

Onderzoeksrapport Lim Tze Tshen, VNM-Fellow 2023

Van 7 tot en met 21 oktober was op uitnodiging van de vereniging onderzoeker Lim Tze Tshen in Nederland. Tshen ontving tijdens de ALV in januari 2023 de meeste stemmen voor zijn onderzoeksvoorstel naar fossiele beenderen uit Maleisië, nu in de collecties van Naturalis en Teylers Museum. De VNM ondersteunde Tshen met een fellowship van tweeduizend euro. Zijn onderzoeksrapport tref je hieronder aan (in het Engels).

Quaternary Mammal Fossils from Malaysia, and Museum Research in the Netherlands

A report prepared by LIM Tze Tshen for Vereniging Nederland-Maleisië

BACKGROUND

The limestone outcrops that are found in parts of Malaysia are geomorphologically unique since they represent tangible records of the history of earth and life going back to hundreds of millions of years when the original limestone bedrocks were formed under the sea by shells and hard body parts of other marine organisms. Some of these bedrocks were later pushed by geological processes to a level near or above the earth surface. In such a way, they became visible outcrops across landscapes, creating a special kind of habitat that, over millennia, nurtured many endemic species of flora and fauna. At this stage, due to the exposure to the elements, caves and rock-shelters of various sizes and shapes started to develop within the outcrops. These newly developed features in turn became natural depositories of fossilized skeletal remains of animals that lived in the surrounding areas hundreds of thousands of years ago; some even became home and burial places of prehistoric humans.

Limestone caves and their sediment layers that contain animal fossils have become, and still are, the major objects of scientific research in many parts of the world, including Malaysia. Remarkable findings had been made in the past in the country well before Malaysia became an independent nation. By necessity, studies were carried out almost exclusively by overseas researchers. New developments in recent years had brought to light numerous fossil sites in Malaysia, especially from the Peninsular, as a result of active research and increasing conservation efforts focusing on limestone outcrops by local grass-root NGOs and higher learning institutions.

Results from preliminary studies conducted in Malaysia – mainly in the Geology Department and Zoology Museum of Universiti Malaya, and Sarawak Museum – on these newly found/re-discovered fossils had been encouraging. This situation has prompted our team to seek opportunities for enhanced research on our materials by making use of relevant reference collections overseas, especially the Dubois Collection of the Naturalis Biodiversity Center. The main objectives of the enhanced research are to refine the species identification of some of the fossil animals for better determination of the palaeo-diversity and relations of prehistoric faunas across the western part of Southeast Asia. In addition, it is equally important for this enhanced research to gain sustainability by establishing an active and mutually beneficial communication platform between relevant institutions in Malaysia and our counterparts in the Netherlands.



Tshen in the Dubois Collection room of the Naturalis Biodiversity Center.

The generous support from Vereniging Nederland-Maleisië (VNM) in the form of a grant for research in the Netherlands, the kind and welcoming collegial atmosphere I experienced in all the museums I visited, as well as the hospitality of my hosts in the Netherlands have not only made it possible to achieve these research aims, but also made this brief stay in the Netherlands an unforgettable, enjoyable, and highly satisfying trip.

This report outlines the major findings obtained during the research trip in the Netherlands (commencing on 7th and finishing on 21st October 2023).

RESEARCH ACTIVITIES

Museum Collections –

Collections from two major museums were consulted: Naturalis Biodiversity Center in Leiden, and Teylers Museum in Haarlem.

A total of five days were spent examining the mammal fossils in the Dubois and von Koenigswald Collections at the Naturalis Biodiversity Center, focused specifically on specimens of orangutans, elephants (and their extinct relatives), rhinoceroses, and tapirs. One more day was devoted to a visit to the exhibition galleries with the aim of learning new ways and concepts about museum exhibition, and to get a first-hand experience of how natural history collections can be displayed meaningfully in line with modern-day conservation issues and new insights from evolutionary biology.

Two days were spent in the Teylers Museum examining in details the historical elephant specimen from Borneo and other comparable specimens. Since the museum is the oldest surviving museum in the Netherlands, the exhibition galleries on arts and natural history topics provide an unparalleled opportunity to learn about the history of museum development.

Together, specimens examined from these two museums encompass a geographic area that includes Peninsular Malaysia, Sumatra, Java, and Borneo. Geologically, these fossils ranged in age from the Pleistocene to the Holocene times (that is, roughly from about 2.5 million to a few thousand years old).

These area/islands were once major components of a single landmass of sub-continental in extent, known as Sundaland. This landmass was periodically exposed above water, and connected to mainland Asia during periods of low sea levels in the Ice Age. Though currently they are geographically separated from one another by large water bodies, these area/islands harbour a large number of species in common among them owing to this shared geological past. Biologically, they form a single entity – it is, therefore, impossible for a researcher to gain a true understanding of the prehistoric fauna of Malaysia without making reference to similar findings in other constituent parts of the entity.

Public talk at the Hague –

A one-day seminar (*Forum Lecture Series II*) was organized by VNM together with the Embassy of Malaysia on 20th October. This seminar was attended by members of VNM, staff from the embassy, and the public. Initial results (see below for the details) from the research trip were presented during the seminar together with two other speakers (Marcos Kueh and Nipun Kaushik) on different subjects.



Speakers and board members VNM at the Forum Lecture Series II, the Embassy of Malaysia at the Hague.

Visit to Eugene Dubois' resting place and other museums –

Eugene Dubois (1858-1940), the intrepid Dutch palaeoanthropologist and discoverer of the Java Man fossils, is instrumental in the academic career of many later palaeontologists who had studied and made use of the fossils he collected from Sumatra, Java, and India that are now curated collectively as the Dubois Collection in the Naturalis Biodiversity Center. To remember this great figure in the history of science and his lasting contributions to global scientific community, it is only fitting that a visit should be made to his final resting place in Venlo, Limburg.

Not far from Venlo, the Missiemuseum in Steyl offered another rare opportunity to learn about the history of natural history collections and museum exhibition.



The final resting place of Eugene Dubois in Venlo, Limburg.

A visit was also made to the Huis van Hilde archaeology information center in Castricum. The small but comprehensive display galleries provide one of the best examples for cross-regional comparative study on submerged landscapes and the prehistoric Ice Age faunas that lived on them – the Doggerland in Northern Europe and its counterpart in western Southeast Asia, the Sundaland.

RESULTS

Orangutans – Thousands of specimens of fossil orangutans had been recovered from the caves in the Padang Highlands of west central Sumatra. Originally collected by Eugene Dubois, these fossils are now curated at the Naturalis Biodiversity Center. The collection forms the main reference material for any study on fossil orangutans. Though the number of fossil discoveries from caves in Peninsular Malaysia paled in comparison with those from Padang Highlands, they do share important features with one another.

Through this comparative research, we know that in both places only isolated teeth were preserved as fossils – no bones of orangutans were known to have survived as fossils. This indicates that the fossil caves in Peninsular Malaysia seem to have experienced a similar history of development as those in Padang Highlands – the natural processes of accumulation and formation of fossils inside caves may have been similar in both cases.

The striking difference between the two places in terms of number of fossils recovered may be due to the fact that many of the caves in Peninsular Malaysia had in the past been subjected to anthropogenic disturbance related to natural fertilizer/mineral mining activities. Many of the sediments and the embedded fossils may have inevitably been lost in the process.

Morphologically, the newly found fossils from Peninsular Malaysia do not seem to show any major anatomical differences from the Padang Highlands specimens. As a group, the combined 'Peninsular Malaysia-Padang Highlands' fossils, however, do show some differences from the orangutan fossils recovered elsewhere in mainland Asia (particularly, those from south China caves) and Java. This unity in morphology may indicate close affinity of past populations in Sumatra and Peninsular Malaysia.



Fossil orangutan teeth from Padang Highland caves, Dubois Collection.

Elephants – *Stegodon*: Within Southeast Asia, fossils of this type of extinct elephants are found in great abundance in Java. Their fossils form the bulk of the Dubois Collection, certainly in volume and perhaps also in the space occupied. To date, only one specimen was found in Malaysia (from a cave in northern Peninsular Malaysia). The rich and well-studied collection in the Naturalis Biodiversity Center has again provided a useful reference material for refining the species identification of this sole example from Malaysia. It was found that all comparable specimens from Java consistently display features different from the Malaysian specimen. This indicates that the *Stegodon* of Malaysia is very likely from a species distinct from the Javan stocks. Further determination of the species will undoubtedly clarify issues pertaining to the migration and evolution of *Stegodon* in this part of Southeast Asia. On-going research work along this line may reveal a degree of palaeo-diversity of elephants hitherto largely unrecognized in Peninsular Malaysia.

Fossil Asian elephants (*Elephas maximus*) in Peninsular Malaysia: A chance discovery, made during this research trip, in the Naturalis Biodiversity Center of a previously reported but largely forgotten and unstudied Asian elephant fossil, originally collected from Peninsular Malaysia, had expanded the past distribution range of the prehistoric Asian elephants in Peninsular Malaysia. Furthermore, a hand-written note associated with the specimen shows that it was collected from an area in Peninsular Malaysia that no longer supports any living elephants. Found in the 1960s, the specimen still represents the only known example of fossil elephant from the general area.

Extinct relative from Borneo: The natural history collection of Teylers Museum contains one fossil tooth of elephant from East Kalimantan. A finding that is geographically important since this specimen was found in an area outside of the current distribution range of the Asian elephants in Borneo. The specimen was formerly described and studied by Dirk Albert Hooijer (1919-1993), a Dutch palaeontologist and past curator of the Dubois Collection, in a paper published in 1952. It was identified as belonging to an extinct elephant from the genus *Palaeoloxodon*, or known commonly as the Straight-tusked elephant. Re-examination of the specimen showed that it is heavily mineralized and fully fossilized, a condition so unlike the Asian elephant remain found in archaeological layers that are much more recent in geological age. It also shows morphological features different from the Asian elephants. Accurately identified specimens of *Palaeoloxodon* are rare in Southeast Asia, and this unusual fossil from Borneo is even more significant since no subsequent finding of similar nature has ever been reported from the island. This and other findings of prehistoric elephants in Borneo strongly suggest that the island may have played an important role in the evolution and migration of elephants in the region.



Straight-tusked elephant fossil tooth from East Kalimantan, Borneo. Collection of the Teylers Museum.

Rhinoceroses – The Lesser one-horned rhinoceros (*Rhinoceros sondaicus*) was last recorded from Peninsular Malaysia in the 1930s. Together with the Asian two-horned rhinoceros (*Dicerorhinus sumatrensis*), it was declared extinct in Malaysia. The prehistoric record of both rhinoceroses in Peninsular Malaysia was poorly documented. Fossil remains are generally not well preserved, with the exception of those recovered in the 1950s from a site in northern Peninsular Malaysia. These old materials were studied and published by Dirk Albert Hooijer in a paper in 1962, but without any picture or illustration of specimens. Re-examination of these superb fossils kept in the Naturalis Biodiversity Center had not only given an opportunity to rectify this gap in the documentation of these important fossils but also chances to supplement Hooijer’s original study with additional morphological and metrical data. Such undertaking is even



Fossil rhinoceros teeth from Kelantan (Peninsular Malaysia), Naturalis Biodiversity Center.

more urgent since the specific locality of these findings, together with other materials that are still embedded in the sediment layers, will soon be submerged due to an impending hydroelectric dam project.

Tapirs – Our current knowledge about prehistoric tapirs in Peninsular Malaysia is even more imperfect than what is known about prehistoric rhinoceroses. For reasons unknown, their fossilized remains are rarely found in cave deposits in Peninsular Malaysia otherwise rich in fossils of other mammals. The few specimens that were recovered show similarities with those collected from the Padang Highland caves kept in the Naturalis Biodiversity Center. Similar to the case of fossil orangutans, the ‘Peninsular Malaysia-Padang Highlands’ fossil tapirs are different from the larger prehistoric form found in south China caves.

CONCLUSIONS, AND FUTURE DIRECTIONS OF RESEARCH

Through this research it was found that:

(i). Among all the known fossil sites in the region, the newly recovered prehistoric mammal fauna from Peninsular Malaysia has a particularly close affinity with its counterpart in Sumatra, as exemplified by the fossil orangutans and tapirs. This realization is important since it reveals where research focus should be placed in order to maximize results when resources allocated to fundamental scientific studies (such as palaeontological and palaeo-environmental investigations) are usually limited. It provides a sound scientific justification for field research collaboration between Sumatra and Peninsular Malaysia that may lead to fruitful results;

(ii). Peninsular Malaysia and Borneo have a prehistoric past yet largely unknown. In both places, the general aspects of the palaeo-diversity of the elephants – as major seed dispersal agents for many plant species, they are an essential part of the habitats they lived in – have only been known recently. It is now clear that both places are not sterile ground for elephant fossils. What remains uncharted are the potential roles each place may have played in the evolution and migration of prehistoric elephants, and the relations among various groups of ancient elephants that lived in different parts of western Southeast Asia. In order to gain a better understanding of this issue and to initiate mutually beneficial communication among scientific workers within the region, I am planning for a research trip to study the fossil elephant collections in Taiwan and the Philippines in 2024;

(iii). Malaysian wild mammals, such as the rhinoceroses, have a long history of existence as indicated by their fossilized remains found in caves and now kept in museums. The

very recent extinction from Malaysia of the rhinoceroses is an unfortunate event. It is hope that more research into the prehistoric fauna of Malaysia, as well as more opportunities for dissemination of new research findings to the general public will bring out a sense of pride among Malaysians about our unique fauna and the determination to protect this irreplaceable natural heritage at all costs.

ACKNOWLEDGEMENTS

I would like to thank Vereniging Nederland-Maleisië for the research grant that fully supported this trip to the Netherlands; Naturalis Biodiversity Center and Teylers Museum for permissions to study their fossil collections; the Embassy of Malaysia in the Netherlands for supporting the *Forum Lecture*; the Geology Department of Universiti Malaya for continuously allowing me to conduct research on their mammal fossils. My sincere gratitude to friends and colleagues for their hospitality, guidance, and encouragements: Yih Shin, Kenneth, Hans van de Bunte, Jamie, Natasja den Ouden, Annet van Westbroek, Menno Schilthuizen, Alexandra van der Geer, Eduard Pop, Tim de Zeeuw, Eulalia Gasso Miracle, Laura Egginton, Iris van Wijhe, Mohd Norhisyam Mohd Yusof, and Annemarie Hooijer.

Over de VNM

De Vereniging Nederland-Maleisië (VNM) is een plek waar mensen met heel verschillende achtergronden elkaar treffen op basis van een gedeelde interesse in Maleisië. De vereniging fungeert als platform waar uitwisseling van kennis over Maleisië plaatsvindt. Zij heeft tot doel een bijdrage te leveren aan het bevorderen 'van begrip van en kennis over Maleisië om daardoor bij te dragen aan vriendschappelijke betrekkingen tussen de Nederlandse en Maleisische bevolking'.

Meer informatie: www.nederland-maleisie.nl