

CERAMAH TEKNIK TECHNICAL TALK

Geological highlights of Brunei Darussalam (North Borneo) with focus on the “Borneo Amber” record

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Platform: Google Meet

Abstract: Since 2014 we have been conducting research on Brunei’s Neogene deposits. During our field surveys we discovered some exceptional fossil assemblages. Here, the already published and most remarkable remains are shown to give a taste of ancient biodiversity of the region. Mollusks, cartilaginous fish among them the famous *Otodus megalodon*, late Miocene turtle remains, and microfossils such as pollen and foraminifera will be briefly discussed. Most of these fossils come from the middle to late Miocene shallow marine deposits of the Miri and Seria formations. These beds, however, and also almost all other sedimentary succession in Brunei, often contain fossilized tree resins (amber) as well. These remains are very common and can be fairly abundant in certain layers. Amber comes with different size and color, some are transparent, and others are completely opaque. Often they show the sign of bioerosion, while others contain trapped insects. We collected a large amount of amber, and selected specimens together with modern tree resins were characterized and investigated with different methods (e.g., physical properties, FTIR, $\delta^{13}\text{C}$). Most of the results point to maturation differences among the samples, while the FTIR spectrum of over 60 analyzes revealed that all the Brunei ambers were produced by dipterocarp trees (Dipterocarpaceae), and no fossil Agathis (Araucariaceae) resin has been detected. This is in agreement with the lower abundance of the gymnosperm taxon in the forests of Borneo compared to that of the widespread dipterocarps. From the late middle Miocene to late Miocene a slight decreasing trend in average $\delta^{13}\text{C}$ values was detected that can be explained by gradual changes in local environmental conditions (e.g., more precipitation) and/or by increased amount of less mature specimens among the younger samples. In contrast, the Pliocene samples yielded the highest $\delta^{13}\text{C}$ values that may link to cooler-drier climate with increased seasonality, probably reflecting the spread of glaciation in the northern hemisphere.

Comments: This talk took place online, using University of Malaya’s Google Meet facility. The talk was recorded, and can be viewed at this URL:

<https://drive.google.com/file/d/1WT0-HkNswsOSdIi5XPI74im4Q49Knwzg/view?usp=sharing>

We had twelve in the audience. The talk covered a lot of ground. Amber is commonly found in Borneo in the Cenozoic sedimentary record, often associated with coal, and also found reworked on modern beaches. Modern tree resins are also commonly found and continuously produced in the region, and can be mixed up with amber. Telling the two apart can be done using physical characteristics, for instance, amber has stronger fluorescence than modern tree resins when exposed to UV light. The talk also covered the geochemistry of both amber and modern tree resins - amber has distinctive FTIR and carbon isotope signatures, as well as distinctive organic geochemistry.

Amber is very often found “across the border” in Sarawak and Sabah, as well as in Kalimantan, so this is an avenue for possible future research. The University of Malaya Geology Department is equipped to participate in this research, since we have a well-equipped organic geochemistry laboratory as well as a Micro-CT which can be used to image and model insects and other organisms or biological particles (pollen?) preserved in amber.

Further reading:

László Kocsis, Anwar Usman, Anne-Lise Jourdan, Syaimaa’ Haji Hassan, Nurhazwana Jumat, Dalina Daud, Antonino Briguglio, Ferry Slik, László Rinyu & István Futó, 2020. The Bruneian record of “Borneo Amber”: A regional review of fossil tree resins in the Indo-Australian Archipelago. *Earth-Science Reviews*, 201, 2020, 103005, ISSN 0012-8252.

<https://doi.org/10.1016/j.earscirev.2019.103005>.

<https://www.sciencedirect.com/science/article/pii/S0012825219302004>.

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