



**Current Studies on Past Biodiversity
in Southeast Asia 2021**

9-11 June 2021 (Online)

Programme and abstracts book



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Foreword

Dear colleague,

Welcome to the workshop "Current studies on past biodiversity in South-East Asia". The workshop is organized as a series of paper presentations (oral and poster over three days) covering all geological and historical periods, from the deep to the recent past. Time slots will be allocated for discussions as well. It is therefore open to topics in paleobiology, paleontology, evolution, anthropology, phylogeography, extinction and diversification processes.

That series of conferences is a follow up on the "Paleobiodiversity in South-East Asia" session that was organised during the 5th International Paleontological Congress in Paris in 2018, and can also serve as a preliminary for the 6th international congress of palaeontology that will be held in Thailand in November 2022. It is designed to answer the need for an international social and scientific event considering the growing interest in the international scientific community regarding the dynamics of past biodiversity in what is considered as one of the most threatened biodiversity hotspots today.

Because of the current sanitary crisis, the workshop will be held online and zoom and discord will be the principal interface for following the workshop. Sessions will start at 13.30 Bangkok time zone in order to allow a maximum of worldwide participants to take part in the event (it will be 08.30 for Paris time zone).

Each session starts with a 30 minutes keynote paper regarding recent discoveries about past biodiversity in South-East Asia. Communications will be allotted 20 minutes time slots, including questions – we recommend limiting your talk to 10 to 15 minutes for allowing enough time for questions). On the last day, the scientific committee will vote to award the *Diversity* prize to the best presentation.

In order to facilitate communications and interactions during the meeting, we will use zoom and discord for oral presentations and poster sessions via chat rooms (<https://discord.com>; <https://zoom.us/>). These applications are freely available and multiOS. It is recommended to install these two applications on your computer. If you do not wish to install them, you need to test that they work properly on your internet browser.

We are looking forward to seeing you soon.

May 30, 2021
Julien CLAUDE & Uthumporn DEESRI

Programme (given in Bangkok time zone)

For each day of the meeting, the zoom webinar URL will be :
<https://umontpellier-fr.zoom.us/j/86002183295>

The online seminar room will be open 30 minutes before it starts everyday.

After each talk is indicated the ID of the “discord” chat room if you want to discuss more, after the zoom sessions, with panelists and their co-authors.

9 June 2021

- 13.30 - 13.35 General introduction: Julien Claude and Uthumporn Deesri [pdb-general]
- 13.35 - 13.55 An International Research Network on Paleobiodiversity in South-east Asia since 2015 : Valery Zeitoun et al. [pdb-zeitoun]
- 13.55 - 14.25 Keynote: Ancient flowering trees in Thailand: stories of past climate, diversity, human connection, and conservation challenges: Nareerat Boonchai [pdb-boonchai]
- 14.25 - 14.45 Various female cones of *Pinus* from the Miocene of eastern Zhejiang, China, Yi Hu et al. [pdb-hu]
- 14.45 - 15.05 Two Species of *Tsuga* from the early Miocene of Northern China and the reassessment of early plant palaeogeography of this genus, Hongyu Wang [pdb-wang]
- 15.05 - 15.25 Palaeodiversity of plants from the late Oligocene to early Miocene of Ban Pa Kha subbasin, Li basin, northern Thailand: spore and pollen proxies, Paranchai Malaikanok et al. [pdb-malaikanok]
- 15.25 - 15.45 First fossil of *Platydictya* (Amblystegiaceae) in East Asia: significance of paleoenvironment, Liyan Guo [pdb-guo]
- 15.45 - 15.55 mini break
- 15.55 - 16.15 A review of the Paleobotanical study of Jianglang site, central Tibetan Plateau, China and future direction, Cédric Del Rio et al. [pdb-delrio]
- 16.15 - 16.35 New fossiliferous deposit from the Pinjore Formation of the Chandigarh Siwalik Frontal Range of northern India, Anubhav Preet Kaur [pdb-kaur]
- 16.35 - 16.55 Fossil insects from the Middle to Upper Miocene, Wang Kaew locality, Mae Sot Basin, Tak province, NW Thailand, Prapasiri Warapeang [pdb-warapeang]
- 16.55 - 17.15 Palaeoecology and palaeoenvironment of the thick gastropods bed in the Mae Moh mine, northern Thailand, Yupa Thasod et al. [pdb-thasod]
- 17.15 - 17.35 Cenozoic ray-finned fish faunas of Thailand: overview and new findings, Bouziane Khalloufi et al. [pdb-khalloufi]
- 17.35 - 17.55 The Cenozoic terrestrial faunas of northern Vietnam, Metais et al. [pdb-metais]
- 17.55 - 18.25 General Discussion. [pdb-general]

10 June 2021

- 13.30 - 14.00 Keynote: *Homo luzonensis*: main characteristics and implications for the evolutionary history of the genus *Homo*, Florent Detroit and Armand Salvador Mijares [pdb-detroit]
- 14.00 - 14.20 Micromammal palaeobiodiversity of prehistoric sites in Mindoro, Philippines, Marian Reyes [pdb-reyes]
- 14.20 - 14.40 Three new extinct species of cloud rats from the Callao Cave Complex, Luzon Island, Philippines, Janine Ochoa et al. [pdb-ochoa]
- 14.40 - 15.00 Exploring Evidence for Early Human-Cuscus (Phalangeridae) Interactions on the Islands of the Asia-Pacific, Shimona Kealy [pdb-kealy]
- 15.00 - 15.20 Taphonomy and site formation history of vertebrate-bearing breccia in the caves of Sumatra, Holly Smith [pdb-smith]
- 15.20 - 15.40 Late Pleistocene and Early Holocene Southeast Asian turtles and tortoises: The Hoabinhian zooarchaeological record, Corentin Bochaton et al. [pdb-bochaton]
- 15.40 - 16.00 New specimens of giant tortoises, *Megalochelys* from Northeastern Thailand, Wilailuck Naksri et al. [pdb-naksri]
- 16.00 - 16.10 mini break
- 16.10 - 16.30 The first record of elasmobranchs from the coastline of Samut Sakorn Province, Thailand., Suchada Khamha et al. [pdb-khamha]
- 16.30 - 16.50 Pollen analysis in ancient whale excavation site at Samut Sakhon province, Thailand, Wipanu Rugmai [pdb-rugmai]
- 16.50 - 17.10 Forty years of continental palaeontology in the Mesozoic of South-East Asia : main results and perspectives, Uthumporn Deesri et al. [pdb-deesri2]
- 17.10 - 17.30 A large ‘macrobaenid’ turtle from the basal Cretaceous of Thailand, Haiyan Tong et al. [pdb-tong]
- 17.30 - 17.50 Mesozoic turtles from South-East Asia as key taxa for understanding the phylogenies of modern taxa, Julien Claude et al. [pdb-claude]
- 17.50 - 18.10 Paleoneuroanatomy of an atoposaurid (Neosuchia, Crocodylomorpha) from the Sao Khua Formation (Thailand) and paleobiological implications., Yohan Pochat et al. [pdb-pochat]
- 18.10 - 18.30 Sibumasu as the key to understanding changing evolutionary modes in the early Palaeozoic: a shared research and geoscience education effort in southeast Asia, IGCP668, Nigel C. Hughes and Shelly J. Wernette. [pdb-hughes]
- 18.30 - 18.50 General Discussion. [pdb-general]

11 June 2021

- 13.30 - 14.00 Keynote: Twenty years of cooperation with Thailand and China to understand the events of the Late Palaeozoic crises, Sylvie Crasquin [pdb-crasquin]
- 14.00 - 14.20 Fossil Ostracods from Limestones in Satun UNESCO Global Geopark (Thailand), Anisong Chitnarin [pdb-chitnarin]

- 14.20 - 14.40 The role of eastern Tethys in the emergence of Mesozoic marine ecosystems : the ostracods' record, Marie-Béatrice Forel [pdb-forel]
- 14.40 - 15.00 Diversity of Permian gastropods from the Indochina Terrane of Thailand, Chatchalerm Ketwetsuriya [pdb ketwetsuriya]
- 15.00 - 15.20 New Early Carboniferous crustaceans (Cyclida and Trilobita) from eastern Peninsular Malaysia and their palaeobiogeographic implications, Hung Yung Tang et al. [pdb-tang]
- 15.20 - 15.40 Preliminary Investigation of Ancient Fossils in Cambodia, Lim Vanchan and Heng Sophady [pdb-vanchan]
- 15.40 - 15.50 mini break
- 15.50 - 16.10 First dinosaur bone from Cambodia : a sauropod fibula from the Late Mesozoic of Koh Kong Province, Eric Buffetaut et al. [pdb-buffetaut]
- 16.10 - 16.30 New sinamiid fish (Actinopterygii: Halecomorphi) from the Early Cretaceous of northeastern Thailand, Uthumporn Deesri et al. [pdb-deesri1]
- 16.30 - 16.50 Postcranial material of a spinosaurid (Dinosauria: Theropoda) from the Early Cretaceous Sao Khua Formation of Khon Kaen, Thailand, Adun Samathi et al. [pdb-samathi]
- 16.50 - 17.30 General discussion [pdb-general]
- 17.30 - 18.15 Diversity Prize announcement and conclusions

Zoom and Discord

Using Zoom during the conference

In order to follow the workshop, participate, and ask question, you need to install the zoom client on your computer. The installation is simple and works for all operating systems. For zoom, you just have to follow the instruction at <https://zoom.us/download>. If you do not want to do the full installation, you can also use it as a plug in in firefox or chrome.

- **Everyone** : Make sure that you have your surname and name indicated correctly. If you are using a pseudo, please rename yourself so that the moderator can identify you.

- **Panelist** : please be ready at least 15 minutes before your talk. If you need training/checking your presentation before the symposium, just email us and we will give you a slot a few days before the conference. Pdf presentations are preferred. Make sure that they are not too heavy. Think about ending your talk at least 5 minutes before the end so that people can ask questions. You will have to share your screen, and to unmute your microphone when starting your talk. You can also activate your webcam (but this is not required). If you feel that your presentation or sharing screen might generate problems, you can email the .pdf of your presentation and I will display it (julien.claude@umontpellier.fr) ; for email larger than 10 Mo, please use a large transfer file system. When you have finished your talk.

- **Attendee** : After the talk is finished, you can raise your hand, and the moderator will allow you to speak. Do not forget to unmute your microphone before you speak. If you need (for instance during general discussions), you can ask the moderator to allow you to use the camera, then he will temporarily change your status as panelist.

To attend the workshop go to : <https://umontpellier-fr.zoom.us/j/86002183295>

Using Discord during the conference

Because people often want to discuss more after each presentation, we have set up chat-rooms for the different talks during the seminar using discord program. Before the conference (and as soon as possible), you can register to the server in discord following that invitation : <https://discord.gg/YPWymcVhEW>

With that invitation, you can have access to the server and the different chatrooms related to each presentation. You can use discord on your browser or you can install it on your computer. You will have to indicate your date of birth before you login, that information will not be displayed at any time but it is required to validate your account. Keep in mind that these chatrooms are public, so we advise you to use english language to engage discussions and chat there. As discord user, we also ask to make sure that you are clearly identified, I therefore recommend to change your pseudo and use your surname and family name so that everyone can identify you.

Once identified by moderators, your status will be upgraded to participant and you can send messages. Only panelists are allowed to send files in chatrooms. We ask authors of papers to regularly watch at their proper chatroom so that they can answer participants's questions even well after their presentation. The discord server will be available until June 12.

If you need to send a file, just send me a private message at julienclaude in discord.

Discord works well, but it is possible that you do not have access to it if your university has a strong firewall. Then you can still use the general discussion slots during the congress to ask your questions. Feel free to ask us (julien.claude@umontpellier.fr) if you encounter any problem.

Late Pleistocene and Early Holocene Southeast Asian turtles and tortoises: The Hoabinhian zooarchaeological record

Corentin Bochaton *¹, Wilailuck Naksri², Valéry Zeitoun³, Prasit Auetrakulvit⁴, Hubert Forestier⁵, Heng Sophady⁶, Christophe Griggo⁷, Julien Claude⁸

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The Quaternary paleontological record of Southeast Asia is not well documented and its composition strongly biased toward large mammals because it is mostly composed of porcupine bone accumulations found in caves. Consequently, our knowledge of the quaternary smaller vertebrates is currently very limited. Hopefully, some taxa among which are freshwater turtles and tortoises are well represented in archaeological deposits which for the Late Pleistocene and Early Holocene periods constitute a useful addition to the paleontological record. In addition of paleobiodiversity information, these archaeological bone remains provide useful data regarding the behaviors of past human groups and their environmental impact in the long run. In this talk, we will present three different chelonian bone assemblages from Hoabinhian archaeological deposits in Thailand and Cambodia. Hoabinhians are the last hunter-gatherer human groups having inhabited Southeast Asia between the end of the Pleistocene era to the mid-Holocene. Our results demonstrate the exploitation for food consumption of several species of chelonian by these prehistoric groups as well as their symbolic use in funerary practices. We also describe the past biodiversity of freshwater turtles and tortoises in the investigated areas and discuss its evolution through time in relation to anthropization and environmental changes.

Keywords: Hoabinhian, Paleontology, Southeast Asia, Tortoise, Turtle, Zooarchaeology

*Speaker

Ancient flowering trees in Thailand: stories of past climate, diversity, human connection, and conservation challenges

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Cenozoic petrified trunks are commonly found in Southeast Asia, especially in Indonesia, Myanmar, Laos, and Thailand. In Thailand, large fossil angiosperm trees have been discovered in the northeast and the north. A few localities from the two regions are discussed here as case studies. In Khorat, fossil wood of legumes (Fabaceae: *Pahudioxylon*, *Cynometroxylon*) and palms are very common. Other families include Combretaceae (*Terminalia*), Meliaceae (*Azadirachta*), and Lecythidaceae (*Careya*). These fossils were discovered in Miocene to Pleistocene gravel deposits of the Ancient Mun River and its tributaries. Based on wood anatomical studies and the Nearest-Living-Relative (NLR) method, the past flora resembles extant flora of mixed deciduous, dry dipterocarp, and dry evergreen forests. According to the Köppen climate classification, the palaeoclimate was tropical wet and dry (Aw) and tropical monsoon (Am), corresponding to the present climate in the northeastern region. Petrified wood in Khorat also provides important archaeological evidence. The Stone Age tools made of petrified wood were discovered in Sung Noen District, Nakhon Ratchasima; thus, archaeologists termed "Sung Noen Culture" to the people who made those tools (Sangvichien, 1987). Besides, an elderly in Khorat used fossil wood to generate a spark for domestic purposes (Jintasakul, 2003). In Doi Soi Malai – Mai Klay Penhin National Park (formerly known as the Petrified Forest Park), Tak province, the modern vegetation is a dry dipterocarp forest and the climate is Aw. However, the discovery of fossil dicot trees, ranging from 20 to 72 meters long, indicates that the region was dominated by a very different forest type during the late Middle Pleistocene. Wood anatomical features of these specimens resemble Fabaceae (*Koombassia*, *Pahudioxylon*, *incertae sedis*), Malvaceae (*Sterculia*), Sapindaceae (cf. *Schleicher oleosa*), and a Nyctoh-like wood from Sapotaceae. Ninety percent of them represent canopy-emergent legume trees. Indistinct growth rings, wide vessels at low densities, exclusively simple perforation plates, and the distribution of their NLRs suggest a tropical lowland forest (Af) similar to present-day tropical rainforests in Maritime Southeast Asia. This research provides evidence of substantial climatic change in Southeast Asia. Unfortunately, with the tropical wet and dry climate, limited budget, and insufficient knowledge in conservation, these ancient trees have been rapidly weathering. These fossil tree sites not only provide a snapshot of the Earth in time and space and can teach us about how our climate and forests have changed through time, but are also flagship symbols for conservation. By protecting these fossil trees where they are found, we can conserve living plants and animals at those sites and generate income for local communities through geotourism. Therefore, by conserving these precious fragments of Earth's history, we are making the best of our present and ensuring a better future for generations to come.

Keywords: petrified wood, dicot, Cenozoic, Khorat, Tak

*Speaker

First dinosaur bone from Cambodia : a sauropod fibula from the Late Mesozoic of Koh Kong Province

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A 70 cm- long limb bone found in Koh Kong Province (south-western Cambodia) is identified as a left fibula of a sauropod dinosaur. It is the first skeletal element of a dinosaur to be reported from Cambodia. It comes from non-marine red beds considered as Late Jurassic to Early Cretaceous in age (the so-called " Grès supérieurs ", which cover vast areas of western Cambodia and have yielded Early Cretaceous palynomorphs in their upper part). The bone from Koh Kong shows similarities with the fibula of the titanosauriform sauropod *Phuwiangosaurus sirindhornae*, from the Sao Khua Formation (Barremian) of Thailand. It suggests that the Early Cretaceous dinosaur fauna of Cambodia was similar to that of the Khorat Group of Thailand, which is not unexpected since in the Mesozoic present-day Cambodia and Thailand were part of the same tectonic unit (the Indochina block), and the sedimentary basin of south-western Cambodia is comparable with the Khorat basin of north-eastern Thailand. The discovery of this dinosaur bone suggests that the non-marine Mesozoic rocks of south-western Cambodia may turn out to be an important source of fossil vertebrate remains.

Keywords: Cambodia, Mesozoic, Dinosauria, Sauropoda, Fibula

*Speaker

Fossil Ostracods from Limestones in Satun UNESCO Global Geopark (Thailand)

Anisong Chitnarin * ¹

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Ratchasima Province, Thailand, Thailand

Fossil faunas have been discovered from Upper Cambrian to Permian strata, either on land or islands of Satun Province. The marine macro fossils such as trilobites, brachiopods, molluscs and nautiloids are charming and well-known for non-geologists. Contrarily, micro-size fossils including radiolarians, graptolites, conodonts, tentaculitids and ostracods found in siliceous and carbonate rocks are useful for stratigraphic and sedimentological context. In this work, Late Ordovician ostracods recovered from Pa Kae limestone and Middle Devonian ostracods recovered from Kuan Tung limestone are discussed. The Pa Kae fauna comprises of 31 species belonged to 14 Families without Binocope ostracods. The assemblage suggests the middle to deep shelf setting. The Kuan Tung fauna comprises of 28 species belonged to 11 Families. Together with tentaculitids and mazuellids, the assemblage represents the deeper marine environment. The Kuan Tung fauna is recognized from Khao Tanan limestone which was assigned to the Permian; therefore, the age of this isolated limestone is revised to Devonian.

Keywords: Pa Kae Formation/ Ordovician/ Kuan Tung Formation/ Devonian

*Speaker

Mesozoic turtles from South-East Asia as key taxa for understanding the phylogenies of modern taxa

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Up to eight taxa of Mesozoic turtles have been described from relatively good material (shells and sometimes skulls) in the last 20 years in Southeast Asia, which allows a phylogenetic assessment within the global phylogeny of fossil and extant turtles : *Siamochelys peninsularis* from the Middle Jurassic of Southern Thailand, *Phunoichelys thirakhupti* and *Kalasinemys prasarttongosothi* from the Upper Jurassic of the upper Phu Kradung Formation of NE Thailand, *Basilochelys macrobios* and an unnamed macrobaenid turtle from the Lower Cretaceous of the uppermost Phu Kradung Formation of NE Thailand, *Protoshachemys rubra* and *Isanemys srisuki* from the Lower Cretaceous of the Sao Khua Formation of NE Thailand, and *Kizylkumemys khoratensis* and *Shashemys laosiana* from the Lower Cretaceous Khok Kruat and Grés Supérieurs Formations of Thailand and Laos respectively. All these taxa have been assigned to three different systematic groups of turtles: basal Trionychoidea, related to living softshell and pig-nosed turtles classified as Trionychia (*Basilochelys macrobios*, *Protoshachemys rubra*, *Isanemys srisuki*, *Kizylkumemys khoratensis* and *Shashemys laosiana*); Xinjiangchelyiidae (*Siamochelys peninsularis*, *Phunoichelys thirakhupti*, *Kalasinemys prasarttongosothi*) and Macrobaenidae (unnamed taxon), which are stem Cryptodira. All these taxa have strong affinities with Chinese taxa or taxa from the eastern margin of Eurasia. Although scientists agree that documenting the anatomy and systematics of these turtle groups is of prime importance to understand the relationships of modern day Cryptodira, no clear agreement has been reached. South-east Asian taxa have not yet been jointly analysed all together within the global phylogeny of turtles. Thanks to additional material found after the initial discovery of these taxa, it is possible to improve our understanding of the phylogenetic relationships of Southeast Asian taxa relative to other taxa worldwide. Based on a large matrix of taxa and characters, we here propose an improved outline of phylogenetic relationships of South-east Asian taxa with other taxa. When Southeastern Asian taxa are included in global phylogenetic reconstructions, phylogenetic hypotheses show that the separation among Xinjiangchelyiidae, basal Trionychoidea and Macrobaenidae is not well supported. In particular several Thai taxa formerly assigned to different groups are found to have direct strong relationships, which suggests that potential transitions might have occurred in South-East Asia. In several phylogenetic scenarios, basal Trionychoidea members split to cluster independently with Xinjiangchelyiidae and Trionychia so that Xinjiangchelyiidae are no longer monophyletic. This demonstrates that fossils from the region are filling major gaps regarding our general understanding of turtle relationships, in particular

*Speaker

for documenting the divergence among modern Cryptodira and of softshell and pig-nosed turtles (Trionychia). This point of view is well supported by the fossil record which tends to point to Asia as the region of origin for modern Cryptodira and Trionychia as these groups have their oldest record there. The analysis also indicates where field work should be intensified in order to better consolidate phylogenetic scenarios.

Keywords: Turtles, Mesozoic, Phylogeny, softshell turtles, Xinjiangchelyidae

Twenty years of cooperation with Thailand and China to understand the events of the Late Palaeozoic crises

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Since 2002, we built strong and efficient cooperation with scientific teams from Thailand (Nankon Ratchasima University) and China (Geosciences University Wuhan and Nanjing Institute of Palaeontology and Stratigraphy). Our common topic is to analyse the behaviour of ostracods (microcrustacea) before – during – after the events of the Late Devonian, Middle-Late Permian and the Permian – Triassic boundary. Our researches realized with Chinese, Thai and French PhD theses and postdoctoral positions were conducted during these twenty years to characterize the changes in ostracod (Crustacea) palaeobiodiversity. The ostracods are benthic microcrustaceans and are very sensible to the variations of the palaeoenvironment. They have the particularity to be present in the fossil record since the Ordovician and still exist today in all aquatic environments. They survived to all the Phanerozoic crises. They are unique tools to apprehend the events of the end of Palaeozoic. Our main topic was the Permian – Triassic boundary. After intensive fieldworks in Thailand and China (GSSP, South China, Tibet), we identified the different stages of extinction and recovery both in neritic and deep environments. The works on Middle-Late Permian and Late Devonian bio-crises are still in progress. Three PhD thesis are devoted to these two intervals in South China.

Keywords: Palaeozoic, ostracods, crises

*Speaker

A review of the Paleobotanical study of Jianglang site, central Tibetan Plateau, China and future direction

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The past diversity in the central Tibetan Plateau (TP), as revealed by macro and micro-fossil of plants, changed throughout the Cenozoic following the dynamics of climate and topography. However, the Cenozoic flora in the core area of TP is still poorly known. A new Eocene site from the TP containing plenty of well-preserved leaves, fruits and seeds was discovered recently. The Jianglang site is located in Bangor County, Lunpola Basin, central TP. which is at 4850 m in altitude and corresponds to the Niubao Formation with is radiometric dating as the middle Eocene (~47.5 Ma). A preliminary analysis reveals ca. 42 leaf morphotypes and ca. 34 morphotypes of fruits and seeds. The taxonomic study focused on fruits and seeds show 21 species of 13 families including Apocynaceae, Buxaceae, Ceratophyllaceae, Fabaceae, Hernandiaceae, Malvaceae, Menispermaceae, Passifloraceae, Rhamnaceae, Sapindaceae, Simaroubaceae, Ulmaceae and Vitaceae. The overall biodiversity corresponds to a tropical to subtropical forest. In addition, the Jianglang leaf traits indicate a subtropical climate, mostly frost-free. All together the fossils show a strong floristic affinity with what we can find in the early-middle Eocene of the Green River Formation in USA and with modern floras in Asia (Southeast China and north of mainland Southeast Asia). This flora is compatible with a low elevation during the Eocene in the Tibetan area. Several new scientific directions were developed in order to give a specific view of the past biodiversity in the TP during the Eocene. The taxonomic study of new fruits and seeds and of the leaves will allow us using the coexistence approach method in order to estimate climate parameters and to confirm or revise previous results. The study of the insects (5% of the total specimens) as well as the plant-insect interaction will bring new light on the ecological process associated to the flora.

Keywords: Biogeography, Eocene, Fruits, Paleobotany, Seeds, Tibet

*Speaker

Forty years of continental palaeontology in the Mesozoic of South-East Asia : main results and perspectives

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Vertebrate palaeontology started in South-East Asia with the discovery of Cenozoic mammal fossils in Burma in the 19th century, followed by the discovery of tetrapods in Triassic beds of Laos. Other vertebrates were later described in the middle of the 20th century in Laos with the discovery of dinosaurs by Josué-Heilman Hoffet, and even later in Thailand where non-marine reptile teeth from the Khorat Plateau were initially mistaken for marine reptiles in the 1960s. Thailand started to play a major role regarding continental Mesozoic palaeontology at the end of the 1970s when Rucha Ingavat initiated forty years of fruitful collaboration between small groups of Thai and French scientists. Subsequently, the team gathered around Varavudh Suteethorn and French and other foreign collaborators played a major role in the development of palaeontology in Thailand. Thanks to collaborative efforts, a large number of fossil assemblages composed mostly of vertebrates were unearthed at several localities in northeastern Thailand as well as in the northern, southern and eastern parts of the country). Many new taxa have been named and the succession of ecosystems and faunas could be reconstructed, as well as their palaeobiogeographical significance, and can now serve as a reference for the region. Fossil remains also included ichnites found in several formations. Palaeontological excavations and discoveries later followed in neighbouring countries involving other teams of scientists: in Laos in Savannakhet province, in Myanmar with the systematic study of fossils from the Kachin amber, and in Malaysia with the recent discovery of freshwater vertebrate microremains. In addition to fundamental research, palaeontology had major impacts in northeastern Thailand where a new kind of scientific tourism could develop centered on the palaeontological heritage. In terms of knowledge transfer, collaborative efforts between teams also resulted in higher education programs allowing students to specialize in palaeontological studies in Thailand. In addition, several international research and higher education programmes have allowed scientists to exchange experiences in the course of joint field trips both in Asia and in Europe and to learn together from new data coming from new techniques. While scientists are currently working on these Mesozoic assemblages, field work and research efforts are still needed to improve stratigraphic correlations and better understand the palaeobiology of the discovered organisms. Stratigraphic correlations between basins must be improved and refined at the regional scale since Mesozoic terrestrial faunas are now known from Myanmar, Thailand, Malaysia, and Laos, with research efforts extending to neighbouring countries (Cambodia) and within countries (e.g., northern and southern Thailand). Kachin amber from Myanmar shows that correlations can be done between terrestrial and marine sequences but this remains to be done for Laotian and Thai formations. Systematic excavations should be intensified in the long term since they can yield important information regarding the palaeobiology of fossil taxa. International collabo-

*Speaker

ration among palaeontologists working in South-East Asia is likely to answer these important questions through the joint work of experts in various disciplines.

Keywords: Mesozoic, Vertebrate assemblages, Review, International collaboration

New sinamiid fish (Actinopterygii: Halecomorphi) from the Early Cretaceous of northeastern Thailand

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The North American bowfin (*Amia calva*) is the only living representative of the Halecomorphi, a clade of ray-finned fish (Actinopterygii) which together with the Ginglymodi (gars) constitute the Holostei. Holostei were more diverse during the Mesozoic than today in both marine and freshwater environments. In Thailand, the Jurassic-Cretaceous Khorat Group has yielded a diverse assemblage of Holostei represented primarily by the Ginglymodi (Deesri et al., 2017). Fifteen years ago, however, remains of Halecomorphi were discovered in the locality of Phu Phok, in the Sao Khua Formation (Cavin et al., 2007), and referred to the Sinamiidae. This family, well characterized by the presence of an unpaired parietal, was so far restricted to northern and central China, and Japan (Yabumoto, 2017). During the last decade, Sinamiidae remains have been found in several localities of the Sao Khua and Khok Kruat formations (Deesri et al., 2017), but most of them cannot be identified at a specific or even generic level. A small specimen found in the locality of Phu Phok provided little information when viewed from the outside, but its CT scan provided a wealth of information on his cranial anatomy. Its morphology differs from *Siamamia naga* found in the same locality, but it is still not known whether these differences are due to ontogenetic differences or to intraspecific variations. During a Thai–Japan joint excavation in 2018 in the locality of Ban Krok Duean Ha, Nakhon Ratchasima province, Khok Kruat Formation, a sub-complete articulated specimen of a Sinamiidae was discovered. It shows clearly different characters from *S. naga*, indicating its belonging to a new species or possibly a new genus. Recently, many isolated remains, including skull bones, vertebral centra and scales, have been collected from the Phu Din Daeng locality, Nakhon Phanom province (Tong et al., 2019). They belong to a species close to *Siamamia naga*, from Phu Phok, supporting the placement of the locality of Phu Din Daeng in the Sao Khua Formation. Interestingly, this locality has also yielded isolated elements referring to the Vidalamiinae, a subfamily of Amiidae with representatives in the freshwaters of the Early Cretaceous of Europe and Western Gondwana (Africa and South America). This clade was considered by Grande and Bemis (1998) as the sister subfamily of the Amiinae subfamily (*Amia* and *Cyclurus*). In their phylogeny, Grande and Bemis (1998) found Sinamiidae in a lower position respectively to Amiinae + Vidalamiinae. The biogeographic signal of Vidalamiinae in Thailand is therefore very different from that of Sinamiidae (Europe plus western Gondwana versus North-East Asia). It should be noted, however, that recent phylogenies of Halecomorphi (Xu, 2019; El-Hossy et al., 2021) have resolved Sinamiidae as a sister group of Amiinae, while Vidalamiinae resolve

*Speaker

as sisters of Sinamiidae + Amiinae. This pattern is quite different from that of Grande and Bemis (1998) and, if confirmed, the occurrence of Sinamiidae and Vidalamiinae in the Lower Cretaceous of Thailand is more logical and will shed new light on the palaeobiogeographical history of these freshwater Halecomorphi worldwide.

Keywords: Halecomorphi, Sinamiidae, Vidalamiinae, Sao Khua Formation, Khok Kruat Formation

Homo luzonensis: main characteristics and implications for the evolutionary history of the genus Homo

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The new species *Homo luzonensis* was described in 2019 from an assemblage of thirteen fossil elements discovered in Callao cave (Luzon island, Philippines) in 2007, 2011 and 2015. Direct dating of two of these fossils by U- series indicate respective minimum ages of 50,000 and 67,000 years. In this keynote, we show that these specimens present a combination of primitive (*i.e.* *Australopithecus*-like) and derived (*i.e.* *Homo sapiens*-like) morphological characteristics which differs from that encountered in all other species of the genus *Homo* known so far, including *H. floresiensis* and *H. sapiens*. The potential implications of the primitive features observed on the bones of the hand and foot on the manipulative and locomotor capacities of *H. luzonensis* are discussed, as well as the hypotheses on the origin of these characteristics and more generally of the species *H. luzonensis*. These characteristics could have been inherited directly from early hominins such as *Australopithecus* or *H. habilis*, hitherto unknown outside Africa, or alternatively have been inherited from Asian *H. erectus* (from China and / or Indonesia) and, after having evolved under selective pressures specific to Luzon island, "resemble" the primitive conditions observed in the hominin tribe. If, considering the hominin fossil record in Asia, the second hypothesis currently seems the most probable, one or the other of these hypotheses would have major implications for our understanding of the recent evolutionary history of the genus *Homo*.

Keywords: Southeast Asia, Philippines, evolution, hominins, Pleistocene, insular endemism

*Speaker

The role of eastern Tethys in the emergence of Mesozoic marine ecosystems : the ostracods' record

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In marine environments, ostracods (Crustacea) have been severely affected by the end-Permian extinction, about 252 Ma, and it is considered that this crisis prompted a deep restructuring of their assemblages: the transition from the Palaeozoic Fauna to the Meso–Cenozoic or 'Modern' Fauna. However, this shift only became truly visible in the Jurassic, so that Triassic marine assemblages can be considered neither really Palaeozoic anymore, nor truly 'Modern' yet. The Permian and Triassic are consequently pivotal to unravel the evolutive history of these organisms, how modern marine ecosystems were restructured in the long term. During the Early Triassic, marine ostracod assemblages are largely known from South China where they illustrate two very distinct and unique survival strategies. The first one is the result of the exploitation of 'oases' provided by microbial mats that thrived in the direct aftermath of the extinction. The second one corresponds to the local survival of pre-adapted taxa in association with high sediment influx. The Middle and Late Triassic taxa have been extensively studied during the 1970's and 1980's: most of what we know today of ostracods during this period and during the Jurassic derives from European localities, which has led to consider that Modern ostracods radiated in western Tethys. However, new data lay the groundwork for a revolution of how we conceive the origin of Triassic and modern marine ostracods. Several assemblages from Northern Thailand (Sukhothai terrane) and South China evidence the oldest records of taxa considered as typical of Triassic and Jurassic interval of the western Tethys. These observations are the very first tangible evidences of the hypothesis already being proposed in the 1980's that the eastern portion of the Tethys might have played a major role in the radiation of 'Modern' marine ostracods during the Triassic, which then might have colonized the western Tethys owing to the Late Triassic transgression.

Keywords: Ostracods, Permian, Triassic, eastern Tethys, radiation, dispersal

[†]Speaker

First fossil of *Platydictya* (Amblystegiaceae) in East Asia: significance of paleoenvironment

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The mosses is a simple group of plants lacking vascular tissue, which are not easy to preserve in the strata. Therefore, there are few well preserved moss fossils in geological history. *Parafunaria sinensis*, probably the ancestor fossil of bryophytes, was discovered in the Cambrian Kaili Formation of Guizhou Province, which has the characteristics of small mosses and lack of vascular tissue. Although some moss fossils have been found in the Paleozoic and Mesozoic strata, it is difficult to accurately identify their taxonomic location, and they were extinct before the Cenozoic. It was not until the Neogene and early Quaternary that the fossil records of bryophytes in the strata became more and more abundant. Almost all of these fossil bryophytes can identified to their corresponding living species, so most of them are directly classified as existing genera and species. There are adaptive characteristics between organisms and environment. Certain plant communities depend on certain environments, and environmental changes will lead to adaptive adjustment of plants. Their migration evolution and spatial and temporal distribution are closely related to environmental changes, so we can invert paleogeography and paleoclimate accordingly. Fossils can store this information well, and the kinship between species is partly a reflection of that. By comparing the newly discovered fossil species with the known species, the relevant information between plants and their living environment can be inferred, thus providing a reference for the prediction of paleoecological environment and paleogeography. In previous studies on fossil moss fauna in Europe and North America, Kuc classified the fossil mosses from the early Pleistocene lignite seam in northern Ellesmere Island as living *Drepanocladus*, *Calliergon* and *Sphagnum*. *Leptodictylum riparium*, *Drepanocladus subtrichophyllus* sp. Nov. and *Amblystegium varium* discovered by Guo Caiqing et al. in Weichang, Hebei Province during the early Miocene in northern China are also classified as present genera. *Platydictya jungermannioides*, a fossil moss found in Chifeng, Inner Mongolia, is very similar to the living mosses. Therefore, it is verified that Miller's viewpoint that the Neogene bryophytes in the northern hemisphere are not essentially different from the present bryophytes. In this study, a moss fossil was found in the early Miocene strata in the Chifeng area of Inner Mongolia. Through detailed observation of the macroscopic morphology and microstructure of the fossil, the moss has the characteristics of small but slender branches and leaves with serrulate margins and no costea. Therefore, it was identified as *Platydictya jungermannioides* (*Platydictya*, Amblystegiaceae). This fossil belongs to the first record of Willow moss in East Asia. According to the existing *Platydictya jungermannioides* living in the moist base of the tree trunk, combined with the characteristics of woody plants in the early Miocene Pingzhuang area of Chifeng, Inner Mongolia, it is speculated that the Pingzhuang fossil *Platydictya jungermannioides* is in a warm and humid micro-habitat with extensive forest coverage. Therefore, we know that Chifeng Pingzhuang was located in a relatively humid forest environment at early Miocene.

Keywords: fossil plants, Chifeng city, Miocene, fossil mosses, paleoenvironment

*Speaker

Various female cones of *Pinus* from the Miocene of eastern Zhejiang, China

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Zhejiang lying on the southeast of China, is characterized by a humid central subtropical climate with varying seasonality today. This region has extremely high species diversity, and then is known as "the treasure house of plants" in southeast China. The studied section, lithologically confined to the Shengxian Formation, is located at the opencast diatomite mine, near the Jiahu Village of Tiantai County, Zhejiang Province, China. The sediments consist of several layers of alternate basaltic and sedimentary rocks representative of repeated continental volcanic and fluvial-lacustrine successions. The age of the Shengxian Formation has been interpreted as Late Miocene on the basis of ^{40}Ar - ^{39}Ar dating. As one of the highly diversity Neogene floras in China, this flora is not only composed of paleotropical-tertiary elements (e.g. tropical) but also arcto-tertiary elements (e.g. temperate). In this work, we recognize four fossil taxa of *Pinus* (Pinaceae) based on fossil cones from the late Miocene Shengxian Formation. *Pinus* is a evergreen genus of trees and rarely shrubs with a very large distribution range in the Northern Hemisphere. Only one species, *Pinus. merkusii*, grows in the mountains of central Sumatra of western Indonesia and its geographical range just crosses the equator into the Southern Hemisphere. This genus is of ecologically and economically great significance and usually pine trees are dominant components of boreal and mid-low latitudinal montane forests. It is subdivided into two subgenera *Strobilus* (Sweet) Rehd. and *Pinus* on the basis of cone and leaf. Detailed morphological comparisons enable our fossils to be assigned to the type of perexcentromucronate (only discovered in seven modern species of subsect. *Pinus*), characterized by a short mucro lies above the transverse keel near the upper margin of the umbo. Diverse taxa at species level from the Shengxian Formation, indicate a fairly high diversity in the late Miocene. The combination of evergreen or deciduous broad-leaved, and coniferous taxa documented from the paleoflora implies vertical zonation in local vegetation. This work is supported by the National Natural Science Foundation of China (grant numbers 41972010, 41872017); the Foundation of State Key Laboratory of Palaeobiology and Stratigraphy (Nanjing Institute of Geology and Palaeontology, CAS) (grant numbers 193113, 183125); Opening Foundation of Shaanxi Key Laboratory of Early Life and Environments (Northwest University).

Keywords: Miocene, diversity, *Pinus*, cones

*Speaker

Sibumasu as the key to understanding changing evolutionary modes in the early Palaeozoic: a shared research and geoscience education effort in southeast Asia, IGCP668

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The latest Cambrian – earliest Ordovician witnessed the last of the "boom and bust" evolutionary episodes before the transition to the more prolonged evolutionary radiation that characterized the "Great Ordovician Biodiversification Event". These episodes comprised evolutionary radiation of shallow-shelf invertebrate fauna followed by a rapid extinction. The later Cambrian also experienced a global peak in felsic volcanism, as indicated by the prolific production of zircon grains. The main locus of that volcanism was the equatorial peri-Gondwanan margin, and its best record is in the ancient microcontinent of Sibumasu – which encompasses parts of Malaysia, Sumatra, Thailand, Burma and likely also the Baoshan region of China. Oddly, the upper Cambrian is also one of the most poorly geochronologically calibrated intervals of the entire Phanerozoic, likely because Sibumasu's geology still offers many new opportunities for discovery. Ko Tarutao, an island in Thailand's Satun Province, and the southern part of the Burma's Shan State both contain datable tuff horizons interbed with trilobite and brachiopod-bearing sandstones, providing the opportunity to integrate new radioisotopic dates with equatorial Gondwanan trilobite-based biostratigraphy, and thus to greatly improve dating of the Furongian Series. We are also interested in using information from fossils, stratigraphy, and detrital zircons to reconstruct the palaeogeography of the equatorial peri-Gondwanan sector and to test recent models such as one that places North China in a detached, mid Palaeo-Pacific position. UNESCO-funded IGCP668 (<https://swern001.wixsite.com/igcp668>) brings local and international scientists together to investigate the Cambrian and early Ordovician palaeontology and geology of Sibumasu, including integrated biostratigraphical, palaeogeographical and geochronological analysis of these rocks. So far, we have held meetings, workshops and fieldtrips in Thailand, the USA, and Myanmar, and Japan's University of Tsukuba will host an on-line conference this summer <https://swern001.wixsite.com/igcp668/next-meeting>. IGCP668's mission includes a variety of geoscience outreach projects aimed at place-based education for communities near to fossil localities; interested non-scientists from South and Southeast Asia have partnered with IGCP668 to craft outreach visuals to suit local audiences. IGCP668 is co-lead by scientists from Thailand, Burma, China, Japan and the USA. It involves collaborators from several other southeast Asian countries including Malaysia, Việt Nam and Cambodia as well as other scientists worldwide.

Keywords: Cambrian, IGCP 668, trilobites, brachiopods



*Speaker

New fossiliferous deposit from the Pinjore Formation of the Chandigarh Siwalik Frontal Range of northern India

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The Chandigarh Siwalik Frontal Range provides one of the most extensive and continuous exposure of the Pinjore Formation (2.6-0.7 Ma) in northern India. Since 20th century palaeontologists have been extensively surveying the region that resulted in a vast collection of Pinjore mammalian faunal remains. These collections are housed in the American Museum of Natural History, the Yale-Peabody Museum, Natural History Museum-London, Wadia Institute of Himalayan Geology and Panjab University. However, most of the evidences are either in secondary context i.e., from ephemeral streams or recovered from surface of the slopes. Therefore, their exact stratigraphic position and geological association is still unknown. A fresh set of surveys were initiated in January 2020 in order to identify new fossil localities (in a datable and stratified context) and re-survey the previously known ones from the region. The main objective of these surveys was to understand the chrono-contextual relationship of the fossils within Pinjore geological deposit for more accurate palaeoenvironmental reconstructions. As a result, six new fossil localities with multiple findspots have been identified, across the region. These have yielded a variety of fossilized vertebrate remains ranging from bovids, rodents, equids, cervids, proboscideans, hippos and ostrich egg shells. In March 2021, a trial excavation was conducted at the richest fossil locality (CBN 22) that resulted in recovery of in-situ fossil remains. This research is a part of a project focused on understanding the human-animal-environment interface in the Pinjore Formation of the Chandigarh Siwalik Frontal Range. The present paper focuses on reporting and summarising recent field results, its implications, future scope and plan of action.

Keywords: Vertebrate Palaeontology, Siwalik Hills, Pinjore Formation

*Speaker

Exploring Evidence for Early Human-Cuscus (Phalangeridae) Interactions on the Islands of the Asia-Pacific

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Cuscuses – the northern radiation of members of the family Phalangeridae – have a fascinating history of human interactions. Not only are cuscus considered the first Australasian marsupial encountered by Europeans, but the archaeological record suggests they could be the very first animals purposely introduced by humans – as much as 23,000 years ago to the island of New Ireland. Today, members of the Phalangeridae family are the most widely dispersed of the marsupial families; found throughout eastern Indonesia, New Guinea, Micronesia, Melanesia, and Australia (even discounting the very recently introduced brushtail possums on New Zealand!). Here I discuss the archaeological records for cuscus hunting on the different islands of Indonesia, Timor-Leste, New Guinea and the Solomons, exploring the value this resource presented past peoples with regards to subsistence strategies, incentives for translocation of cuscus, and the state of current evidence to support hypotheses of early translocation on different islands. A greater understanding of past cuscus-human interactions has important implications for our understanding of early inter-island networks in the Asia-Pacific region as well as the ecological impacts of humans on islands and improved conservation management strategies in these unique ecosystems.

Keywords: Possums, ISEA, Indonesia, PNG, archaeology, phylogenetics, translocation

*Speaker

Diversity of Permian gastropods from the Indochina Terrane of Thailand

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Thailand is geographically located in Mainland Southeast Asia, which was formed by the collision of the Indochina Terrane in the East and the Sibumasu terrane in the West during latest Paleozoic to early Mesozoic times. Permian gastropod assemblages, from the Tak Fa, Khao Khad and Khao Taa Ngog formations of the Indochina Terrane of Thailand, have been investigated regarding diversity and taxonomic compositions based on quantitative data. All studied faunas come from shallow water carbonates that are rich in fusulinids, followed by e.g., gastropods, ostracods, bivalves and brachiopods. These gastropod faunas, comprising 85 species in total, yielded bellerophontids, euomphalids, pleurotomarians, trochids, neritids, murchisoniids, cerithiids, loxonematids and subulitids. The comparison between the taxonomic compositions (at the species level) of these three Permian gastropod assemblages reveals that they differ strongly from each other. Therefore, this could suggest that beta-diversity is high in the Permian carbonate platforms of the Indochina Terrane of Thailand. Most of the studied gastropod species belong to Late Palaeozoic cosmopolitan genera such as *Bellerophon*, *Warthia*, *Worthenia*, *Naticopsis*, *Meekospira*, *Protostylus* and *Streptacis*. These results facilitate a better understanding of palaeobiogeography in Thailand.

Keywords: Tak Fa Formation, Khao Khad Formation, Saraburi Limestone, PaleoTethys

*Speaker

Cenozoic ray-finned fish faunas of Thailand: overview and new findings

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In Thailand, Paleogene and Neogene rocks are distributed in a series intermontane basins, resulting from an active rifting during middle-upper Paleogene. Several fossiliferous outcrops, often associated with coal mining or the excavation of water reservoirs, have yielded vertebrate assemblages formed by tetrapods (mammals, reptiles and a few amphibians) and actinopterygians. However, even though actinopterygian remains are frequently cited in geological reports or in paleontological studies, they are rarely identified or described. To date, three studies published in scientific journals along with a few unpublished reports were dedicated to the Cenozoic fish faunas. Most of the material collected these last decades is still unpublished and stored in Thai scientific institutions. Paleogene ray-finned fish-bearing localities are restricted to the Peninsular Thailand, with a material dated as Late Eocene in the Krabi basin and as Late Oligocene in the Nong Ya Plong and Khian Sa basins. The Neogene record is richer and known in the Northern (Lampang, Li, Mae Moh, Mae Teep basins), Central (Phetchabun basin) and Western (Mae Sot basin) parts of the country. Both Paleogene and Neogene ray-finned fishes are retrieved in continental deposits and are exclusively represented by teleosts, marking a break with the older continental late Mesozoic faunas, predominantly formed by ginglymodians and lungfishes. However, the Cenozoic remains are rare, fragmentary and often restricted to poorly diagnostic elements. The few exceptions are articulated specimens originated from the Miocene basins of Mae Moh, Mae Sot and Phetchabun, related to the Recent freshwater assemblages from the Mekong, Chao Praya and Salween rivers. New articulated specimens were recently collected from unpublished outcrops of the Phetchabun basin. This assemblage, previously known only from private collections, is similar in term of taxonomic diversity to the other described outcrops of the basin. However, it differs significantly in the relative proportions of the taxa, indicating a different paleoenvironment. The scarcity of Cenozoic ray-finned fishes in Thailand, compared to their current freshwater biodiversity, is also observed in other Cenozoic localities of Southeast Asia. Only a few sites have yielded a noteworthy fauna, in Indonesia (Eocene Sangkarewang Formation), Vietnam (Eocene Na Duong and Oligocene Cao Bang basins) and Myanmar (Eocene Pondaung and Miocene Irrawady Formations). In spite of this inadequacy, the Southeast Asia Cenozoic record includes the rare fossil occurrences of several actinopterygian clades, such as glassfishes (Ambassidae), labyrinth fishes (Anabantoidei) and shark catfishes (Pangasiidae).

Keywords: Actinopterygii, Cenozoic, Thailand, Freshwater, Continental environments

[†]Speaker

The first record of elasmobranchs from the coastline of Samut Sakorn Province, Thailand.

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An almost perfectly preserved whale skeleton has been discovered in Thailand. The 138 bones were found in a soft marine clay known as the Bangkok Clay, some 12 km from the coast just west of Bangkok in Samut Sakorn Province. Carbon-14 (¹⁴C) dating of a bone sample indicated that it is only $3,380 \pm 30$ years ago. In addition, isolated teeth of elasmobranch were found associated with the whale skeleton, including teeth of Carcharhinidae indet., *Glyphis* sp., Myliobatidae indet., as well as fragmentary spines of Myliobatiformes. These sub-fossils allow reconstructing the biological community at the time, as well as precisising the conditions of deposits and an estimate of the sea level.

Keywords: elasmobranch, sub, fossil, Thailand, Bangkok clay

*Speaker

Palaeodiversity of plants from the late Oligocene to early Miocene of Ban Pa Kha subbasin, Li basin, northern Thailand: spore and pollen proxies

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To obtain a clearer picture of palaeodiversity of plants during the late Oligocene to early Miocene of Ban Pa Kha subbasin, Li basin, northern Thailand, fossil sporomorphs in sediments collected from interburden layer of the subbasin were extracted using a standard palynological procedure. Combined LM and SEM study with a single grain technique was used to examine recovered palynomorph fossils. A total of 59 sporomorph taxa were found, including 5 pteridophyte spore taxa, 7 gymnosperm pollen taxa, 39 angiosperm pollen taxa, and 8 unidentified taxa, which appeared to be twice as many as those found in previous studies. Higher taxonomic resolution can be observed in 3 genera, *Pinus*, *Alnus*, and *Quercus*. These include 2 morphotypes from genus *Pinus* belonging to subgenera *Pinus* and *Strobus*, 4 morphotypes from genus *Alnus* belonging to subgenera *Alnus/Clethroopsis* and *Alnobetula*, as well as 9 morphotypes from genus *Quercus* belonging to group *Ilex* and group *Quercus/Lobatae*. Surprisingly, spore and pollen fossils of many taxa were found in Thailand for the first time, including sporomorphs of *Osmunda*, (Osmundaceae), *Abies* (Pinaceae), *Sciadopitys* (Sciadopityaceae), *Aralia/Polyscias/Schefflera* (Araliaceae), *Diospyros* (Ebenaceae), Ericaceae, *Rehderodendron* and *Styrax* (Styraceae), Sapotoideae/Chrysophylloideae (Sapotaceae), *Symplocos* (Symplocaceae), and *Viburnum* (Adoxaceae). Such new discoveries of fossil palynomorphs from many plant taxa would allow us to have an insight into palaeodiversity of plants and their environments during the late Oligocene to early Miocene of northern Thailand.

Keywords: fossil, palynoflora, Cenozoic, Thailand

*Speaker

The Cenozoic terrestrial faunas of northern Vietnam

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Today, the Indochina region represents one of the global hotspots in biodiversity, especially with regard to continental flora and fauna. But the deep history of the continental ecosystems in this region remains spottily documented. Here we will focus on the Eocene and Miocene terrestrial faunas of northern Vietnam with a special emphasis on the late Eocene mammal assemblage of NaDuong. The NaDuong Basin is a small pull-apart basin formed during the Paleogene along the sinistral strike-slip Red-River Faults Zone in which lacustrine coal like sediments accumulated since at least the middle Eocene. These deposits yielded high biodiversity of fossil leaves, dipterocarp trees, mollusks, freshwater fishes, turtles, crocodiles (three taxa), and several well identified mammal taxa that all suggest a late middle to late Eocene age for the coal-bearing Na Duong Formation. Among mammals, anthracotheriids are the most diversified with at least 3 genera and 4 species. An indeterminate traguloid ruminant, and the rhinocerotid *Epiaceratherium* are also present in the fauna. The Eocene mammal faunas from Na Duong and Europe highlights the importance of Southeast Asia as a source region for trans-continental mammal dispersal along the northern Tethys margin, and also probably suggests episodic faunal exchanges with Africa. The mammal assemblage reinforces the hypothesis that Southeast Asia was an important source of Eocene immigrants, which eventually replaced most of the European Eocene endemic faunas, with a culmination at the ‘Grande Coupure’.

Keywords: Vietnam, Cenozoic, Mammals, Paleobiogeography

*Speaker

New specimens of giant tortoises, *Megalochelys* from Northeastern Thailand

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Megalochelys is an extinct genus of giant tortoises which has been recorded from India to Indonesian islands from the Pliocene to the Pleistocene. They had a long-distance dispersal on mainland and islands of South and Southeast Asia. *Megalochelys sivalensis* has been reported first from the Plio-Pleistocene beds of Siwalik, India. Then this genus has been reported from the Early Pleistocene of the Bumiaya area, Central Java, and in Sulawesi and Timor islands. Apart from these, *Megalochelys* is also present in peninsular Southeast Asia including in the Lower Irrawaddy beds of Myanmar and in Thailand. In 2019, *Megalochelys* sp. from Tha Chang sandpits, Chaloem Pra Kiat District, Nakhon Ratchasima Province, Thailand have been described in detail. The material consists of carapace, plastron, limb bones, and isolated plates. Three different morphotypes of epiplastron projections have been recognized. Undescribed new specimens of *Megalochelys* from Tha Chang sandpits are represented by articulated and isolated shell elements and also a femur. These new specimens suggest that these tortoises were abundant in this locality. Based on the size of plastron and epiplastron projections, the new material belongs to sub-adult individuals. Variations in shape of epiplastron projections should correspond to sexual dimorphism and different ontogenetic stages.

Keywords: Giant tortoise, *Megalochelys*, Neogene, Thailand

*Speaker

Three new extinct species of cloud rats from the Callao Cave Complex, Luzon Island, Philippines

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Archaeological excavations in the Callao Cave Complex in northeastern Luzon, Philippines, have produced specimens of fossil and subfossil murid rodents of the endemic tribe Phloeomyini that date from ca. 67,000 BP to the Late Holocene. We identify three extinct species which we name as new members of the genera *Batomys*, *Carpomys*, and *Crateromys*, distinguished from congeners by body size, distinctive dental and other morphological features, and occupancy of a habitat (lowland forest over limestone) that differs from the high-elevation mossy forest over volcanic soils occupied by their congeners. *Batomys cagayanensis* n. sp. is known only from two specimens from ca. 67,000 BP; *Carpomys dakal* n. sp. and *Crateromys ballik* n. sp. were present from ca. 67,000 BP to the Late Holocene. These add to the species richness and morphological diversity of this endemic Philippine radiation of large folivores and show specifically that the lowland fauna of small mammals on Luzon was more diverse in the recent past than it is currently. The new *Carpomys* and *Crateromys* also add to the tally of giant cloud rats, indicating that Luzon recently supported five species of giant rodents (ca. 1 kg or more). As the first Philippine small mammals to be known only from fossils, these new species also add palaeoecological context to the discovery of *Homo luzonensis* described from Callao Cave. All three cloud rat species occurred contemporaneously with *H. luzonensis*, and two, the new *Carpomys* and *Crateromys*, persisted until the Late Holocene when multiple exotic mammal species, both domestic and invasive, were introduced to Luzon, and new cultural practices became evident, suggesting that modern humans played a role in their extinction.

Keywords: biogeography, body size, extinction, oceanic islands, zooarchaeology

*Speaker

Paleoneuroanatomy of an atoposaurid (Neosuchia, Crocodylomorpha) from the Sao Khua Formation (Thailand) and paleobiological implications.

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The internal endocranial structures of an undescribed atoposaurid crocodylomorph from the Sao Khua Formation (Cretaceous: Berriasian-Barremian) in the North-East of Thailand are investigated. The specimen is comparable in size and external morphology to *Theriosuchus grandinaris* Lauprasert et al. 2011 but is preserved with the braincase uncrushed, contrary to the previously described holotype. We document for the first time the internal braincase structures in atoposaurids using synchrotron X-ray micro-computed tomography. The endocast of the braincase, associated nerves and arteries, auditory labyrinth, and cranial pneumatization, although quite deformed, are reconstructed at high resolution and compared to those of extant and fossil crocodylomorphs, representative of different ecological adaptations. This atoposaurid specimen shows an antero-posterior brain curvature and pericerebral spines (new structures), somewhat developed cerebral hemispheres, expanded semicircular canals with a more developed anterior one but an almost straight lateral one, a dorsoventrally expanded pituitary fossa, but also overdeveloped intertympanic diverticula and pharyngotympanic sinuses. The ecological significance of these structures is explored and, using different proxies and comparisons with extant taxa, we suggest that this specimen likely exhibited a downwardly tilted head posture (by about 10°) and was sensitive to both low and mid frequencies. Functional comparisons are proposed between this specimen, extinct terrestrial crocodylomorphs (sebecosuchians), extant semi-aquatic crocodylians and aquatic (thalattosuchians) forms. From the morphology of the auditory labyrinth, we infer an enhanced sensitivity to pitching rather than yawing. Several hypotheses are formulated regarding the pneumatization of the skull. These features are discussed in ecological and phylogenetic frameworks. Our results highlight the need to gather new data, especially on altirostral forms, in order to deepen our understanding of the evolution of

*Speaker

endocranial structures in crocodylomorphs with different ecological specializations, as well as to integrate them into new phylogenetic approaches.

Keywords: Thailand, Atoposauridae, Theriosuchus, neuroanatomy

Micromammal palaeobiodiversity of prehistoric sites in Mindoro, Philippines

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The Philippine archipelago, as a hotspot of biodiversity with the highest number of endemic mammal species in the world on a per-area basis, has a small mammal composition exhibiting a high level of species richness, diversity and endemism. However, despite the rich and diverse faunal biotope profile in the country, the archaeological record of micromammals is still a developing field of inquiry. Excavations of three site localities in Mindoro: shell middens in Bubog rockshelter sites of Ilin Island; and Talisay Cave sites in mainland Mindoro, revealed a range of unexpected micromammal remains. A study on these materials provided additional insights on the changing environments and adaptive human subsistence strategies in the transitional region of Mindoro. The region's micromammal palaeobiodiversity was rich, with a considerably long list of species for rodents (*Crateromys paulus*, *Crateromys* cf. *australis*, *Rattus everetti*, *Rattus mindorensis*, *Maxomys* sp., and *Anonymomys mindorensis*), bats (*Aceredon jubatus*, *Styloctenium*, *Pteropus pumilus*, *Taphozous* sp., *Hipposideros diadema*, and *Rhinolophus* cf. *rufus*) and a shrew (*Crocidura grayi*). Almost half of the micromammal assemblage was represented by endemic species, 50 % endemic for rodents, and 33% endemic for bats. Palaeoenvironment reconstructions of the area suggest a landscape that changed in accordance to the climatic and geographic parameters during the Terminal Pleistocene to Holocene, especially in Ilin Island. The occupation period in Ilin corroborates with the opening of waters surrounding it, as reconstructed by bathymetric data, and an observed shift to more marine-adapted subsistence patterns in the island. About this time, a predominance and abundance of *C. paulus* remains and an increased micromammals species diversity was noted. Faunal studies of Ilin materials proved that coastal resources such as malacofauna, fish, and a few crustaceans, were the most exploited materials, while remains of the larger-bodied vertebrates like suids, bovid, cervid (Pawlik et al. 2014, Boulanger 2015, Boulanger et al. 2019) were found in low frequencies. The consumption of giant cloud rat *C. paulus*, which probably became the micromammal prey of choice in the absence of bigger sources of protein from terrestrial environments, was confirmed by the abundance of its remains, and some evidence of cutmarks and burning on a few materials.

Keywords: micromammals, cloud rat, rockshelter sites, Mindoro, island biogeography

*Speaker

Pollen analysis in ancient whale excavation site at Samut Sakhon province, Thailand

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The discovery of ancient whale remains at Ban Phaeo district Samut Sakhon province in November 2020 brought an attention of Thai society to whales, their environment and ancient sea level in the area. In this regard, palynology can be used to investigate past vegetation because a small amount of sediment can provide a large and variety of pollen which lead to plant identification and plant community reconstruction and their changes through times. In this study, ten clay sediment samples were collected in the whale excavation site at depths 7.50, 7.25, 7.00, 6.75, 6.50, 6.25, 6.00, 5.75, 5.50 and 5.25 m, respectively. The sediment samples were processed by using various chemicals treatment for removal of CaCO₃, siliceous matter, and cellulose. Pollen found in all sediments were mainly in Rhizophoraceae family, together with pollen of *Avicennia* spp. in Acanthaceae, *Sonneratia* spp. in Lythraceae which indicate mangrove ecosystem. Some pollen of floodplain ecosystem (Poaceae, Cyperaceae, and Typhaceae) and lowland ecosystem (*Quercus* in Fagaceae, Euphorbiaceae, and Myrtaceae) were also found. Changes of mangrove pollen percentages in sediment samples indicated changes in sea levels in the area.

Keywords: pollen, mangrove, whale, sea level, Thailand

*Speaker

Postcranial material of a spinosaurid (Dinosauria: Theropoda) from the Early Cretaceous Sao Khua Formation of Khon Kaen, Thailand

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The Spinosauridae is a clade of large-bodied theropod dinosaurs with an elongated snout and crocodile-like teeth from the Jurassic and Cretaceous of Gondwana and Laurasia. They were presumably, at least partially, piscivorous. The Spinosauridae is traditionally recognized as a member of the Megalosauroidea. However, some authors found that the Spinosauridae was identified as belonging to the basal Carnosauria, outside Megalosauroidea. The Spinosauridae monophyly is well supported, whereas the relationship within the lineage of Spinosauridae remains largely debated. The Spinosauridae can traditionally be divided into two subclades, the Spinosaurinae and the Baryonychinae. Another study, however, found that only the Spinosaurinae, which forms a monophyletic clade, is valid, whereas the Baryonychinae is a paraphyletic series relative to the Spinosaurinae. Although some studies found a polytomy where the relationships within the Spinosauridae are unresolved and need further studies. New postcranial material of a spinosaurid is here reported. It consists of caudal vertebrae found from the Early Cretaceous Sao Khua Formation of Phu Wiang Mountain, Khon Kaen, Thailand. These caudal vertebrae resemble the Portuguese *Baryonyx* and pertain to the Spinosauridae based on the presence of striations on the surface of the transverse process of the caudal vertebrae, well developed double keels and a deep ventral groove on the centra, two laminae, delimiting three fossae below the transverse process, and posterior caudal vertebrae having curved, rod-like neural spines with small process at the base. This supports the presence of spinosaurids in the Sao Khua Formation of Thailand. The spinosaurids were often found in association with other large-bodied theropods, and sometimes with other different spinosaurid taxa. The presence of more than one spinosaurid taxon in the same region or strata is common, as observed in the Kem Kem Beds of Morocco, the Araripe Basin of Brazil, the Iberian Peninsula, and the Khorat Basin in Southeast Asia.

Keywords: dinosaur, theropod, spinosaurid, taxonomy, Thailand

*Speaker

Taphonomy and site formation history of vertebrate-bearing breccia in the caves of Sumatra

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Conventional direct dating methods are susceptible to significant risk of time- or habitat-averaging in complex tropical cave environments due to natural ‘mixing’ processes of remains. Thus, I have formed a novel multimethod model to establish the dominant factors responsible for the accumulation and preservation of vertebrate remains in karstic breccia from Sumatran caves. A digital imaging survey combined with a micro-contextual study reveals the internal composition of fossiliferous deposits from Lida Ajer, Ngalau Gupin and Ngalau Sampit cave in the Padang Highlands of western Sumatra that would otherwise have been disregarded or destroyed using standard excavation methods. Thermal neutron imaging of karst breccia gives a three-dimensional view of spatial location and temporal sequence of sediment layers and inclusions within the breccia laid down during formation, revealing several rapid depositional phases of water and sediment gravity flow. Micromorphological analysis exposes the internal geometry and situation of incorporated components, revealing several further taphonomic agents including carnivore occupation, water action and calcite precipitation. This research successfully reconstructs the complex taphonomic history of fossil assemblages in the caves of Sumatra and the diagenesis of the sediments in which they are held. This multi-method approach could be reconstructed to resolve mechanisms of site formation, depositional history, and faunal accumulation in further tropical cave sites. This evidence may establish stratigraphic provenance and temporal positions of fossil-bearing deposits in complex depositional environments across Southeast Asia.

Keywords: taphonomy, neutron tomography, micromorphology, Pleistocene, cave, Sumatra

*Speaker

New Early Carboniferous crustaceans (Cyclida and Trilobita) from eastern Peninsular Malaysia and their palaeobiogeographic implications

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Two species of Early Carboniferous (Visean) crustaceans are recovered from eastern Peninsular Malaysia (East Malaya Block). They were found together with a diverse marine fauna from the Bukit Buchu beds of Terengganu, which has currently been investigated under the first author's postgraduate project. First, *Malayacyclus terengganuensis* Tang et al., 2021, a new genus and species of a rare fossil crustacean, the Cyclida, was recently proposed. The new genus possesses diagnostic features of the two earliest cyclidan families, Cyclidae and Americlidae. It is tentatively included in the Americlidae; nevertheless, *Malayacyclus* develops trifurcate posterior spines, a unique morphology that was not known previously for the cyclidan animals. *M. terengganuensis* represents the first find of the Cyclida from Southeast Asia. During the Early Carboniferous, the Cyclida were confined to the warm-water Palaeo-Tethys. Most cyclidan occurrences are from Europe, as some 12 species were reported from the Early Carboniferous strata of the British Isles (Ireland and Great Britain) and Belgium. In contrast, only two cyclidan species are known from the Carboniferous of the eastern Tethys (Asian Tethys), one from Japan and now *M. terengganuensis* from Malaysia. Second, the phillipsid trilobite *Linguaphillipsia* n. sp. co-occurs in the Bukit Buchu beds. It possesses a tongue-shaped glabella, ties in with a well-defined border furrow on the pygidium, characteristics of *Linguaphillipsia* Stubblefield, 1948. The type species, *Linguaphillipsia terapaiensis* was reported from the Visean of Pahang, Malaysia. The new form is distinct from the type species, suggesting the second Visean species of *Linguaphillipsia* from the East Malaya Block. Species of *Linguaphillipsia* are known only from the Tournaisian-Visean strata, occurring Australia through Asia to Europe of the warm-water Palaeo-Tethys. In summary, the marine crustaceans found from the Visean of the East Malaya Block (proto-Indochina margin) represent warm-water Tethyan elements and are endemic.

Keywords: Early Carboniferous, Crustacea, Cyclida, *Linguaphillipsia*, Malaysia, palaeobiogeography

*Speaker

Palaeoecology and palaeoenvironment of the thick gastropods bed in the Mae Moh mine, northern Thailand

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Twelve meters thick gastropod beds from the middle Miocene, Mae Moh mine, Lampang province, northern Thailand were studied. We found a high variation of gastropod fossils than previously reported that are (1) Viviparidae that composed of the genus *Bellamya*, *Idiopoma*, *Cipangopaludina*, and *Mekongia*, (2) Bithyniidae containing only one genus, *Bithynia*, and (3) Planorbidae, the genus *Indoplanorbis* was identified. The gastropod fossil assemblage suggested that they were inhabited a habitat near a river and in the lake as extant species. X-ray diffraction analysis and stable $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ are used for examination. The mineral composition in the gastropod beds mainly composes of carbonate minerals accompany by clay minerals. Clay minerals are high content of montmorillonite, vermiculite, and chlorite, and low kaolinite. These indicating the influence of marine sediments more than land sediments, suggested marine incursion into the basin at that time. The stable $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ indicated the paleoclimate during gastropod deposited was oscillatory changed from cold and dry to hot and humid at least in three cycles.

Keywords: Cenozoic, Mae Moh, Thailand, stable isotope, freshwater snail, climate change, clay minerals

*Speaker

A large ‘macrobaenid’ turtle from the basal Cretaceous of Thailand

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The family Macrobaenidae is a group of basal eucryptodiran turtles that has its origin in Asia. Known since the Late Jurassic, macrobaenids become dominant in the Early Cretaceous turtle faunas from China and Central Asia (they are notably abundant in the Jehol Biota); their remains have also been reported from the Lower Cretaceous of Eastern Asia (South Korea and Japan). The group dispersed later to North America and Europe during the Cretaceous. Remains of macrobaenids have been collected from three localities in Kalasin, Nong Bua Lamphu and Mukdahan provinces, together with the basal trionychoid turtle *Basilochelys macrobios*. Stratigraphically, these localities are situated at the upper part of the Phu Kradung Formation (basal Cretaceous), Khorat Group. These turtle remains, consisting of shell elements, are assigned to Macrobaenidae on the basis of the upturned anterolateral margin of the carapace forming a gutter, posterolateral peripherals mesiolaterally expanded, a greatly reduced plastron with a short bridge, an elongate oval entoplastron with a reduced ventral exposure and strip-shaped epiplastra. They are otherwise characterized by their large size (with an estimated carapace length about 70 cm.), multiple keels on the carapace, narrow vertebral scutes and a triangular vertebral 4 with a narrow posterior end. These finds represent one of the earliest hitherto known Macrobaenidae and extend the paleogeographical distribution of the group to SE Asia. The discovery of macrobaenid turtles in Thailand provides further support for the Early Cretaceous age of the upper part of the Phu Kradung Formation and new evidence of faunal exchange between SE Asia and more northern parts of mainland Asia at the very beginning of the Cretaceous.

Keywords: Turtle, Macrobaenidae, Phu Kradung Formation, Early Cretaceous, Khorat Group, NE Thailand

*Speaker

Preliminary Investigation of Ancient Fossils in Cambodia

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Fossils have been discovered in a number of locations in Cambodia, but in-depth research and publications regarding the results of those discoveries have not been widely reported. As such, knowledge of fossils in Cambodia has remained a mystery until recently. In 2017, during an archaeological survey in the wildlife sanctuary in Preah Vihear province by a team from Ministry of Environment a fossil deposit was recognized. More research was conducted in 2019 by the Department of Heritage Area of the General Department Local Community of the Ministry of Environment. Thus far, fossils have been identified in 24 locations across 7 provinces in Cambodia. The majority of recorded fossils are early marine life forms such as crinoids, ammonites and other mollusks, fish, tetrapod bones, wood while some others have not been identified yet for the moment. These fossils range from the Permian to the Jurassic and Cretaceous periods. The most interesting fossil which suggests to some experts that it belongs to a dinosaur is a large limb bone found at Koh Kong province. However, this is only an identification based on photos. Therefore, it is necessary to conduct detailed analysis by experts directly on the bone at its location before a final conclusion can be made. As mentioned earlier, fossil investigation in Cambodia is at the starting point. At the same time, the investigation team is challenged by a lack of financial support, human resources and equipment. We hope that fossil research in Cambodia will develop and more fossils will be discovered in other provinces. At the same time, we also need support and collaboration from institutions, organizations and research teams who are interested in helping and improving fossil research in Cambodia to move forwards in the future.

Keywords: Cambodia, fossils

*Speaker

Two Species of *Tsuga* from the early Miocene of Northern China and the reassessment of early plant palaeogeography of this genus

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Tsuga (Endl.) Carrière, which is commonly called hemlock, is an important constituent of the family Pinaceae. According to Farjon's classification system, there are 9 existing species of *Tsuga* genus, intermittently distributed in North America and eastern Asia, of which 4 species in North America including *T. heterophylla* (Raf.) Sarg, *T. mertensiana* (Bong.) Carrière, *T. canadensis* (L.) Carrière and *T. caroliniana* Engelm while 5 in eastern Asia including *T. diversifolia* (Maxim.) Mast, *T. sieboldii* Carrière, *T. chinensis* (Franch.) E.Pritz, *T. dumosa* (D.Don) Eichler and *T. forrestii* Downie. A large number of plant fossils, especially three *Tsuga* cone fossils, have been found in Zhuozi County, central Inner Mongolia. The fossil-bearing strata is the early Miocene Hannuoba Formation, consisting mainly of a set of gray, black and purple-gray olivine basalt with brick-red mudstone, gray-white marl and black oil shale. By studying its internal and external morphology, obtaining its three-dimensional structure by CT scanning and comparing them with living species and fossil species, the fossils were attributed to two species: *Tsuga mertensiana* (Bong.) Carri and a new species of *Tsuga zhuoziensis* sp. nov. This discovery provides important evidence for speculating the spread of hemlock in northern China, and also confirms the intercontinental transmission path of hemlock. Fossil evidence of *Tsuga* includes pollen, seeds, needles, twigs, wood and seed cones, which are abundant throughout the whole Cenozoic. The fossil record of this genus during the early time is dominated by pollen, and the earliest record is found in the Early Cretaceous strata in Poland . It was not until the middle Eocene that the first macrofossil hemlock seed was found in the Allenby Formation in British Columbia, Canada, and the earliest cone fossils were recorded in the middle Eocene Buchanan Lake Formation in Canada. Based on the fossil records of this genus from North America, Europe, and parts of Asia, LePage suggested that *Tsuga* was able to communicate between Europe and North America during the Paleocene-Eocene period via the North Atlantic land bridge (the Thulian Route and the DeGeer Route) and can be exchanged between North America and Asia via Beringian Corridor throughout the Cenozoic. However, due to the lack of fossil records in China, the geographical migration path of this genus in Asia remains to be improved. In this study, we find that two reliable pollen records of *Tsuga* has been reported from northeastern China during the Paleocene epoch, which may indicate that hemlock had spread from Europe via the retreating Turgai Strait to Eastern Asia before the Paleocene epoch. As for the migration between North America and Europe, the DeGeer Route provided conditions for the dispersal of hemlock from Europe to North America during the late Cretaceous-early Paleocene (c. 69Ma and c. 65.5 Ma). The Thulian route was fully formed after the DeGeer Route broke down and existed during the late paleocene-early Eocene, and at least during the late Paleocene (c. 57Ma and c. 56Ma), providing a terrestrial pathway for the transcontinental communication of hemlock.

Keywords: Miocene, cone, *Tsuga*, phytogeography, Hannuoba Formation

*Speaker

A preliminary study on Miocene fossil insects from the Wang Kaew, Mae Sot Basin, Tak Province, Thailand

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Research on fossil insects in Thailand is rare; so far, there are only two publications. The earliest one is about *Neuroctenus* sp. in the family Aradidae (flat bugs) from Mae Sot basin (Miocene), Tak Province, by Endo and Fujiyama (1966). After that, Heggemann et al. (1990) reported the Middle Jurassic insects from orders Blattodea (Cockroaches) and Hemiptera (true bugs), *Procercopina asiatica*, from Phra Wihan Formation, between Phrae and Nan provinces, Northern Thailand. To augment the research on fossil insects in Thailand, here we report five additional insect orders as part of the recent research progress as follows: Coleoptera (beetles), Diptera (flies), Hymenoptera (bees, wasps and ants), Isoptera (termites), Orthoptera (grasshoppers, locusts and crickets). These specimens were discovered in the Middle to Upper Miocene shale of Wang Kaew village, Mae Sot Province, western Thailand. Hence, this research help to learn the diversity of insects in some past of western, Thailand.

Keywords: Fossil insects, Coleoptera, Diptera, Hymenoptera, Isoptera, Orthoptera

*Speaker

An International Research Network on Paleobiodiversity in South-east Asia since 2015

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The **International Research Network Paleobiodiversity in South-east Asia** has been launched in January 2015 and renewed in 2019 for 5 years. This scientific consortium aims to set-up a collaborative research network on Paleobiodiversity in South-east Asia between seven French CNRS laboratories, accompanied by their supporting universities and museums, and twenty European, American and Asian Institutes including Thailand, Malaysia, Cambodia, Vietnam, Cambodia and China. The scientific topics of the network focus on 1) the paleobiogeographical history of South-east Asia, 2) the Asian Inter-basin correlations and 3) the origin and recent dynamics of modern biodiversity in South-east Asia. It targets reinforcement of our knowledge on the Evolution of biodiversity in South-east Asia at different scales. The network activities include the organization of workshops, seminars and training schools within the network partners, but are also open to additional regional collaborators. Its goal is to promote the exchange of permanent researchers and professors as well as master, doctoral and post-doctoral students. In particular, the training of students in the field and in collections is pursued with the support from our different teams. We promote and showcase the co-participation to international congresses and conferences. One of our goals is to act as driver for attracting international attention to the erosion of biodiversity and to act for the enhancement and safeguard of the paleontological heritage. Finally, we encourage joint publications and implementation of joint projects within the IRN-PalBioDivASE research targets. From the end of 2015 to 2020 the IRN-PalBioDivASE organized a total of 96 joint meetings mainly in the field. It allowed the organization of 15 conferences, 10 seminars, 7 workshops and 4 conferences. A total of 31 grant applications were submitted collectively on our 3 themes. 35 members from our ASEAN laboratories were hosted in Europe and 36 European researchers were hosted by the ASEAN partners on site. During that period 8 theses were carried out, 6 of which were in Thailand. Finally we were able to co-produce 91 articles and to present 60 communications and 4 posters within the framework of our joint actions. we hope to further expand our partnership circle at this meeting.

Keywords: Paleobiodiversity, paleogeography, partnership, ASEAN

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