In the Resin

A Catalog of Kachin Amber

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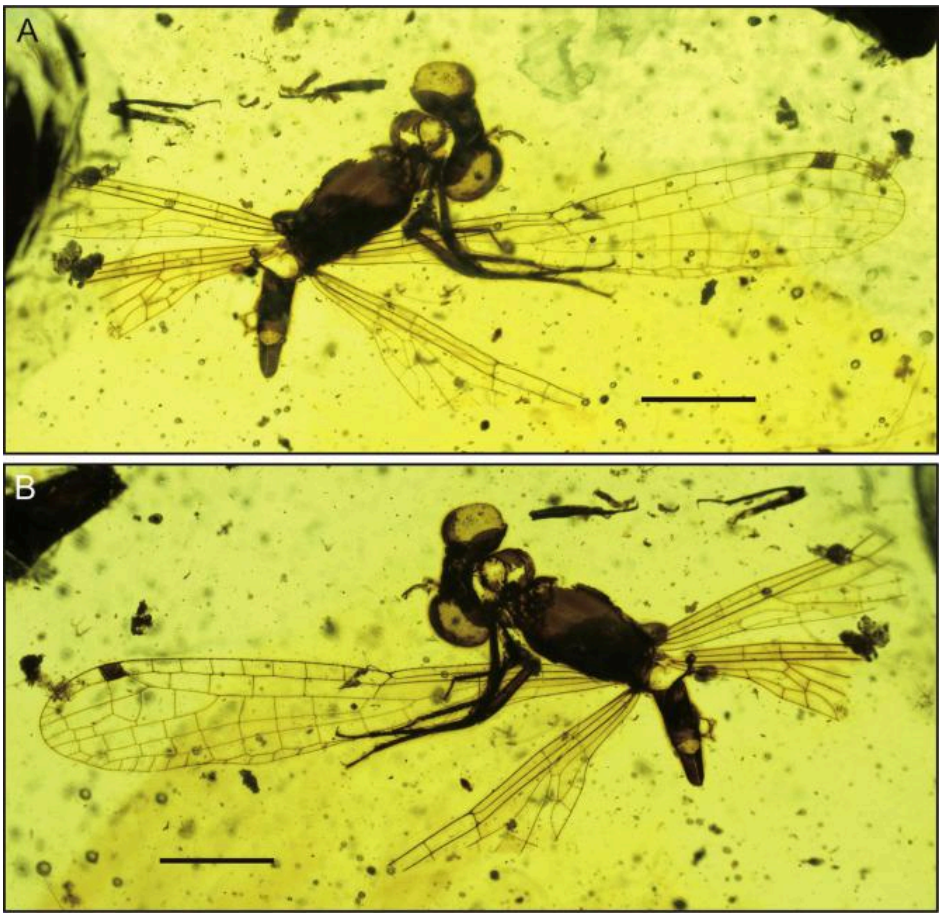
Introduction

In the northernmost part of Myanmar, framed by formidable mountaintops and deep, coursing river valleys, Kachin State boasts of ancient amber mines dating back to over a hundred million years ago. Hukawng Valley has been the source of over a thousand amber specimens from the mid-Cretaceous period for the purposes of paleontological and archaeological research from Myanmar. From marine organisms, such as ammonites, to a wide expanse of arthropods and terrestrial animals, Kachin amber has captured a great abundance and diversity of prehistoric life forms for our close survey today.

Amber is quite a unique and useful method of fossilization for a couple of reasons. Mainly, it is increasingly rare to find fossil specimens that are as old as they are in the condition and detail that they appear in amber. Usually, the fossil record features the bones of large predators, impressions, and generally hard material. However, in amber, oftentimes, smaller organisms are preserved, due to the nature of tree resin, and soft body parts are trapped well. Amber fossils are, therefore, often described as "time capsules" of life.

In this catalog, a variety of such fossilized specimens in amber will be presented, and their contributions to paleontological research and the fossil record explained. As for archaeological value, amber artifacts originating from Myanmar have been discovered in certain tombs of the Han Dynasty. This further illustrates the presence of amber as an object of cultural and historical significance, detailing trade relations in the East with that of the Silk Road.

Though, in recent decades, military and ethnic conflict in the region, atop of existing decades-long tensions, have raised concerns for the ethics of amber research as the purchase of these specimens, supports, even if indirectly, humanitarian crises committed in the region. The scientific value of Hukawng Valley's amber cannot be ignored, and the dilemma of ethical research, with Myanmar's political and social conditions, only serves to illustrate the interconnectedness of human relations with that of human progress–such as scientific advancement. We can have an earnest yearning to understand the complexities of a past that did not have us, but must not forget the present in which we shape the times as they will be remembered in the future.

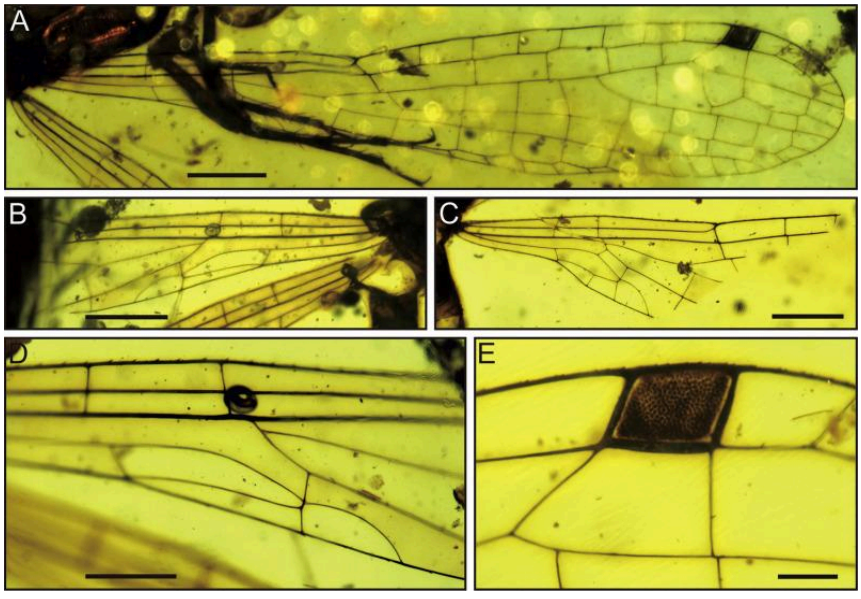


Catalog No. 1

Damselflies

This amber specimen, found near the northern hill of Noije Bum, contains a new species of damselfly (Odonata) found only in Kachin amber. Its scientific name is *kachinhemiphlebia lini* and is categorized under the family of Hemiphlebiidae, which is the general term for damselflies (Zheng, 2021).

The fossil itself is dated to be around the mid-Cretaceous and aligns with the known fossil record about the abundance of damselflies in this region at that particular period of time. The odonatan fossil record is quite sparse in the Cretaceous period in all other regions aside from Kachin State, Myanmar (Zheng and Jarzembowski, 2020). As such, Kachin amber deposits are critical for mapping the development and earliest history of odonatans.



Given their prominent presence, damselflies played quite significant roles in balancing ecosystems, which

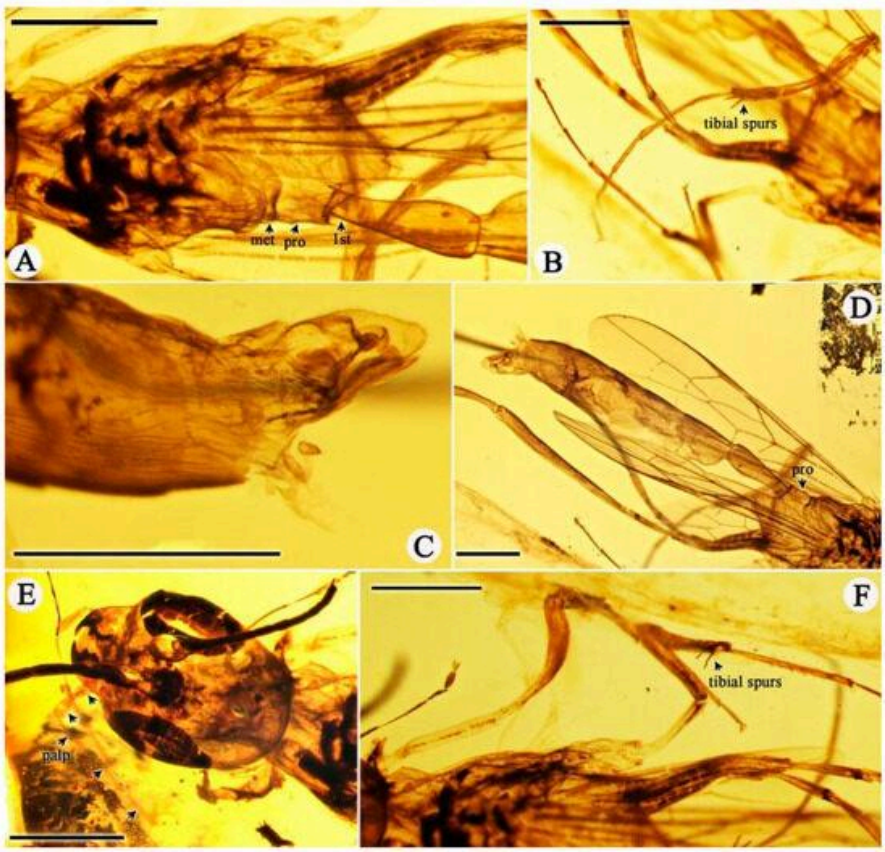
shows in their elaborate courtship rituals and diversification (Willink, 2024). In identifying the new *kachinhemiphlebia* as its own, comparisons were made between the specimen and known Burmese damselfly specimens (*Burmahemiphlebia*) which included variations in postnodal crosswings, length and positioning of hindwings, and, most observable, wing venations. The last of these, wing venations, are particularly important for species identification because of how standard they tend to be within a species, but become more distinct across different species; they also rely more information on the nature of sexual selection within a species as well as other evolutionary features—such as how one transports nutrients through its wings (Donoughe et al, 2011).

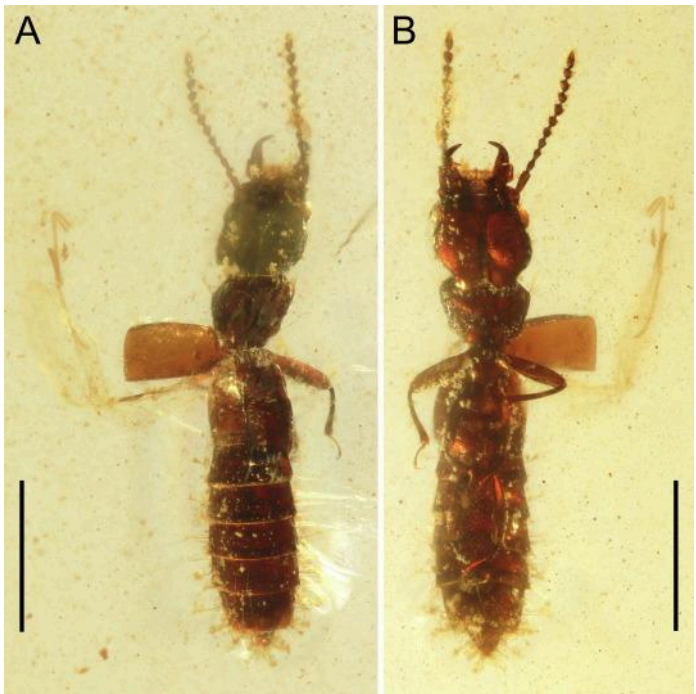
Catalog No. 2

Wasps

Alongside various life forms, such as insects and other species of wasps, a new species and genus of Praeaulacidae was found also in Hukawng Valley close to Tanai. This specimen was given the scientific name *Azygdellitha nova* and is classified under one of the wasp superfamily's, Evanioidea, extinct subfamilies, Praeaulacinae (Yang et al, 2024). This classification was achieved by observing the presence of their characteristic high metasoma and distinct traits from other closely related species, such as the *Mesevania* or *Archeogastrinus* (Engel, 2017). Not dissimilar to the case with the damselfly specimen, distinctions, or apomorphy, in wing venations served as the most prevalent piece of evidence for determining this (Shimmi et al, 2014).

Utilizing a broad overview of surrounding species and organisms around *Azygdellitha* in the mid-Cretaceous amber deposits of Kachin State, scientists are able to observe ecological conditions or interactions during this wasp's time and hypothesize that the Praeaulacidae had specific, and unique adaptations that are exclusive to the Kachin area (Jouault and Nel, 2024).



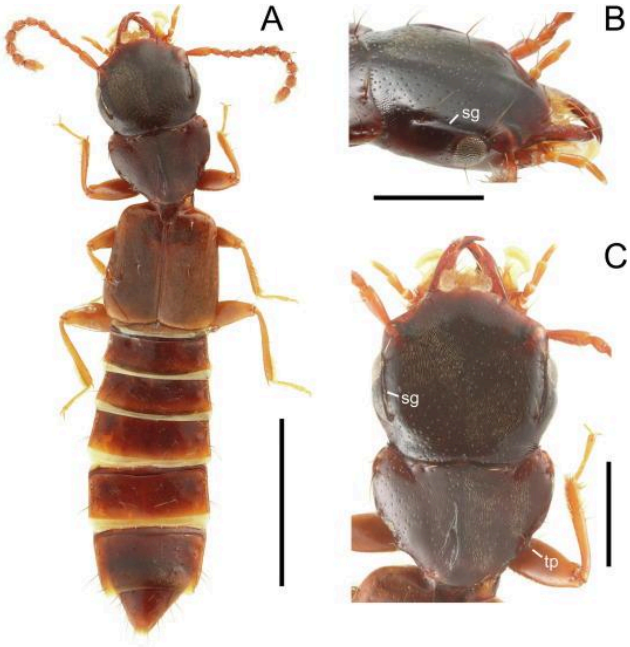


Catalog No. 3

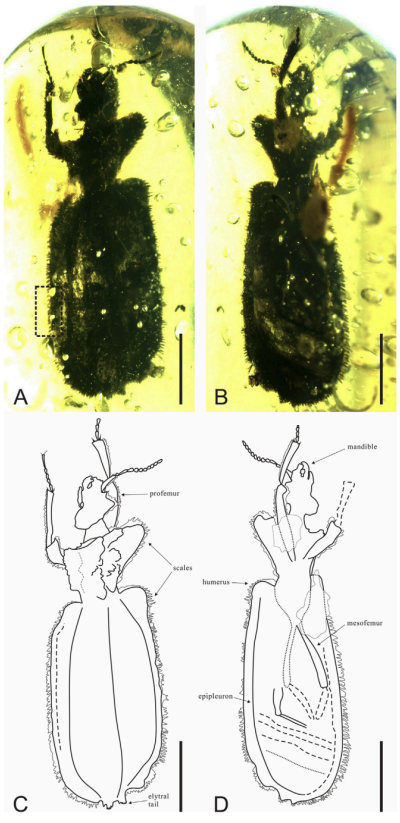
Rove Beetles

Another specimen encased in amber, *Eleusis sulcata*, features the first, and only, eleusinin rove beetles in the Mesozoic era (Yamamoto, 2024). This was also excavated in the Noije Bum site, close to Danai, in Hukawng Valley. Eleusini are an extinct species of beetles under the osoriine tribe/subfamily that are especially rare and were discovered for the first time in the fossil record with this specimen. Now, the fossil record for the osoriine tribes are complete and we have a full

evolutionary timeline of all major epochs for their existence (Cai and Huang, 2015). As of now, it is displayed in museums such as the American Museum of Natural History in New York (Yamamoto, 2024). Furthermore, the discovery of this specimen allows for comparative analyses of extant species of rove beetles and possible categorization of or relation to Eleusini.



One such instance occurred with a specimen from Sapporo, Japan: *Eleusis coarctata*. Scientists found that evolutionary modes and lifestyles had remained quite similar from the Mesozoic period of eleusini to that of extant species today (Sharp, 1889). For example, morphological features like flat bodies and small heads carried over and reflected a "subcortical lifestyle" that involved living between thin spaces, such as under bark or wood (Thayer, 2016). Due to its usefulness in identifying speciation, scientists are also considering using Eleusini as a calibration point in the future through phylogenetic/DNA analysis.



Catalog No. 4

Ommatine Beetles

The Coleoptera order of beetles, which is thought to have first emerged in the Early Permian, is known for having an extensive and abundant fossil record, having over 28 species recorded in Kachin amber alone across 100,000 inclusions (Zhao et al., 2021). This archostematan specimen, *Lepidomma beuteli*, was extracted near Noije Bum, closer to Tanaing town (Song et al., 2022). *Lepidomma beuteli* is categorized under the tribe Clessidrommatini due to its unique vein patterns on its forewings and its, generally speaking, weak presence. It showed large enough distinctions—in its scales and exposed neck in particular—to set it apart as its own species under the genus *Lepidomma*(Li et al., 2020).

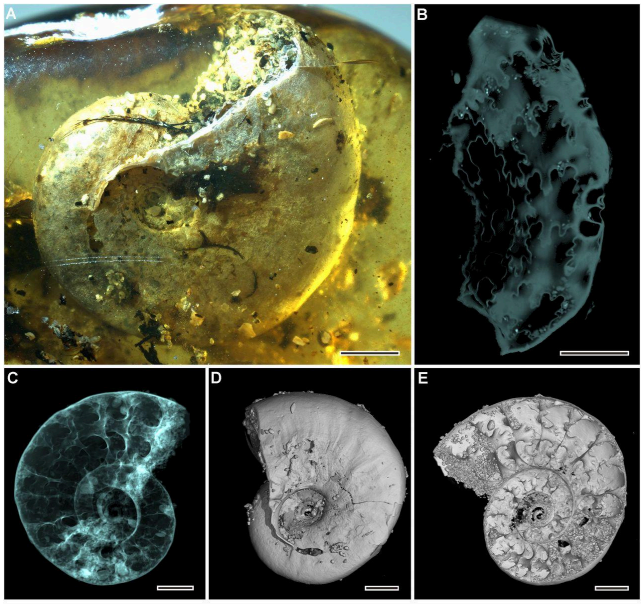
Scientists were able to discern, from its appearance and unique body structures, that the ommatine beetles were adapted for an arboreal lifestyle, meaning for trees (Jarzembowski et al., 2017). This is supported by the presence of thick scale covers and characteristic ridges along its body.

Catalog No. 5

Agamids

Aside from existing Cretaceous amber lizard fossils from Lebanon, another specimen from the Cenomanian epoch of the early Cretaceous period was found in the Noije Bum Site in Kachin State (Arnold et al., 2002). The specimen, known as *Protodraco monocoli* to reference it being the first Southeast Asian type genus of Draconinae (Wagner et al., 2021). It has remarkable preservation of its left hind leg and scales which can be observed in detail.

Other than a closer look at the structures of ancient agamids, the amber as a whole also included other items and materials: pieces of wood and debris, plant trichomes, and mold (Rikkinen et al., 2019). This provided more explicit information on environmental conditions of the location in the Cretaceous period.

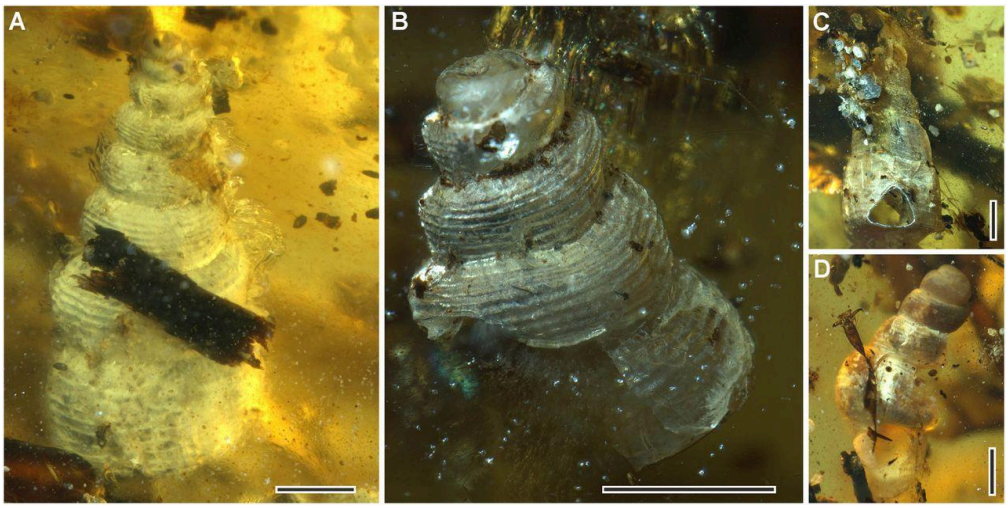


Catalog No. 6

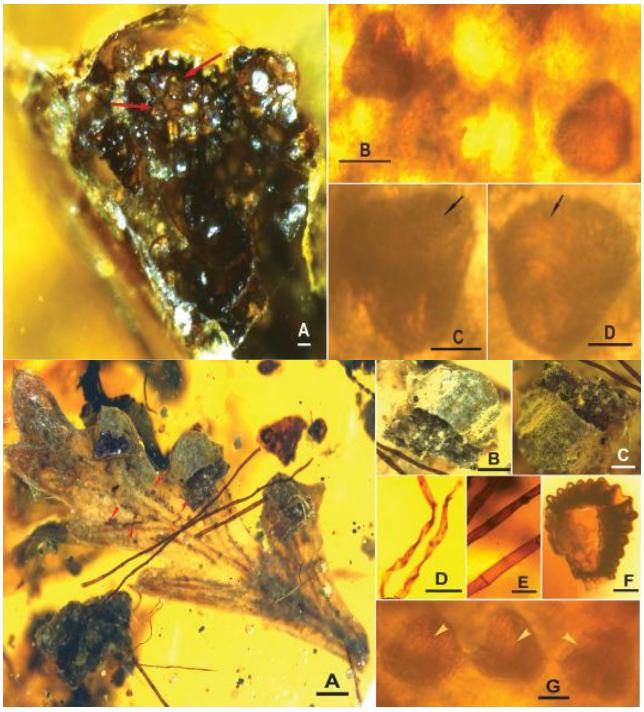
Ammonites

The appearance of marine organisms in amber is exceptionally rare because of the method of preservation being incompatible with water (Schmidt et al., 2018). Nonetheless, an ammonite, categorized to be *Puzosia*, from the Late-Albian-Early Cenomanian period, was found encased in Burmese amber for the first time.

It also appeared with an accompanying assemblage, featuring at least 40 specimens, of terrestrial and various other aquatic organisms as well, such as mites, isopods, spiders, and wasps (Yu et al., 2019). The four gastropods that were found are part of the genus *Mathilda Semper*, which is known to originate from the ancient Tethys Sea (Gardiner et al., 2015). All in all, these fossils were important pieces of evidence in confirming the age of amber deposits in Noije Bum to include Albanian and Cenomanian periods (Shi et al., 2012).



With further analysis, more information was also able to be derived on the environment of Myanmar, at least in its northern region near present-day Tanai in the Myitkyina district, to include “resin-producing trees” near a coastal/beach environment, which allowed these aquatic organisms to be preserved in amber along with other terrestrial arthropods (Yu et al., 2019). The rarity of this occurrence and positioning also implies that other environmental events, such as tsunamis or sea-storms, may also have been recorded in the amber of this region in Kachin state.



Catalog No. 7

Cystodium

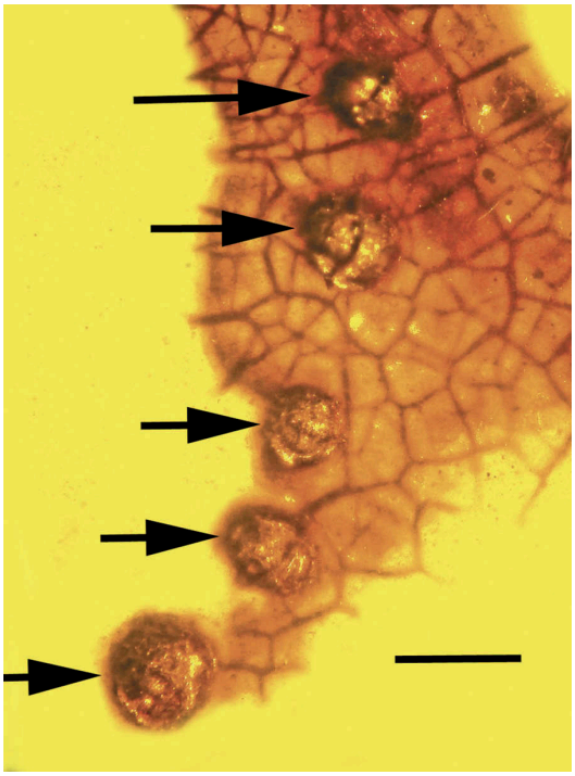
A new species of cystodium, named *Cystodium parasorbifolium*, a type of prehistoric fern, was discovered in Hukawng Valley near Tanai (Li et al, 2024). It is remarkable for its preservation of spores and sori. Sori is the place, located on the underside of the fungi, where spores (its reproductive bodies) are produced and are great areas for observing speciation. Equipped with precise sawing techniques and

a microscope system, the species' diversification during the Cretaceous period was analyzed and resulted in more precise dating that came to contest long held beliefs.

One of these particular beliefs was that, though *Cystodium* has extant species in other parts of the world, such as New Guinea and Borneo, it showed a lack of diversification in Myanmar (Regalado et al., 2017). However, with the classification of this specimen as its separate species—due to morphological comparisons with the extant *C. sorbifolium* or Cyatheales—this idea is contested as the fossil record came to show much greater extents of speciation. In a broader context, this specimen provided crucial clues to piece together the pattern of Cystodium's spread into other areas of the world during the Miocene through the Malesian Archipelago (an ancient region in Southeast Asia with tectonic activity and composed of a variety of islands and land masses), as opposed to attributing its spread to greenhouse phenomena or broader changes in climate in the Paleocene to Eocene (Morley, 2012; Lohman et al., 2011).

Catalog No. 8

Pycnidia Fungi



The first pycnidia, otherwise known as the fruiting bodies of fungi, named *Palaemycus epallelus*, was found on mid-Cretaceous angiosperms in Kachin Amber from the Noije Bum Summit Site (Poinar, 2018). This specimen is thought to have been fossilized from the resin of an Araucarian tree with the use of NMR spectra and dating (Poinar et al., 2007).

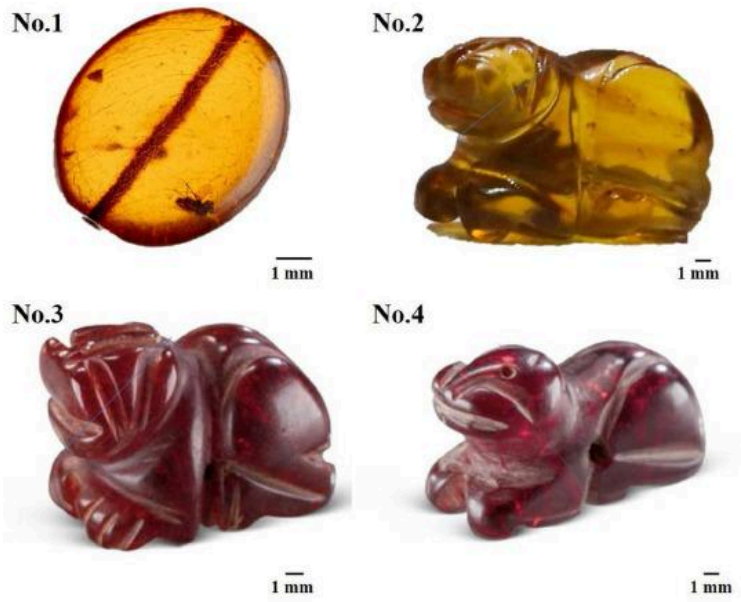
The spores of the fruiting bodies can be observed as "specks and dots" and are similar in structure to those found with extant species *Melasmia Lev.* and *Phomopsis Sacc.*, but the conidiophores (spores) are still too different to be classified as being the same (Barnett, 1970; Sutton, 1973). Being the first of such fruiting bodies being found on plant remains from the Cretaceous period, *Palaemycus epallelus* serves an important role in providing details on the evolutionary history of prehistoric angiosperms and accompanying fungi and its lineages that continue to this day.

Catalog No. 9

Beads & Ornaments

Amber has held cultural and historical significance in China, more prominently in the Han Dynasty, and has been found in various archaeological sites whether in the form of jewelry or ornaments. The earliest instances of amber found in this period can be traced back 3 millenia to Sanxingdui Site in Sichuan (Shen, 2002). The specimens described here, contrary to belief, are of Burmese origin and were found in a tomb in Nanyang City for senior officials ca. 25-250 CE (Chen et al., 2019).

Using infrared spectroscopy, or more precisely FTIR (Fourier transform infrared spectroscopy), it was discovered that the specimens were closer in age to that of Burmese amber, which is about 50 million years older than Baltic amber, and more accurate in color—sporting a “blackish brown” color as opposed to the orangey hue of Baltic ambers (Wang et al., 2015). This completely flipped over previous assumptions by scholars that amber predominantly flowed into China through the Baltic region by virtue of the Silk Road (Huo and Zhao, 2007). Instead, it was found that amber was also distributed without heavy regulation from Burma, perhaps after trade passages were opened by Emperor Wudi of the Han Dynasty. This indicates a larger role of trade interactions with Burma through Yunnan in China’s archaeological and cultural history.



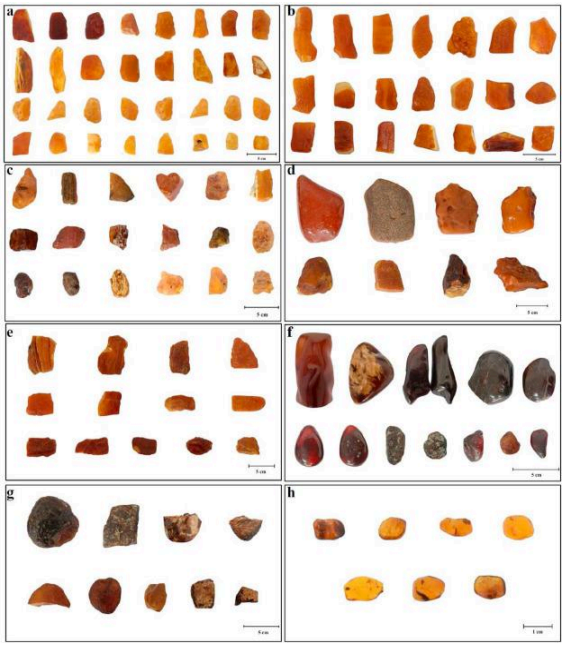
Catalog No. 10

More Beads & Lions

Another four amber artifacts were excavated from Haihun Marquis’ Tomb and are deduced to have arrived from Burma through trade on the Maritime Silk Road during the Western Han Dynasty period (Zhao et al., 2023). The number of amber being found in ancient Chinese tombs

in southern China has expanded since the 1950s, and hold invaluable information to understanding complex cultural exchanges with ancient Chinese society and the surrounding. As mentioned above, Haihun Marquis' Tomb is renowned for the sheer number of archaeological discoveries that have been unearthed from the site, and provide a close look at cultural details, including large-reaching trade, of the Western Han Dynasty; in 2015 and 2021, respectively, the site received prestigious rankings for archaeological contributions (Dai and Sangiamvibool, 2024).

With this wealth of information, scientists decided to compile a database of markers indicating categorization for amber being of either Baltic, Burmese, or Fushun origin, analyzing peaks and positioning in infrared spectrums by FTIR. The ages and origins of Burmese and Baltic amber were able to be distinguished: the former was from "Araucariaceae or Pinaceae fossil resin" from either the Triassic or Cretaceous period (Wang et al., 2014). The latter was from sciadopityaceae or cupressaceous fossil resin from the Eocene period (Poinar et al., 2007; Tappert et al., 2011).



Burmese as a whole had greater discrepancies within its different amber groups largely due to its wide geographic age span; for the same reasons, Burmese amber shows a variety of colors and opacity, ranging from bloodish amber to reddish hues, whereas Baltic amber is known to have the presence of yellowish lighter hues overall (Zhao et al., 2023). The growing classification of ancient amber artifacts in the center of China's archaeological past serves as direct evidence of lasting trade relations with Myanmar through Yunnan during the Western Han Dynasty with the rise of the Silk Road.

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