankton one and the '*Sciara* zone' dwellers, break into six parts depending on developmental environments (terrestrial saprotrophs vs. aquatic) and adult behavior (low level fliers and tree trunk visitors vs. air plankters and others who show no preference to tree trunks). A central pleiad embraces *Eohelea, Gedanohelea, Fossihelea, Meunierohelea*, *Forcipomyia*, Mycetophilidae and Cecidomyiidae. Male *Forcipomyia* visit flowers for nectar, and the same is known for females *Cacaohelea* Wirth & Grogan, 1988 with a distinctive patch of microtrichia on wing similar to that characteristic of extinct *Eohelea* (Borkent & Picado, 2008).

The Dolichopodidae (Diptera): a highly diverse family in Baltic and other Tertiary ambers

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Although there are no reliable records of Dolichopodidae from the Cretaceous, the family displays notable diversity in Baltic and other Tertiary ambers. Further, a molecular phylogeny suggests the family underwent explosive radiation in the early Tertiary, which lends additional support to its apparent absence in the Mesozoic. The Dolichopodidae are one of the most abundant and diverse families in Baltic amber. I have seen some 4000 inclusions, from both institutional holdings and outstanding private collections for a taxonomic revision nearing completion. The fauna will comprise some 150 species in 32 genera (some 120 species and 22 genera to be newly described). Although many recent subfamilies and genera are present, there are many new and often enigmatic taxa. The Baltic amber fauna is reviewed and compared with those of other Tertiary ambers, notably the recently discovered Eocene Cambay amber from India, and the Miocene Dominican Republic and Chiapas faunas from the New World. Other topics include bioeographic links between various ambers, and between the Baltic and recent Australasian faunas. This talk will be illustrated with photographs of many striking dolichopodid inclusions.

Diptera in Baltic amber – the most frequent order within arthropod inclusions

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Diptera are the most frequent order of insects in Baltic amber, represented with 42-63% within arthropod inclusions. The diversity of flies and midges in amber thoroughly was documented (Loew 1861; Meunier1892-1923; Hennig 1937-1973) und catalogued (Evenhuis 1992). Actually Nematocera are recorded by 29 families: Tipulidae, Limoniidae, Cylindrotomidae, Pediciidae, Trichoceridae, Nymphomyiidae, Dixidae, Corethrellidae, Culicidae, Simuliidae, Ceratopogonidae, Chironomidae, Chaoboridae, Tanyderidae, Psychodidae, Scatopsidae, Ptychopteridae, Bibionidae, Hesperinidae, Anisopodidae, Mycetophilidae, Diadociidae, Ditomyiidae, Bolitophilidae, Keroplatidae, Lygistorrhinidae, Sciaridae, Rangomaramidae (unpublished) und Cecidomyiidae.

Brachycera are recorded by 60 families: Xylomyidae, Stratiomyidae, Xylophagidae**,** Rachiceridae, Rhagionidae, Athericidae, Tabanidae, Vermileonidae, Acroceridae, Bombyliidae, Mythicomyiidae, Therevidae, Apsilocephalidae, Scenopinidae (unpublished), Asilidae, Empididae, Hybotidae, Atelestidae, Dolichopodidae, Platypezidae, Opetiidae, Phoridae, Syrphidae und Pipunculidae; the section Acalyptratae is recorded by 34 families: Micropezidae, Pseudopomyzidae, Cypselosomatidae, Diopsidae, Psilidae, Megamerinidae, Conopidae, Pallopteridae, Lauxaniidae, Chamaemyiidae, Dryomyzidae, Sciomyzidae, Sepsidae, Natalimyzidae, Clusiidae, Acartophthalmidae, Odiniidae, Anthomyzidae, Aulacigastridae, Periscelididae, Neurochaetidae, Asteiidae, Carnidae, Milichiidae, Cryptochetidae, Chloropidae, Heleomyzidae, Proneottiophilidae, Chyromyiidae, Sphaeroceridae, Camillidae, Drosophilidae, Campichoetidae, Hoffeinsmyiidae. The placement of the latter in the system still is open.

The fossil record of the Calyptratae, omnipresent in the recent fauna, is extremely poor with one specimen in Anthomyiidae. Two families are considered to be extinct: Proneottiophilidae and Hoffeinsmyiidae. The great number of "*incertae sedis*" inclusions within acalyptrate Diptera may be explained by taxonomical problems.
Families with a low extant abundance, specialised biology or preferences in habitat show a low fossil record, whereas families with a high extant abundance are recorded

by significant individuals.

Chironomidae, Sciaridae and Mycetophilidae s. l. are representing 65% of all dipteran inclusions whereas members of families and genera with specialized preferences on habitat are known by few or unique specimens only.

The recent Diptera fauna with about 155.000 species in 189 families actually face more than 1.000 described taxa within 350 genera and 89 families in Baltic amber.

A new psychodid fly from Mexican amber (Diptera; Psychodidae)

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A second fossil species of psychodid genus *Succinarisemus* is described characterized, but this time from Mexican amber, Totolapa outcrop, located in the central depression of Chiapas. This new species shares with *Succinarisemus scheveni* (from Dominican amber) the same wing features with the autapomorphic enlarged wing area between costa and radius, and differs by its male genitalia structure.

The discovery of a species in the Mexican amber belonging to a genus known from Dominican amber indicates that this genus was spread and living in the Central America-Caribbean area during the Oligo-Miocene and increases our knowledge about palaeobiodiversity of this peculiar fossil psychodine genus.

Results of study of Coleoptera (Insecta) from the Lowermost Eocene Oise amber

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The overview on fossil Coleoptera from the Lowermost Eocene Oise amber of the Paris Basin (circa 53 Myr old) was prepared. This case is unique in the context that all specimens from one comparatively large resource of amber were taken for examination. At present 45 beetle families have been found from there. This fossil "fauna" has some peculiarities in comparison with the other amber resources. Some families are not recorded in older outcrops (Pselaphidae, Smicripidae, Coccinellidae, Ciidae) and one family is described from there as new. Some subfamilies and tribes of other groups have their oldest representatives recorded in Oise amber, i.e. Eurygeniinae (Anthicidae), Inopeplinae (Salpingidae), Trinodini (Dermestidae), Megatominae (Dermestidae), Attageninae (Dermestidae), Brontinae (Silvanidae), Synchitini (Zopheridae), and Opatrini (Tenebrionidae). The genera defined in the "Oise fauna" show very diverse geographical links with their modern relatives. These alternative links support that the faunistic composition of the early Eocene had a weak zonal differentiation. The data from this resource are very important providing information on the groups of small-sized beetles which are very rear or absent in deposits with compression fossils. Therefore combining both will make it possible to get a more realistic image on insect faunas of the Early Palaeogene.

Diverse assemblages of tanaids (Crustacea) related to Albian-Cenomanian resin-producing forests in Western Europe and their paleobiological implications

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Attempts at reconstructing amber forest habitats have sometimes neglected some aspects concerning arthropod communities in the soil, particularly those related to humid terrestrial conditions with, at least, certain proximity to partially flooded areas. The improving knowledge of the Spanish and French amber-bearing localities (Albian-Cenomanian) has allowed the discovery of organisms that lived close to or in aquatic environments. Among these, small crustaceans belonging to the peracaridan Order Tanaidacea are exceptionally preserved. Except for a few rare freshwater and brackish species, Recent tanaids are marine organisms which occur over the full range of depths, and they typically hide in crevices or interstices, or construct tubes or burrows.

Tanaids are exceedingly sparse in the geological record, with only 13 fossil species recorded to date. These are mostly rock-impressions, and only few specimens have been found as bioinclusions in ancient resins from some deposits around the world. The history of tanaids goes back to Lower Carboniferous, with the oldest species discovered in Scotland. Paleozoic taxa are also known from the Upper Carboniferous of Illinois and Lower Permian of Germany. Various Mesozoic tanaids were described from Lower Jurassic of Germany, Middle Jurassic of Bulgaria, Germany and Switzerland, Upper Jurassic of Germany, and Lower Cretaceous of Germany, but until recently, the only fossils known as bioinclusions were three species from Lower Cretaceous amber of Spain, placed in Alavatanaidae (Suborder Tanaidomorpha).

The new findings include 19 tanaids in Albian Spanish amber from Álava (Peñacerrada I outcrop, Burgos Province), with at least two new morphotypes. A single specimen from El Soplao amber (Cantabria Province) has been tentatively assigned to *Alavatanais carabe* Vonk and Schram, 2007. Furthermore, Albian-Cenomanian French amber has provided 17 tanaids among which three potential new morphotypes. These specimens were found in amber from various localities in the Charentes region (Archingeay-Les Nouillers and La Buzinie), and in the departments of Vendée (La

Garnache) and Aude (Fourtou). The new fossils all belong to the Suborder Tanaidomorpha and are remarkably modern in appearance, which is of great interest in understanding the history of the Order and their relationships with extant families.

These tanaid assemblages from palaeogeographically close Spanish and French Cretaceous amber bearing-deposits, suggest that this group was relatively common in or around the ancient resin-producing forests, and often some of them have been found together in the same amber piece. Moreover, taphonomic and palaeobiological approaches showed that Spanish tanaids were preserved together with diverse non-aquatic syninclusions originating from the litter, i.e. inorganic soil components, decayed plant debris, arthropod remains, fungal hyphae, coprolites, and body-fossils such as isopods, mites, and thysanurans. French tanaids, however, were generally preserved in a mixture of terrestrial, often litter-inhabiting arthropods and fungi, but also marine organisms like centric diatoms and sponge spicules. This provides evidence for the early adaptation of tanaids to various habitats, from edaphic conditions in moist terrestrial or freshwater habitats, as suggested by Spanish fossils, to brackish or even marine habitats, as suggested by French fossils.

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Santonian Vendeen amber: large amounts of data from a small sample in north-western France

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Until now, Cretaceous amber in western France was found mainly in the Albian and Cenomanian of the Sarthe and Charente-Maritime departments (Schlüter, 1978; Perrichot et al., 2010). A new Early Santonian deposit was discovered recently in the department of Vendée. This locality, however, was only accessible during road works, and thus a limited amount of material has been collected to date. In contrast with Albian-Cenomanian amber deposits from western France, which contain mostly turbid-to-opaque large amber pieces, the Vendeen deposit contains mostly small amber pieces that are all translucent yellow to orange. The investigation of 5700 pieces totaling only 300 grams of amber revealed abundant organic inclusions, with 165 fossil arthropods and numerous microorganisms. In addition to various flying or crawling hexapods and arachnids that are commonly entombed in fossil resins, Vendeen amber remarkably contains many marine organisms like crustaceans (tanaids, ostracods, and isopods), micro-algae (centric diatoms), and porifers (sponge spicules). This small but beautifully-preserved sample provides valuable information on a Late Cretaceous ecosystem of north-western France, and suggests the resin-producing trees were growing along the seashore. The sample adds to our understanding of the environments and ecosystems of the western part of the European Archipelago during the middle and early Late Cretaceous.

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Triassic amber inclusions: arthropods, plant remains and microorganisms preserved during the Carnian Pluvial Event

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Until recently, the oldest fossil records of organisms preserved in amber were from the Early Cretaceous of England, Japan, Lebanon and Jordan. This has widely been attributed to the production and preservation of large amounts of tree resin beginning about 130 million years ago. The first global occurrence of amber in earth history, however, dates back to the Carnian (Late Triassic), about 230 million years ago. Widespread amber occurrence and deposition during this time period may be a result of the Carnian Pluvial Event, a global episode of atmospheric perturbation linked to massive volcanism and profound changes leading to a more extreme monsoonal climate. Such climate is ideal for the secretion of large amounts of resins today, as well as the formation of fluvial sediments that optimally preserve amber. Carnian strata of the Italian Dolomites contain the largest and most promising pre-Cretaceous amber deposit discovered thus far. Initial research revealed a plethora of delicately preserved microorganisms and plant remains inside minute amber drops from this locality. Prokaryotes are represented by rod-shaped bacteria, sheathed bacteria and cyanobacteria. Inclusions of unicellular eukaryotes comprise diverse testate amoebae, ciliates, and desmids. Remains of vascular plants include leaf cuticles, spores, and pollen grains. Fungal inclusions such as ascomycete anamorphs and ascospores are rather rare. Subsequent screening of about 70,000 amber drops has revealed the oldest arthropods preserved in any amber: a nematoceran fly (Diptera) and two species of eriophyoid mites (Acari). The midge is fragmentary and consists of a partial head with portions of some appendages, an antenna, and a partial thorax with remnants of at least four legs. The inclusions of the eriophyoid mites represent the only definite pre-Cenozoic fossils of this group and possess very distinct morphologies. One mite is elongate and vermiform and shows bizarre feeding structures, while the other is fusiform, more compact and possesses more integrated mouthparts. Vermiform mites generally live in sequestered spaces (sheaths, galls, buds) that protect them from desiccation, while a fusiform body correlates with a vagrant lifestyle on exposed surfaces of plants. The amber was formed on the leaf surfaces of the source trees which have been assigned to the extinct conifer family Cheirolepidiaceae. It is therefore likely that the fossilized mites were either sheath dwellers or surface vagrants feeding on the coniferous foliage. Eriophyoidea are one of the most specialized and species-rich lineages of phytophagous arthropods and comprise at least 3,500 Recent species, 97% of which feed on angiosperms. The Triassic fossils document that the loss of the third and fourth pairs of legs occurred much earlier than had been thought, and confirm conifer feeding as an ancestral trait. Further recovery of inclusions in Carnian amber from the Dolomites is promising and will have profound implications for understanding the antiquity and evolution of terrestrial arthropod lineages.

Diverse feathers in amber from the mid-Cretaceous of New Jersey and Myanmar

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Until very recently, all Mesozoic fossil feathers of modern aspect were considered to derive from ancient birds. However, in the last few years, abundant new examples of such branched integumentary structures have been found, including many from the Liaoning Province of China – primarily from the Lower Cretaceous Yixian Formation, but also from the middle Jurassic Tiaojishan Formation. The Liaoning fossils are preserved as impressions associated with skeletal remains, not only of Avialae (primitive birds), but also the birdlike dinosaur families Dromaeosauridae and Troodontidae (collectively the three groups comprise the clade Paraves). Notably, significant feather specimens have also been studied from two Upper Cretaceous deposits: (1) the Santonian clays of the Eutaw Formation in Alabama, and (2) Late Campanian amber from western Canada. In addition, a piece of amber from the Late Albian of western France has revealed multiple branched feather portions.

Here we report on a very diverse assemblage of mid-Cretaceous feathers in 20 pieces of amber from New Jersey and Myanmar (Burma). The various feathers and feather portions appear to represent both immature (hatchling or juvenile) and adult animals. As inclusions in amber, the feathers are preserved in remarkable sub-microscopic detail and three dimensions. For the most part, specimens are immediately recognizable as feathers and contain one or more subdivisions of branched filaments, such as barbs and barbules, though details in the arrangement, size and overall relationship among these integumentary subcomponents vary significantly. The samples in amber include diverse pennaceous, plumulaceous and semiplumulaceous feathers / feather portions (conforming primarily to stages 3-4 in the evolution of the morphology of feathers as proposed by Prum 1999).

Measurements and comparisons of these feathers and their subcomponents with examples from studies in China and elsewhere may ultimately allow us to distinguish between paravian families, or recognize integuments of other closely-related theropod groups. The great diversity of paravian feathers by the mid-Cretaceous raises the question of how long ago these integuments evolved and diversified, in fact whether feather origins date to as early as the Triassic among the earliest dinosaurs or archosaurs, as other recent studies have suggested.

Two new biting midges of modern type from the Santonian amber of France (Diptera: Ceratopogonidae)

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Two new taxa of Ceratopogonidae representing the first arthropods from the Santonian amber outcrop of Piolenc (Vaucluse, France) are described. These biting midges stand respectively for a new genus and species corresponding to the second Mesozoic representative of the Dasyheleinae + Forcipomyiinae clade, and for a new species belonging to the genus *Metahelea* Edwards 1929, and representing the first Mesozoic Ceratopogoninae Heteromyiini. The new genus shares with *Atriculicoides* Szadziewski 1996, *Dasyhelea* Lenz 1934 and *Lasiohelea* Kieffer 1921 so many features that renders rather difficult the assignation to any subfamily of the clade. Nevertheless these characters ensure the presence of a solid relationship between these three genera, but certainly only a phylogenetic study would help in resolving this affiliation. Our new genus differs from *Atriculicoides* by its last flagellomere with rounded apex, and its monofid claws' apices; from *Dasyhelea* by its unsculptered flagellomeres and from *Lasiohelea* by the absence of empodium.

Our new species of *Metahelea* Edwards 1929 is distinguished from all other species by a swollen fifth tarsomere of fore leg, the presence of an acute and very long spine on dorsal arm of each lobe of fourth tarsomere and its hyaline wings.

Both new taxa confirm the great morphological stability through time within the Ceratopogonidae and suggest that the remaining ceratopogonine clades were also present by at least the Upper Cretaceous.

Hallucinochrysa diogenesi, a trash-carrying chrysopoid larva (Neuroptera) from Early Cretaceous Spanish amber

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Recently, *Hallucinochrysa diogenesi* Pérez-de la Fuente et al., 2012, a neuropteran larva belonging to the Chrysopoidea (extant Chrysopidae and fossil allies), has been described in Albian amber from the El Soplao outcrop (Cantabria, Spain). This finding is exceptional in that the specimen was preserved together with its trash packet, i.e., a dense cloud consisting only of plant trichomes that the larva meticulously gathered and carried on its dorsum, camouflaging itself from prey and predators and garnering physical defense against the latter.

Modern trash-carrying chrysopids use a wide variety of exogenous elements to construct their trash packets, both animal and vegetal in origin. Trash-carrying larvae can be generalists when selecting materials for their trash packets; however, studies with Recent species show that they can be very specific in that regard, because some chrysopid species only use a single source of "trash".

Chrysopid-like larvae are extremely rare in the fossil record. Only four fossil specimens were previously known, all from younger amber deposits, i.e., Canadian, Baltic, and Dominican ambers. *Hallucinochrysa diogenesi* most likely represents an advanced instar and has a unique morphology. Contrary to all other known trash-carrying chrysopid larvae (both extinct and extant), and in order to retain the elements of the trash packet, *H*. *diogenesi* possesses pairs of extremely elongate tubercles (lateral and laterodorsal pairs) that bear setae with trumpet-shaped setal endings.

Hallucinochrysa diogenesi's trash packet is composed of multibranched, dendritic trichomes belonging to ferns. All evidence indicates that *H*. *diogenesi* gathered these trichomes from gleicheniacean ferns, a group widespread during the Early Cretaceous.

Today, gleicheniaceans are known to be primary succession pioneers after fires or lava flows, and such a role has been inferred back to the Cretaceous.

This finding has significant paleoethological, paleoecological, and evolutionary implications. It currently represents the oldest known direct evidence of trash-carrying camouflage among insects, and one of the earliest proved cases of camouflage in the animal fossil record, showing how this behavior has remained in stasis for over 110 million years in the chrysopid lineage. Furthermore, it highlights an ancient plant-insect interaction between an immature neuropteran and a fern.

Although modern immature chrysopids develop in gymnosperms and angiosperms, where abundant prey are present and trash-carrying forms find plenty of available “trash”, our finding suggests that ferns played an important role in the evolution of trash-carrying chrysopoid lineages before the angiosperm radiation.

This work is a contribution to the projects CGL2011-23948 from the Spanish Ministry of Economy and Competitiveness, 491-CANOA 35015 from the Instituto Geológico y Minero de España, and DEB-0542909 from the United States National Science Foundation.

Neuroptera from Early Cretaceous Spanish amber

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Until recently, the diversity of neuropterans from Albian Spanish amber was completely unknown and in need of assessment.

A trash-carrying chrysopoid larva, *Hallucinochrysa diogenesi* Pérez-de la Fuente et al., 2012, was recently described from El Soplao amber. This exceptional fossil highlights an ancient plant-insect interaction and represents the earliest known evidence of camouflage among insects by selecting and transporting exogenous elements.

As occurs in other Cretaceous ambers, Berothidae are the most common neuropterans in Spanish amber. They are represented so far by three undescribed genera and species based on almost complete specimens from Peñacerrada I, San Just, and El Soplao outcrops, respectively (one new genus and species from each deposit). The specimens from Peñacerrada I and San Just ambers are characterized by especially elongate mouthparts. Also, a possible record of the genus *Ethiroberotha* Engel & Grimaldi, 2008, described from Burmese amber, has been recognized from a partial specimen in El Soplao amber. Moreover, an almost complete immature and four indeterminate fragmentary berothids are present in Peñacerrada I amber.

Within the family Coniopterygidae, a new species of the genus *Glaesoconis* Meinander, 1975 based on five specimens has been discovered in El Soplao amber. Species classified within this genus are known from Burmese, Raritan, and Siberian ambers.

A complete specimen of about one centimeter long representing a new morphotype of psychopsoid has been recognized from El Soplao amber. Psychopsoids are extremely rare in Cretaceous ambers, and no complete psychopsoid specimens have been previously reported from them.

Lastly, a fragmentary specimen from El Soplao amber represents a possible record of the family Nymphidae.

These discoveries contribute to our understanding of the greater diversity that neuropterans, one of the most ancient among holometabolous groups, enjoyed during the Mesozoic. New specimens from San Just and El Soplao are currently being assessed.

This work is a contribution to the projects CGL2011-23948 from the Spanish Ministry of Economy and Competitiveness, 491-CANOA 35015 from the Instituto Geológico y Minero de España, and DEB-0542909 from the United States National Science Foundation.

A survey of the fossil biting midges from the Lebanese, with description of new taxa

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Ceratopogonidae, or biting midges, are a family of small nematoceran Diptera with more than 5000 described living species. They are closely related to the Chironomidae, Simuliidae, and Thaumaleidae. Their earliest record is from the Early Cretaceous amber of Lebanon, but the high diversity reported from this fossil material suggests a much earlier origin.

A survey of the described ceratopogonids from the Lebanese amber is given including an attempt to retrace their paleoenvironment and data on the type localities from which these biting midges were recovered.

New species belonging to genera *Lebanoculicoides* Szadziewski, 1996, *Archiaustroconops* Szadziewski, 1996 and *Protoculicoides* Boesel, 1937 are described.

Lebanoculicoides is the only representative genus of the subfamily Lebanoculicoidinae Szadziewski, 1996 that differs from other Ceratopogonidae by the plesiomorphic feature "wing with well developed R4+5", and is known from Lebanese and Spanish amber. *Archiaustroconops* belongs to the subfamily Leptoconopinae Lenz, 1934 and is known from Early and Late Cretaceous amber of Lebanon, Spain and Burma. The genus *Protoculicoides* is not placed in any subfamily yet; maybe a further phylogenetic analysis will help placing it, and is known from Spanish, Burmese and Lebanese amber.

Context and genesis of the Lebanese ambriferous palaeoenvironments at the Jurassic-Cretaceous transition

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The Lebanese amber still the oldest for Gondwanaland, and its fauna is relatively well studied as to date about 180 taxa have been described from this material. Nevertheless the formation of the different Lebanese amberiferous outcrops is not yet clearly understood. We propose herein a new hypothesis and interpretation for the formation of amber deposits in the Late Jurassic and Lower Cretaceous Lebanese sediments. We thus evoke the evolution of the stratigraphy and the geodynamical context that lead to the amber deposition. Indeed, tectonic complexity of what is now a part of the Middle East area existed since the Precambrian times and still modeling its geology. We redefine as well Lebanon during the formation of its amber deposits, but we do not conclude on the real age of this amber.

Results of study of Coleoptera (Insecta) from the Lower Cretaceous Lebanese amber

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This overview includes more than 39 families of fossil Coleoptera from Lower Cretaceous Lebanese amber of 9 outcrops. Lebanese amber contains the oldest representatives of the families Scydmaenidae (considered by some as a subfamily of Staphylinidae), Ptiliidae, Elodophalmidae, Clambidae, Throscidae, Libanophytidae fam. n., Ptilodactylidae, Cantharidae, Melyridae, Dasytidae, Dermestidae, Ptinidae, Kateretidae, Erotylidae, Latridiidae, Laemophloeidae, Salpingidae, Anthicidae, Melandryidae, Aderidae, Curculionidae (Scolytinae). The families Chelonariidae and Scraptiidae are known from both Lebanese amber and Baissa, with both sites having a comparable age. The subfamilies Trechinae (Carabidae), Euaesthetinae (Staphylinidae) and Liparochrinae (Hybosoridae) first appear in the fossil record in Lebanese amber. The Coleoptera in Lebanese amber mostly belong to groups with arboreal habits (as found today in wood and tree fungi). Some species remained without family attribution belong to families which are needed to be described. The first insect from the newly discovered outcrops of Nabaa Es-Sukkar – Brissa: Caza (District) Sir Ed-Danniyeh, Mouhafazet (Governorate) Loubnan Esh-Shimali (North Lebanon) is described and the first general description

New Jurassic amber outcrops from Lebanon

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Reports of amber of occurrence predating the Lower Cretaceous are extremely rare. During the past two decades, records of discoveries of amber sites have increased considerably worldwide, consequently to the alertness by the scientific community of the importance and conservational pristine quality of the amber.

Lebanon is well known to contain abundant Lower Cretaceous amber outcrops (more than 400 localities). A number of these outcrops yielded the oldest amber containing intensive biological inclusions. We report herein the discovery of nineteen outcrops of amber from the Late Jurassic in Lebanon. Some of these outcrops gave large centimetric sized amber pieces. These new amber sites are all located in the Northern part of Mount Lebanon in volcano-lateritic Late Jurassic deposits (Kimmeridgian age, *circa* -150 Million Years). The amber is found in lens of lignite mixed with laterites and pyrite that occupy pits in a volcano-basaltic complex soil.

The characterization of these Late Jurassic ambers is performed by studying their chemical constitution via FTIR (Fourier Transform InfraRed) spectroscopy.

Though the new Jurassic amber yielded to date no more than some fungal inclusions, but the discovery of such material is very significant and promising especially in the reconstruction of the paleoenvironment. It also opens great prospects to reveal hopefully some Late Jurassic fossil arthropods.

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Posters abstracts

New Palaeodictyopteroida from the Upper Carboniferous of China enlightens close relationships of tropical and temperate insect fauna

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Discovery of new Palaeodictyoptera and Megasecoptera from Upper Carboniferous (early Bashkirian) of Tupo Formation in northern China (Ningxia Hui Autonomous Region) is reported. A new palaeodictyopterid based on single specimen bearing well preserved wing venation pattern with coloration of five transversal dark bands is attributed to the family Spilapteridae and compared with other spilapterid genera within Spilapteroidea. The character matrix used to separate the genera of three families within Spilapteroidea is provided. Furthermore, the preliminary results on new material of megasecopterans counting of 39 examined specimens are outlined. In conclusion it is interesting to point out differences in composition of insect faunas between Euramerica and North China during the in early Late Carboniferous (Bashkirian) possibly reflected tropical and temperate zones.

Galls and gall makers on plant leaves from the lower Miocene (Burdigalian) of the Czech Republic: systematic and palaeoecological implications

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The rich North Bohemian taphocenosis of Bílina Mine and Brestany Lagerstätten from lower Burdigalian offer an unique opportunity to study the exceptionally preserved galls on many fossil leaves of different plant taxa. A detailed study of more than 4000 plant macrofossils has been made in order to implement quantitative and taxonomic analyses of gall occurrences. Significant differences in diversity and frequency of the galls can be traced between older strata of Holesice Member (DSH) and the younger ones of Libkovice Member (LCH). The most probable explanation lies in the distinct environmental circumstances, namely in climatic conditions. Much drier, but colder climate with unevenly distributed rainfalls seems to have prevailed during the younger period, as can be judged from the nearly two and half fold increased level of gall frequency, but apparently lower diversity of all types of damage including galls. This finding proves the existence of abrupt climatic oscillation during the lower Miocene preceding the much later ones of Pliocene and Pleistocene times.

Many of the studied galls show a striking resemblance with the recent ones. Some of them are attributable on the basis of their similarities in the form, size and position on the host-plant leaves to recent insect or mite families or even genus, proving their relatively long evolutionary stasis. Fourteen distinct arthropods were identified as possible causers of fossil galls. The fossil galls were induced by members belonging to the following insect and mite families: Psyllidae (Hemiptera), Cecidomyiidae (Diptera), Cynipidae (Hymenoptera) and Eriophyidae (Acari). Galls on *Taxodium dubium* induced by gall midges of the genus *Taxodiomyia* (Diptera: Cecidomyiidae) are recorded for the first time.

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ResPine: A long-term actuotaphonomical survey of organism trapping in plant resins

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Preservation of organisms (micro- and macro-organisms) in plant resins is documented since several centuries (for details see Perrichot, 2005; Girard, 2010). Such studies greatly improved our knowledge about evolutionary history of diverse groups of plants, arthropods and microorganisms and provided many important data about the ecology and structure of past forests. However current researches face a major problem: the lack of long-term survey of organism trapping in plant resins. Indeed only sporadic experiments of organism trapping in plant resins and/or episodic collects of resin flows in modern forests have been led. The *ResPine* project will contribute to better understand the mechanism of organisms trapping and preservation of organisms in plant resins by studying three spots with different Pinaceae of the Montpellier region (Southern France) during 10 years. The Pinaceae was chosen because of their important resin production and, for some of them, of their Mediterranean endemism (local interest such for *Pinus halepensis* Miller and *P. nigra* subsp. *salzmannii* (Dunal) Franco). The three spots will have different environmental characteristics: one under clear sea influences, a second located in the Montpellier hinterland and the last one located in a more mountainous area of Montpellier region. On each spot, plant and organisms diversity will be studied at the beginning of the survey and environmental parameters (such as temperature and humidity) will be measured. These data will be completed during the 10 years of the survey. Resin sampling will be realized each two months and organism diversity in resin flows will be analyzed in the lab. Such data will be accompanied by analyses of soil water in order to highlight a possible influence of resin chemistry (Aquilina et al., 2013) on the organism trapping. Also the fate of resin after solidification on the tree bark will be surveyed. Mechanisms of fossilization and burying will be analyzed. The *ResPine* project will thus constitute a solid and huge database on organism trapping in plant resin and will thus contribute to the improvement of ecological reconstruction of past forest ecosystems.

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Evolution aspects of Ellinaphididae and phylogeny relationship of new Early Cretaceous aphids from Bon-Tsagaan Locality (Mongolia)

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Bon-Tsagaan [=Bon-Tsagan (Rasnitsyn, Zherikhin 2002)] is one of the richest in Mongolia, and one of the best known and richest Mesozoic insect remains outcrops in the world. Numerous outcrops of mudstone and marls are widely distributed in Central Mongolia, south of the recent Lake Bon-Tsagaan-Nur. The remains are well preserved in lacustrine sediments of the lake which was situated in the mountain valley in a warm climate zone [1].

The exact age of the lacustrine sediments of Bon-Tsagaan is estimated as Early Cretaceous, probably the Aptian [1]. Rasnitsyn et al. (1998) correlate it with the Purbeck and Wealden (Europe, South England). Ten thousand of fossil insects have been collected there (Zherikhin 1978) representing 15 orders and approximately 108 families, among them 172 imprints have been identified as aphids. Some of the collected specimens of aphids were described earlier (Heie & Wegierek 2011): *Oviparosiphum jakovlevi* Shaposhnikov, 1979 (family Oviparsiphidae; Paleontological Institute, Academy of Sciences, Moscow PIN 3559/51); *Cretacallis polysensoriata* Shaposhnikov, 1979 (?Drepanosiphidae; PIN 3559/4596); *Brimaphis abdita* Wegierek, 1989 (Szelegiewicziidae; PIN 3559/7402 (7288)); *Sepiaphis versa* Wegierek, 1989 (Szelegiewicziidae; PIN 3559/4592); *Nuuraphis gemma* Wegierek, 1989 (Canadaphididae PIN 3559/4589, 4595, 4627, 4630, 4635, 7267, 7273, 7383, 7388). The most numerous, among the undescribed materials, are representatives of extinct Cretaceous family of aphids Ellinaphididae Kania & Wegierek, 2008. The family Ellinaphididae comprises 9 genera and 32 species (Kania & Wegierek 2008). Most of those already described come from Baissa (Lower Cretaceous, Valanginian, Russia, Transbaikalia), while only three species from the genus *Caudaphis* come from China (Shandong, Laiyang Basin, Tuanwang).

The paper presents evolution aspects of Ellinaphididae and phylogeny relationship of new Early Cretaceous aphids from Bon-Tsagaan Locality (Mongolia). In the collection of the Arthropod Lab, Palaeontological Institute, Russian Academy of Science, Moscow [PIN] among Early Cretaceous imprints of aphids from Bon-Tsagaan (Mongolia) the representatives of two new genera and seven new species of the family Ellinaphididae (Kania & Wegierek, 2008) have been found. The analysis of morphology was supported by 150 photographs made under the scaning microscope HITACHI S-3400N. Relationships among taxa of the extinct aphid of family Ellinaphididae are explored using 34 morphological characters, representing the 11 genera. A key to species of Ellinaphididae is provided. The distributional and ecological pattern of Ellinaphididae is discussed. A comparison with the aphids of Ellinaphididae from Early Cretaceous Baissa deposits is mentioned.

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Revision of Jurassic family Genaphididae (Aphidomorpha, Sternorrhyncha, Hemiptera)

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The oldest fossils of aphids are known from the Triassic. Only five species and genera were described. All of them (except *Dracaphis* Hong et al., 2009) have been described from isolated wings (Heie & Wegierek 2011).

The first descriptions of Jurassic aphid wings were made by Brodie (1845) – *Genaphis valdensis* (Genaphididae). A few specimens belonging to the genera *Jurocallis* (undetermined to the family) and *Juraphis* (Genaphididae) have been described by Shaposhnikov (1979) from the Late Jurassic Karatau (Kazakhstan). The latest information comes from Middle Jurassic Daohugou (China), from where *Sinojuraphis* Huang & Nel, 2008 (Sinojuraphididae) was described (Heie & Wegierek 2011).

In addition to the outcrops, whose age is not in doubt, aphids fossils are known from a number of localities whose age is defined as the 'disputed'. By some authors they are considered as Upper Jurassic but by others as the Early Cretaceous. Eight species belonging to the families Genaphididae, Ellinaphididae, Naibiidae and Oviparosiphidae were described from this sites (Heie & Węgierek 2011).

The research aimed to revise *Genaphis*, type genus for family Genaphididae and designation of a new type genus. This family includes four genera of Jurassic aphids and is type of the superfamily Genaphidoidea. Interpretations of this material by current researchers, Heie (1967) and Becker-Migdisova (1966) are contradictory.

The key difference is the construction of the fore wings, which is a characteristic position of CuA_1 and CuA_2 against each other and the main vein (Heie & Wegierek 2009). After analyzing the holotype it has been concluded that the accepted description (veins CuA_1 and CuA_2 connected by a short, common stem at the base of the main veins; Heie 1967) is incorrect, and the interpretation of the characteristic features is wrong.

Other genera belonging to Genaphididae (*Aphaorus*, *Juraphis* and *Pterotella*) were also revised, and a new type genus was assigned and the genera were redescribed.

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Two new biting midges of modern type from the Santonian amber of France (Diptera: Ceratopogonidae)

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Two new taxa of Ceratopogonidae representing the first arthropods from the Santonian amber outcrop of Piolenc (Vaucluse, France) are described. These biting midges stand respectively for a new genus and species corresponding to the second Mesozoic representative of the Dasyheleinae + Forcipomyiinae clade, and for a new species belonging to the genus *Metahelea* Edwards 1929, and representing the first Mesozoic Ceratopogoninae Heteromyiini. The new genus shares with *Atriculicoides* Szadziewski 1996, *Dasyhelea* Lenz 1934 and *Lasiohelea* Kieffer 1921 so many features that renders rather difficult the assignation to any subfamily of the clade. Nevertheless these characters ensure the presence of a solid relationship between these three genera, but certainly only a phylogenetic study would help in resolving this affiliation. Our new genus differs from *Atriculicoides* by its last flagellomere with rounded apex, and its monofid claws' apices; from *Dasyhelea* by its unsculptered flagellomeres and from *Lasiohelea* by the absence of empodium.

Our new species of *Metahelea* Edwards 1929 is distinguished from all other species by a swollen fifth tarsomere of fore leg, the presence of an acute and very long spine on dorsal arm of each lobe of fourth tarsomere and its hyaline wings.

Both new taxa confirm the great morphological stability through time within the Ceratopogonidae and suggest that the remaining ceratopogonine clades were also present by at least the Upper Cretaceous.

Current State of Knowledge of the Mesozoic Neuroptera of China

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The order Neuroptera is known in the fossil record since the Early Permian (about 280 to 260 Ma) and it thrives ever since. The neuropterans occur relatively rare in the pre-Mesozoic localities. The order was most diverse in the Mesozoic. Most of the extinct and extant groups have been present at this time. Many families, genera and species of the Chinese neuropteran fossils have been published since the order was first reported by Ping Chi in 1928. Up to now, 20 families have been recorded from the Mesozoic of China, and 58 genera and 97 species have been described from this era.

We mainly study the fossils materials from two localities of northeast China: the Middle Jurassic Daohugou (Jiulongshan Formation) in Inner Mongolia, and the Early Eocene Huangbanjigou (Yixian Formation) in Liaoning Province.

The Daohugou beds contain a diverse insect fauna, with 19 insect orders being represented. We have examined approximately 4000 Neuroptera specimens which are housed in the Capital Normal University. Hitherto, only 58 species (29 genera) belonging to 11 families were described. Osmylidae are most abundant and diverse among neuropterans in the assemblage. Chrysopidae, Grammolingiidae, Saucrosmylidae, Ithonidae, Kalligrammatidae, Psychopsidae, Osmylopsychopidae and Parakseneuridae are common. Aetheogrammatidae, Berothidae, Mantispidae, Panfiloviidae, Nymphidae, Brongniartiellidae, and Mesochrysopidae are rare.

The fossils from Huangbanjigou are mostly beautifully preserved, and represent a wide variety of animal and plant taxa. The insect fossils are also numerous and diverse. There are more than 200 neuropteran specimens housed in the Capital Normal University. Up to date, 25 named neuropteran species (19 genera) belonging to 11 families have been recorded: Aetheogrammatidae, Ascalochrysidae, Berothidae, Chrysopidae, Dipteromantispidae, Ithonidae, Kalligrammatidae, Mesochrysopidae, Myrmeleontidae, Palaeoleontidae, and Psychopsidae. Undescribed material belongs to the families Mantispidae, Osmylidae, and Nymphidae. The families Chrysopidae and Ithonidae (undescribed yet) are most common in the assemblage.

These valuable materials give us a great opportunity to study biodiversity and ecology of the Mesozoic Neuroptera.

Catching insects in amber- a taphonomical study in Southern Mexico

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Amber is a complex entomological trap. Due to differences in the production and process of maturation it contains organisms of various microhabitats such as tree bark, soil and litter, freshwater, ponds, and even coastal zones. In discussions about the taphonomy of amber and its inclusions, MARTÍNEZ-DECLÒS et al. (2004) mentioned different factors, which may influence the preservation of insects in amber. However, few taphonomic examinations of amber faunas have been done so far. BRUES (1933) compared the fauna of Baltic amber with the insect fauna from Petersham, Massachusetts, using tanglefloot-coated paper as a trap. His conclusion that this trap is similar to the resin trap was later rejected by HENWOOD (1993). She compared extant faunas collected with different kinds of traps from Neotropical rain forests of the world with the fossil fauna from Dominican amber. Based on this, she concluded that the fauna trapped with emergence traps was most similar to the Dominican amber fauna and that the amber therefore reflects ground-subterranean level resin production. The present work highlights the difficulty to find the best amber resembling trap. Seven different traps were compared, showing that the most similar entomological traps to resin are sticky and malaise traps.

Beetle fauna in the Early Cretaceous Spanish amber

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Coleoptera is one of the most represented orders of Cretaceous insects, as similarly occur in extant terrestrial ecosystems. Though Coleoptera is usually less represented than Diptera, Hymenoptera, Heteroptera or Thysanoptera in terms of abundance (depending on worldwide localities), it is always the most diverse. One hundred twenty specimens have been collected from three Cretaceous better studied Spanish amber sites: Peñacerrada, San Just and El Soplao, all three from the Lower-Middle Albian (112 My). Beetles constitute, up to now, 62 of 2,843 bioinclusions in Peñacerrada I (Burgos) and Peñacerrada II (Álava), 7 of 225 bioinclusions in San Just (Teruel) and 51 of 546 bioinclusions in El Soplao (Cantabria). From those beetles, seventy specimens have been identified in thirty-two families and eleven as indeterminate specimens.

Spanish beetles found in amber are from suborder Polyphaga, i.e., Hydrophiloidea (Histeridae), Staphylinoidea (Staphylinidae, Scydmaenidae), Scirtoidea (Eucinetidae, Scirtidae), Elateroidea (Elateridae, Artematopodidae, Cantharidae), Bostrichoidea (Nosodendridae, Dermestidae, Anobiidae), Lymexyloidea (Lymexylidae), Cleroidea (Trogossitidae, Cleridae), Cucujoidea (Nitidulidae, Monotomidae, Silvanidae, Cryptophagidae, Erotylidae, Phalacridae, Latridiidae), Tenebrionoidea (Ciidae, Melandryidae, Mordellidae, Tenebrionidae, Oedemeridae, Meloidae, Aderidae, Scraptiidae), Chrysomeloidea (Cerambycidae) and Curculionoidea (Brentidae, Nemonychidae).

All these beetle groups share an extant relationship with the litter soil and decaying trees, as could be in Cretaceous. Mostly identified groups are related today with saproxylic environment, living during different ontogenetic stages feeding on wood (some are woodborers), decaying timber, hyphae of wood-decaying fungi, or another dead wood dependent organism; so factors related with decaying wood and wood-inhabiting fungi are the most significant explanatory variables for the Cretaceous species richness in Spanish amber, at least related to beetles richness.

The study of this beetle assemblage will permit clear up important paleogeographical, paleoecological and taxonomical factors in the evolution of the order, as well as clarify relevant aspects of its taphonomy in order to better interpret the fossil record.

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New Jurassic amber outcrops from Lebanon

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Reports of amber of occurrence predating the Lower Cretaceous are extremely rare. During the past two decades, records of discoveries of amber sites have increased considerably worldwide, consequently to the alertness by the scientific community of the importance and conservational pristine quality of the amber.

Lebanon is well known to contain abundant Lower Cretaceous amber outcrops (more than 400 localities). A number of these outcrops yielded the oldest amber containing intensive biological inclusions. We report herein the discovery of nineteen outcrops of amber from the Late Jurassic in Lebanon. Some of these outcrops gave large centimetric sized amber pieces. These new amber sites are all located in the Northern part of Mount Lebanon in volcano-lateritic Late Jurassic deposits (Kimmeridgian age, *circa* -150 Million Years). The amber is found in lens of lignite mixed with laterites and pyrite that occupy pits in a volcano-basaltic complex soil.

The characterization of these Late Jurassic ambers is performed by studying their chemical constitution via FTIR (Fourier Transform InfraRed) spectroscopy.
Though the new Jurassic amber yielded to date no more than some fungal inclusions, but the discovery of such material is very significant and promising especially in the reconstruction of the paleoenvironment. It also opens great prospects to reveal hopefully some Late Jurassic fossil arthropods.

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A short review of fossil lace bugs (Hemiptera: Heteroptera, Tingoidea) with notes on evolution of their morphological stuctures

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Superfamily Tingoidea includes five families: Ignotingidae Zhang et al., 2005, Hispanocaderidae Golub, Popov et Arillo, 2012, Cantacaderidae Stål, 1873 (sensu B. Lis, 1999), Tingidae Laporte, 1873 and Vianaididae Kormilev, 1955. Approximately 45 fossil species and forms of all these families have so far been described. Four families are known from the Cretaceous, the oldest known Tingoidea (Ignotingidae, Hispanocaderidae and Tingidae) have been described from the Lower Cretaceous. Ignotingidae and Hispanocaderidae are monotypic extinct families and have respectively been described from East China and Hispania. General body habitus, structure, and venation of hemelytra, the ratio of length of antennal segments of Ignotingidae suggest that this family is an ancestral one to the superfamily Tingoidea and has some similarities with the superfamily Miroidea. The structure and venation of elytra, head shape and other features indicate that Hispanocaderidae is probably ancestral family to the recent family Cantacaderidae. The oldest fossil Tingidae, *Golmonia pater* Popov, 1989 and *Sinaldocader drakei* Popov, 1989, have been described from the later Early Cretaceous of Central Mongolia, the former belonging evidently to a special Mesozoic subfamily of Tingidae and the latter to Phatnomatinae Drake et Davis, 1960 (sensu B. Lis, 1999). *Sinaldocader* Popov, 1989 includes three species. Besides *S. drakei* two more species are known: *S. ponomarenkoi* Golub et Popov, 2008 from the late Early Cretaceous of Transbaikalia and *S. rasnitsyni* Golub et Popov, 2012 from the Upper Cretaceous (Turonian) of southwestern Kazakhstan. It is obvious that the status of the latter must be raised as a separate new genus. Another member of Phatnomatinae - *Ambarcader eugenei* (Perrichot et al., 2006) have been described from the Cretaceous amber of France. Two monotypic genera of Vianaididae (Tingoidea) have also been described from the lower layers of the Upper Cretaceous of the United States (Turonian amber of New Jersey): *Vianagramma goldmani* Golub et Popov, 2000 and *Vianathauma pericarti* Golub et Popov, 2003, but the latter species evidently does not belong to this family.

The remaining 36-37 fossil species and forms of Tingoidea are known from the Cenozoic. Most of them belong to the subfamily Phatnomatinae (Tingidae) and family Cantacaderidae, whose recent members are almost exclusively distributed in the tropics and subtropics. At the same time, all the Cretaceous taxa of generic rank in the Cenozoic are absent. Only in the Eocene (Baltic amber) there appeared representatives of the most evolved subfamilies Tinginae - Archepopovia yurii Golub, 2001. All Eocene genera of Tingoidea morphologically are closely related to recent genera, but in reality only genus Sinalda Distant, 1904 is common in the Eocene and in recent faunas. The majority of Oligocene and Miocene representatives of Tingoidea belong to recent genera, such as Leptopharsa Stål, 1873, Stephanitis Stål, 1873 etc. In the Miocene fauna there is a morphologically specific taxon *Amberobyrsa* Heiss, 2009 from the Dominican amber.

A survey of the fossil biting midges from the Lebanese, with description of new taxa

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Ceratopogonidae, or biting midges, are a family of small nematoceran Diptera with more than 5000 described living species. They are closely related to the Chironomidae, Simuliidae, and Thaumaleidae. Their earliest record is from the Early Cretaceous amber of Lebanon, but the high diversity reported from this fossil material suggests a much earlier origin.

A survey of the described ceratopogonids from the Lebanese amber is given including an attempt to retrace their paleoenvironment and data on the type localities from which these biting midges were recovered.

New species belonging to genera *Lebanoculicoides* Szadziewski, 1996, *Archiaustroconops* Szadziewski, 1996 and *Protoculicoides* Boesel, 1937 are described.

Lebanoculicoides is the only representative genus of the subfamily Lebanoculicoidinae Szadziewski, 1996 that differs from other Ceratopogonidae by the plesiomorphic feature "wing with well developed R4+5", and is known from Lebanese and Spanish amber. *Archiaustroconops* belongs to the subfamily Leptoconopinae Lenz, 1934 and is known from Early and Late Cretaceous amber of Lebanon, Spain and Burma. The genus *Protoculicoides* is not placed in any subfamily yet; maybe a further phylogenetic analysis will help placing it, and is known from Spanish, Burmese and Lebanese amber.

About some fossil mirids from the peculiar subfamily Psallopinae (Hemiptera: Heteroptera, Miridae)

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Regarding the number of the described species Psallopinae is a very small subfamily of extant plant bugs (Miridae) inhabiting tropical and subtropical regions. The extinct Psallopinae are very important for classifying and establishing the relationship with the closely related plesiomorphic mirid groups of Isimetopinae and Cylapinae. The modern species belonging to Psallopinae are usually characterized by 2-segmented tarsi, the claws with subapical tooth, and usually a single cell on the membrane. Furthermore, very big eyes occupying almost entire head nearly overlapping the gula and very low-set antennae are essential features of the known species. All recent species have small bodies (usually 2-3 mm), they lead cryptic life and their chorology is poorly known since most of them were collected in light traps. The described recent species are placed in two genera: *Psallops* Usinger, 1946 and *Isometocoris* Carvalho & Slater, 1954.

More abundant in the described forms is a fossil fauna of the Late Eocene of Baltic amber. Up till now representatives of five genera have been described from Baltic and Dominican amber: *Isometopsallops* Herczek & Popov, 1992, *Epigonomiris* Herczek & Popov, 1998, *Cylapopsallops* Popov & Herczek, 2006, *Epigonopsallops* Herczek & Popov, 2009 (Baltic amber) and also the extant genus *Psallops* Usinger, 1946, represented by seven extant species from Micronesia, Saudi Arabia, South Africa, Japan, Taiwan, China and Australia. Some described fossil species (e.g. *Cylapopsallops kerzhneri* Popov & Herczek, 2006, *Isometopsallops schuhi* Herczek & Popov, 1992, *Epigonomiris skalskii* Herczek & Popov, 1998) differ from the recent forms by bigger body size (ca. 5 mm) and 3-segmented tarsi. However, all of them have a subapical tooth on claws and do not have the ocelli. This last character distinguishes them from representatives of the subfamily Isometopinae. However, a mosaic of the remaining morphological characters suggests close relationship between these subfamilies. Maximal reduction of the ocelli in some fossil Isometopina e.g. *Electromyiomma schultzi* Popov & Herczek, 1992 or *Electroisops ritzkowskii* Herczek & Popov, 1997 and at the same time presence of the ocelli in undescribed representatives of Psallopinae from Baltic amber counts in favour of accepting previous suggestions (Herczek & Popov, 1992), according to which Psallopinae is a unit inside Isometopinae. There are also more undescribed Psallopinae, including *Psallops* from Baltic, Ukrainian (Rovno) and Saxonian amber. The discovery of fossil psallopine bugs in Late Eocene Baltic and Ukrainian amber, especially the oldest representative *Isometopsallus prokopi* Vernoux et al., 2010 from Lowermost Eocene French amber and also in Lower-Middle Miocene Dominican amber indicates that appearance and spreading of this peculiar mirid group happened not later than in the early Cenozoic.

Youth over adulthood? Whiteflies classification 100 year after (Hemiptera: Sternorrhyncha: Aleyrodidae)

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The whiteflies (Hemiptera: Sternorrhyncha: Aleyrodomorpha) reveal as unique group within the Hemiptera, with the classification system based on morphological features of immatures. Almost all taxonomic levels from species to subfamilies could be diagnosed by the morphological features of the instars, being precise, by the fourth instar named puparium. Contrary, identification of the species for the adult specimen, regardless, male or female, is extremely difficult, or impossible.

Hundred years ago, Quaintance and Baker (1913-1915) were the first putting attention on this neglected at these times insects, and presenting the classification, relationships within the Aleyrodidae genera and subfamilies and placement of the Aleyrodidae within the Sternorrhyncha. For this purpose, they gave the morphological and anatomical descriptions of developmental stages since the egg up to adult. They used the forewing venation patterns for separation particular subfamilies, and since then these models were copied for various purposes. During last 100 years, the only additional imaginal features used in taxonomy of whiteflies are the wax-plates of males and females, differing among males and females of particular subfamilies. No discrimination key based on adult's morphological features is available; the situation is even worst, as for vast majority of recently recognized genera and species the imaginal forms are not known. Imagines are generally neglected in taxonomic practice of whiteflies, as their systematics and classification is 'locked' on puparial characters.

The question arose, how to manage with fossils, which are quite frequent among inclusions in resins but also as imprints, but represented almost uniquely by the imagines? In our opinion the fossil whiteflies cannot to be ignored. The high numbers of fossils available for study reveal the necessity of search for the new morphological features, and we believe these could be also useful for discrimination of genera and species among the recent whiteflies. Our first results indicate the possibility of finding reliable features on the venation of forewings and hind wings, head capsule characters, antennae, legs and their armature and genitals of males and females.

Recently, the Aleyrodidae are subdivided into four subfamilies: extinct Bernaeinae (Jurassic to Palaeocene?); Udamoselinae (subfamily of vague validity);

Aleurodicinae and Aleyrodinae. The oldest fossil representatives of the Aleurodicinae and Aleyrodinae were recorded from Early Cretaceous fossil resins (Lebanese amber and Burmese amber). The other rich materials of Aleyrodidae are known from the Lowermost Eocene Oise amber and the Eocene Baltic amber. The other unplaced to subfamilies Aleyrodidae were mentioned from late Cretaceous Ethiopian amber, Miocene Dominican and Mexican ambers and Miocene amber from Peru. All these fossils are represented by imagines. The only fossil puparium (*Aleurochiton petri* Rietschel, 1983) is reported from the Pliocene deposits of Germany.

How this plenty of imagines preserved as fossils can influence the classification and phylogeny of Aleyrodidae? We do not know yet, as we just started to play with the conundrum of imaginal characters of Aleyrodidae. Anyway, we believe that our studies on adult morphology and taxonomy on fossil whiteflies, release the 'puparial lock' in studies on diagnostic values of imaginal features in the recent Aleyrodidae.

Fossilized barcodes - Wing Interference Patterns present also in the fossils

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`The colours of many animals arise from ordered nanometer-scale variations in tissue structure. Structural colours – the most intense, reflective and pure colours in nature – are widespread among modern insects. Metallic structural colours occur in modern insects and can be preserved in their fossil counterparts, but it is unclear whether the colours have been altered during fossilization, and whether the absence of colours is always real. There are a few examples of preservation of such coloration in fossil beetles and butterflies (McNamara *et al*. 2011a, b; 2012).

Recently, another type of coloration, named by its discoverers Two-Beam Wing Interference Patterns (WIP) is a newly recorded morphological character system present in extremely thin insect wings (Shevtsova *et al*. 2011). Color patterns play central roles in the behavior of insects, and are important traits for taxonomic purposes, e.g. distinction of sibling species. WIPs were used in taxonomic works dealing with recent Hymenoptera (Hansson & Shevtsova 2010, 2012; Hansson 2011, 2012; Shevtsova & Hansson 2011).

We found that Wing Interference Patterns are present not uniquely among the Hymenoptera they are present among the Diptera and Hemiptera. This system of communication probably exists also among the other groups of insects, in which minute forms with transparent (or patchy) wings are to be found.

The second part of this discovery is that we found coloration closely resembling WIP patterns not only in recent insects, but also among some fossils preserved as inclusions in ambers. The colors in WIPs are similar to the colors on the surface of a soap bubble, and the origin of the structural colors in WIPs is readily explained by the two-beam Thin Film Interference hypothesis. Therefore the question arose, if the preservation in amber is fair enough and the colorations observed could be explained also by TFI? The original insect cuticle is not preserved in amber, but its microsculpture and the distance between two layers of cuticle forming the wing surface could be preserved in the minute details and extreme fidelity. Then we believe that non-zero chance for reconstruction of Wing Interference Patterns in the insects preserved in amber exists. The preservation of WIPs in fossils gives the new tool not only for taxonomy, but also evolutionary studies. Investigations on Wing Interference Patterns of the fossils is vital not only for entomology or evolutionary approach but could be also the new, exciting field of research for taphonomy, biophysics, material sciences, etc.

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A new mantis (Insecta: Mantodea) in the Early Cretaceous Spanish amber

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The Mantodea are one of the poorest represented order of insects in the fossil record with less than 20 species described. Many of them were found in Cretaceous deposits, both in limestones (mainly wings) and amber (some complete adults but mainly unwinged nymphs). Other specimens from the Cretaceous ambers of Japan, Lebanon and Canada, and in Spanish limestones, etc., are still undescribed. The Mantodea are phylogenetically related to Blattaria and Isoptera in the clade Dictyoptera, which evolved from roach-like insects with reduced ovipositor during the Late Jurassic or Early Cretaceous. Kukalová-Peck and Beutel (2012) denied the hypothesis proposed by Béthoux and Wieland (2009) and Béthoux et al. (2010) about relationships between Mantodea and the Anthracoptilidae Handlirsch, 1922 and considered this family as stem-Holometabola. Some other authors proposed that Mantodea evolved from the free-living Jurassic roaches of the family Liberiblattinidae, as a result of a predaceous way of life. Grimaldi (2003) considered the genera *Amorphoscelites, Burmantis, Chaeteessites, Cretophotina, Electromantis, Jersimantis, Kazakhaphotina,* and *Vitimiphotina* with uncertain familial placement within Mantodea.

A new unique mantid nymph has been found in the Early Cretaceous amber (Albian) of Spain. It comes from the San Just outcrop (Teruel Province). The amber piece appeared in grey-black claystones rich in *Frenelopsis* remains at the top of the Regachuelo Member (Escucha Formation), which correspond to a fluvial delta swamp deposit.

The new specimen represents the first record of mantises in the western European Cretaceous amber-bearing deposits. Tentatively it will remain unplaced to family level (Recent or fossil). The new specimen is distinguished from other genera known as nymphs in amber (*Chaeteessites*, *Electromantis*, *Jersimantis*, *Burmantis*) by the following combination of characters: ocelli present; fore femur with ventromesal row of eight stout spines, alternating with nine shorter ones; three relatively short spines (not stiff setae) on ventrolateral edge; with dense, fine pilosity in ventral furrow. Fore femoral brush not present. Fore tibia with mesal row of ten thick spines on distal two-thirds of tibia, with slight longitudinal grooves in it, increasing in size distad; apex of tibia with two thick, spine-like setae (one large, one small) having well-defined articulation points, but no spur at apex of tibial extension. Fore basitarsomere shorter than fore tibia, and coxae covered by spicules.

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Micropalaeontological investigation of the Mdairej Formation or "*Falaise de Blanche*"

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"Falaise de Blanche", also known as Jezzine Cliff, was first described by Ch.I. Blanche (1847). It represents a very distinctive geomorphological unit running throughout the chain of Mount Lebanon, Anti-Lebanon (Lebanon), and into Southern Alawite Mountains (Syria). For instance, it forms the natural bridge of Fakra and the background of the waterfall of Jezzine. This sheer-sided cliff consists of grey massive limestones that were given the status of a formal stratigraphic unit by Dubertret (1963) as the Mdairej Formation. It lies between the Abeih Formation (Walley, 1983) below and the Hammana Formation (Walley, 1983) above. According Dubertret and Vautrin (1937), the Mdairej Formation is Albian in age, but according to Dubertret (1963) it is late Aptian *sensu anglico*, or it even ranges from Early Aptian to early late Aptian in age according to Walley (1998). None of these datings is strongly constrained: there are ammonite records only from the Hammana Formation and they point to a Late Albian–Vraconnian age; according to Dubertret and Vautrin (1937) the Abeih Formation might span the Barremian and the Early Aptian for its marly layers that yield some "*Orbitolina lenticularis* Blum".

One of the main goals of the ongoing study will be to better constrain the age of the Mdairej Formation. We are currently completing the field work, i.e., logging sections in several localities at the scale of Lebanon. A number of sections have already been logged and are under investigation (sedimentary petrography and paleontology). There are few macrofossil finds (echinoids and ammonites) in the Mdairej Formation or in the underlying and overlying units; therefore, biostratigraphic keys will come from the benthic foraminifers and calcareous green algae which are common in the shallow-water carbonate facies.

Micropaleontological investigations will cover first systematics of the various taxonomic microorganisms. Their distribution either vertical (time) or horizontal (landscape) will help to understand environmental changes in relation with the relative sea-level and the palaeogeography during this episode at the scale of Lebanon.

Petrographical analyses of the carbonate rocks (identification of depositional, erosional or diagenetic features) should contribute in validating the model.

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