With compliments,

Anne-Marie Sémah & Kasman Setiagama
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Apologies to:
Director Corazon S. Alvina, Director of the National Museum of the Philippines,
ASEMUS Chairwoman, author of the foreword on page 11
Names misspellings:
Professors Henry de Lumley (page 7), Mike Morwood (page 8), Pisit Charoenwongsa (3rd cover)
and Viengkeo Souksavatdy (3rd cover)
The HOPsea network’s activities have been also supported by

ASEM, Asia-Europe Meeting
ASEMUS, Asia-Europe Museum Network
DAAD, Deutscher Akademischer Austausch Dienst
EGIDE, Centre Français pour l’Accueil et les Echanges Internationaux
Goethe Institut
IRD, Institut de Recherche pour le Développement
Ministère des Affaires Etrangères :
- Ambassade de France, Jakarta
- Délégation Régionale, Bangkok
- Centre Culturel Français, Bandung
- Sous Direction des Sciences Sociales et de l’Archéologie
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Pemerintah Daerah Tingkat II Pacitan, Indonesia
Pemerintah Daerah Tingkat II Sragen, Indonesia
Puslitbang Arkeologi Nasional, Jakarta
SEAMEO – SPAFA, Regional Centre for Archaeology and Fine Arts.
UNESCO

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A large part of humankind finds its roots in Southeast Asian world-wide famous human origins heritage. Beyond national and bilateral current programmes, the HOPSEA project aims to build an expert network able to overstep the threshold between research and valorization of the patrimony. It will enhance skills of teaching-staff, promote (post-) graduate students’ training, and build a useful expert network addressing all aspects of the involved cultural and scientific asset. Activities will range from student training and field data collecting up to touristic development, via MSc/PhD co-supervision, collections and data access facilities, museographic events and expertise about sites protection and development. During the 36 months long project, the 4 partners (higher education institutions from France, Germany, Indonesia and The Philippines) and 2 external partners (from Indonesia and The Netherlands) will endeavour to ensure the network’s future sustainability and extension to other countries and institutions.

http://hopsea.mnhn.fr
Francois Semah, HOPsea coordinator

1- A network grounded by a scientific and patrimonial concern

As submitted to the European Commission, the HOPsea project’s objective aims at building “an expert network able to overstep the threshold between research and valorization of the patrimony. Activities range from student training and field data collecting up to touristic development, via MSc/PhD co-supervision, collections and data access facilities, museographic events and expertise about sites protection and development”.

The initial HOPsea network was built with higher education institutions and associated partners (mostly larger museums with a deep concern in Natural History) whose specializations range from Quaternary Geology up to Archaeology, via Palaeobiology and Prehistory.

The challenge of building such a network was therefore to fully integrate the project’s actions (such as students training, conservation of sites and collections, data sharing, development and dissemination of knowledge activities) within the scientific objectives of the partnership. Moreover, the partnership developed during the first period (2005-2007) was intended to ensure the HOPsea network’s sustainability, noticeably by enlarging the number of participants.

That sustainability objective represented the main concern of the organizers of the Milestone Conference Human Origins Patrimony Studies in Southeast Asia held in Paris in December 2007, and attended by more than 120 participants from Asian and European countries: France, Indonesia, Philippines, Germany and Netherlands, founders of the network, but also Australia, Cambodia, China, India, Ireland, Italy, Laos, Malaysia, New Zealand, Portugal, Spain, Thailand, Taiwan, UK, and Viet Nam.

Under such a perspective, it was necessary to highlight that the wider scientific concern shared by most of the involved scientific partners and associated partners of HOPsea, and by the potential future members of the network as well, was the interdisciplinary approach of the chronology of ancient human settlements and migrations in Eurasia.

Southeast Asian Human origins patrimony, at the southeastern part of the concerned area, is likely to provide numerous valuable data regarding such a question. Following Alfred Russel Wallace’s and Charles Darwin’s work on evolution and biogeography, and also the Neanderthal discoveries made in Europe during the 19th century, the southeast Asian archipelagos yielded the first human fossil that was considered as definitely different from Homo sapiens, namely the ‘Pithecanthropus erectus’ found in Eastern Java by Eugène Dubois at the turn of the 19th century.
Dubois’ work opened the way to the acknowledgment of Human Palaeontology as a scientific field of research. A special mention has to be made of Ralph von Koenigswald’s studies, as they followed an actual multidisciplinary trend involving Geology, Palaeobiology and Prehistory. Von Koenigswald was also the first scholar working in Southeast Asia who, during colonial times, realized that the scientific training of young scientists, local and from abroad, was the best way to ensure the future development regarding scientific perspectives and patrimonial conservation.

The HOPsea network intends to follow his paths… mostly by involving young scientists from the participating countries in combined scientific and patrimonial studies in a developmental perspective. For such a purpose, the network makes use of its own activities, as presented in this volume, and also built a strong synergy with other extant networks, such as the International Master in Quaternary and Prehistory (IMQP, Erasmus Mundus) which fosters international co-promotion of Master and doctoral studies.

The HOPsea network made also special use of the joint exhibition First Islanders whose catalogue is following in the present volume. That exhibition represented, during its building phase, a fantastic forum for the concerned community to exchange and precise ideas in order to present to the public the best ideas shared among the network and the major present scientific trends related to the Human Origins patrimony in Southeast Asian archipelagos.

2- Outline of HOPsea’s scientific orientations

Since the 1990’s the Eurasian continent has become a major centre for human evolution research, following the palaeoanthropological discoveries of Dmanisi (Georgia) and Atapuerca (Spain). These discoveries, along with amazingly old artefact assemblages in Italy, Spain, and Central France have deepened the roots for the earliest human dispersals from Africa. They ground the interdisciplinary work of the HOPsea network’s members.

The development and application of several dating methods, including on most difficult but frequently found samples such as quartz grains bleached by the sunlight, or even on more pioneer samples like gypsum and diatomites, is oriented towards setting an accurate chronostratigraphical context.

In Southeast Asia, the need to precise the stratigraphic position and the chronology of the most ancient Homo erectus remains found in the Sangiran Dome (World Heritage site, Indonesia, c. 1.5 million years old) has become a priority.

Palaeoanthropological researches characterize the evolutive and adaptative stage of those archaic Homo erectus and reconstruct their behavioural adaptations with respect to a variety of quite specific conditions (e.g. rain forest and mangrove environments or the recurrent active volcanic phases). Developing dental microwear analysis also helps to assess the hominin dietary habits together with their environmental conditions.
Regarding a history of more than one million years for the taxon *Homo erectus*, special attention is paid to:

- the relationships between the fossil specimens of continental and insular Asia;
- the emergence of classical *Homo erectus* forms on Java island, which probably descend from the oldest insular forms, but also had likely been influenced by a genetic flow from the continent c. 0.8 million years ago, an assumption supported by mammal migrations evidence;
- the mechanisms of evolution towards the most derived, late *Homo erectus* forms like the Solo Man, classically attributed to an *in situ* endemic evolution but which need to be compared to the unique Indian fossil of Hatnorah and to Chinese specimens.

Such questions are also related to the issue of the possible (pene)-contemporaneity or even coexistence of two or more hominin taxa in the Old World. That issue opens the way to an approach of the stressors, noticeably ecological, which caused the emergence and spread of specific characters, ‘extreme’ specializations and also extinction. The research benefits here from the application of methods such as geometric morphometrics or high-resolution microtomography.

When it comes to behavioural concerns, one can take the example of the Acheulian tradition, including hand-axes and cleavers, which is related to migrations or cultural contacts. Acheulian industries appear around one million years ago in India and spread around 0.8 million years. Some are correlated with the large Australasian tektite field which constitute a good chronological marker c. 0.8 million years. It is necessary to compare the discoveries in Java, Sumatra and Luzon with the early Palaeolithic artefacts found elsewhere in the archipelagos, and also with the European Acheulian observed since 0.7 million years ago. The Acheulian, which cannot be closely related to a specific environment, might correspond to diffusion from an African source or to a phenomenon of local convergence in distinct areas at different times.

Behavioural traditions as revealed by the excavations have also to be investigated for more recent periods, the late Middle and Upper Pleistocene, and the Holocene as well. Those periods cover important milestones in Human history, such as the replacement of *Homo erectus* by anatomically modern humans, the mysteries of other human forms such as the recently discovered *Homo floresiensis*, and the complex dissemination of Neolithic traditions all over the so-called Austronesian world.

Special attention has to be paid to areas located at the crossroads of different continents or which recurrently experienced ‘extreme’ environmental conditions. Southeast Asian lithic technology is completely different from that found in Africa and Europe. Besides the classical typo-technological approach, innovative methods such as artefact morphometry, stone artefacts microwear and residue analyses are mandatory in order to understand such a wide puzzle, considered in the frame of the nature and availability of raw materials. Human behaviour must also be studied in an archaeozoological perspective: the use and treatments of hard animal raw material, the complex relationships developed since ancient times with the animal world, especially the primates.
All the above-mentioned concerns are closely related to palaeontological and palaeoenvironmental concerns. Mammal palaeobiology includes adaptative-evolutionary and migratory mechanisms, but also purely biological methods such as eco-profiling. Palaeobotanical disciplines are used to reconstruct landscapes and habitats, and are still far from covering a sufficient number of regions in Southeast Asia. In order to precise the migration and endemic evolutionary mechanisms, attention is paid to the landscape dynamics during the major Pleistocene climatic oscillations at the interface between continental areas and archipelagos. The studies especially consider low to middle altitude areas, most likely to be settled by hominins. Comparative studies involving different paleobotanical markers - such as pollens, phytoliths, charcoals, and seeds - have also to be further developed with respect to a selected number of different climatic areas of insular Southeast Asia (e.g., Philippines vs. Indonesia, monsoonal Eastern Indonesia vs. ever humid western islands). The involved researches moreover include correlation with the Pacific area, with cores realized on coral reefs in a palaeoclimatic perspective, and also with speleothem geochemistry.

All the above-mentioned topics were fairly represented during an exciting one day’s scientific session of the Human Origins Patrimony Studies in Southeast Asia conference, during which the involved Master and PhD students presented their work. They are illustrated as well at the end of this volume by several short papers from HOPsea participants.
### The main HOPsea networking events

#### 2005

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<tr>
<th>Month</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>April</td>
<td>Kick-off meeting, Frankfurt/Main, Germany</td>
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<tr>
<td>August</td>
<td>International excursion, Indonesia</td>
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<tr>
<td>October</td>
<td>International teaching module, Paris, France</td>
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<td>December</td>
<td>International teaching Program, Frankfurt/main, Germany</td>
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#### 2006

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<tr>
<th>Month</th>
<th>Event Description</th>
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<tr>
<td>March</td>
<td>First annual meeting, Philippines</td>
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<tr>
<td>July</td>
<td>International excursion, Germany and Netherlands</td>
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<tr>
<td>August</td>
<td>International Field School, Indonesia</td>
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<td>December</td>
<td>International teaching module, Paris, France</td>
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<td>International teaching Program, Frankfurt/main, Germany</td>
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#### 2007

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<th>Month</th>
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<tr>
<td>March</td>
<td>Second Annual meeting, Bandung, Indonesia</td>
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<tr>
<td>March-April</td>
<td>International Field School, Philippines</td>
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<tr>
<td>July</td>
<td>Summer school in Tautavel, Southeast France</td>
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<tr>
<td>August</td>
<td>International Field School in Indonesia</td>
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<td>September</td>
<td>Exhibition “First Islanders”, Bandung, Indonesia</td>
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<tr>
<td>September-October</td>
<td>International Field School, Philippines</td>
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<tr>
<td>December</td>
<td>International teaching module, Paris, France</td>
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<td>December</td>
<td>International Milestone Conference, Paris, France</td>
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<tr>
<td>December</td>
<td>International teaching Program, Frankfurt/main, Germany</td>
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The above-mentioned events were supported also by permanent activities, such as the building of the Virtual Platform (network’s website, common database, digital library and virtual museum), the development of an e-teaching module about Human Evolution, annual publication of the project’s brochure and milestone activities, and the regular internal circulation of the HOPsea Contact Letter.
In memoriam
Prof. Dr. Teuku Jacob

Henry de Lumley
Professor of MNHN Paris

HOPsea responsibles
E. Dizon  C. Hertler  F. Sémah  J. de Vos  Y. Zaim  T. Simanjuntak

At the opening of the Conference
Corazon S. Alvina
ASEMUS Chairwoman

H.E. José Abeto Zaide
Ambassador of the Philippines
First Islanders

Milestone Conference, Paris, December 2007

1, 2, 10 - Presentation of Homo floresiensis reconstruction, Musée de l'Homme
1 - E. Daynès, D. Grimaud-Hervé, A. van Heteren, H. Widianto
2 - M. Morwood & Y. Coppens

3 - Conference session

4, 9 - The students' poster session
9 - Discussion with T. Simanjuntak, V. Paz, S. Chia

5 - International module Prehistory of Southeast Asian Diploma supplement award
C. Peretto, P. Debey, Th. Garestier, Mirza Ansyori

6, 7, 8 - K. Setiagama, A.-M. Sémah, F. Détroit
First Islanders

THE EXHIBITION
From a geodynamic viewpoint the Indonesian region is situated between three major tectonic plates, the Eurasia continent in the North, the Pacific plate in the East and the Indo-Australian plate in the South. Movement of the plates represents the major tectonic activity during the Plio-Pleistocene forming Indonesia as archipelago. Due to climatic changes during the Quaternary land bridges were formed opening migration routes for faunal elements as well as early hominids from the Asia mainland into Indonesia passing Sundaland. The first discovery of a hominid skullcap, a femur, and a cheektooth (molar) in the Trinil area in 1891 by Eugène Dubois, which were associated with a distinct vertebrate fauna provided evidence for the presence of early humans. The hominid skullcap was named *Pithecanthropus erectus*, which literally translated means "upright ape man".

ITB strongly supports all activities concerning the study of earth sciences, both for exploration as well as for basic research such as human and vertebrate paleontology performed by the Department of Geology at ITB. ITB moreover supported corresponding activities of the Laboratory of Paleontology in association with the AsiaLink Program and the Human Origins Patrimony in Southeast Asia (HOPSea) network, for instance hosting the exhibition “First islanders” being jointly arranged by the network members.

We address our deep appreciation to all HOPsea members: the University of the Philippines at Diliman, the Muséum national d’histoire naturelle and Institut Paléontologie Humaine in Paris, France, the Johann Wolfgang Goethe University and the Senckenberg Museum in Frankfurt, Germany, as well as Naturalis Museum in Leiden, Netherlands. Our acknowledgments are also addressed to IAAI, ICPAS and Puslitbang Arkeologi Nasional, Indonesia. We hope this international cooperation program as well as the successful exhibition will continue in the future.

Bandung, September 5th, 2007

Prof. Dr. Djoko Santoso, MSc.,
Rector ITB
In 2004, the Human Origins Patrimony Studies in Southeast Asia (HOPsea) network was formally organized through the efforts of Professor Dr. François Sémah, Directeur du Département de Préhistoire, Museum national d’histoire naturelle, Paris (France); with the Naturalis Nationaal Natuurhistorisch Museum, Leiden (Netherlands); Johann-Wolfgang Goethe Universität and Senckenberg Forschungsinstitut und naturmuseum, Frankfurt (Germany), the Archaeological Studies Program, University of the Philippines, Diliman, Quezon City and the National Museum of the Philippines, Manila (Philipines); and Institut Teknologi Bandung, Ikatan Ahli Arkeologi, Centre for Southeast Asian Prehistoric Studies, Jakarta (Indonesia). The HOPsea network is supported by the Asia-Link, Europe Aid Co-Operation Office. The first kick-off meeting was held in April 2004 in Frankfurt. Since then a number of activities and outputs with corresponding reports have been accomplished, and the HOPsea network conference in Paris has been the culmination of its program activities.

The HOPsea network has become a channel and a venue for a truly collaborative international work in prehistoric and archaeological research activities, where scientists, professors and their young graduate students alike have laid open new avenues and dimensions for the new archaeological data they have gathered by excavation and exploration, including the re-assessment of old data, and current understanding about the prehistory of Southeast Asia on the origins, evolution, migrations of humankind in various environmental conditions.

The HOPsea network has grown and is still growing, with more representations from Universiteit Uterech (Netherlands), England, Ireland, Guam, Australia, Cambodia, Laos, Malaysia, Thailand and Vietnam present in the Paris meeting. Hence, it will need the support of their countries and institutions to sustain HOPsea’s mission and vision, and aims and objectives in the propagation of prehistoric research and international collaboration. We are very proud that the Philippines have been actively involved in this program of international collaboration, networking activities, and as an intellectual forum for archaeological and prehistoric research by eminent scientists around the world.

The Philippines is committed to sustaining its collaborative work in this endeavor, to make the data gathered relevant to the changing issues facing people and their environment, the furtherance of intellectual understanding, and appreciation of one another’s cultures and concerns.

Director Corazon S. Alvina,
Director of the National Museum of the Philippines,
ASEMUS Chairwoman
First Islanders

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Donan Satia Yudha
Sofwan Noerwindi
Friedemann Scherri
David Tanudirjo
Archie Tiaucone
Laurent Vergné
Harry Widianto
The exhibition

First Islanders

The Exhibition's opening, Bandung, september 5th, 2007

1 to 5:
Y. Zaim, D. Santoso, ITB's Rector,
T. Djubiantono, E. Dizon, F. Sémah
Evolution via natural selection is the natural process by which the living species give birth to a modified descent. Isolation, which naturally takes place in the archipelagos, implies important environmental pressure and therefore conspicuous evolutionary phenomena. That is why Southeast Asia represents a fantastic laboratory to study palaeobiodiversity, including the descent of the genus Homo.
In ancient times, as related for instance in the Serat Centhini, the Javanese used to recognize in the abundant fossil bones the remains of the victims of the epic battles of the Hinduist tradition (Mahabharata). Raden Saleh, the famous Javanese painter, happened to pay much interest into these traditions, and even organized palaeontological excavations near Kedung Broeboes (East Java).
First Islanders

"Giant bones"
Charles Darwin and Alfred Russel Wallace are outstanding figures of the progress of natural sciences during the 19th century. Their work and discoveries grounded the modern approach of biogeography, adaptation, natural selection and evolution as a whole. Wallace said that the ancestor of humankind, if any, should be searched for in the areas which, like the Southeast Asian tropical rain forests, presently host the anthropoid apes.
1887: The Dutch anthropologist and physician Eugène Dubois leaves Europe for the Netherlands Indies in search for the ancestor of humankind.

1889-92: In the Pleistocene deposits of East Java, near Kedung Broeboes (the place excavated by Raden Saleh) and Trinil, he discovers various fossils among which one was to become the famous “Pithecanthropus erectus”, now recognized as the Homo erectus type specimen.
First Islanders

Evolution

The Trinil human fossils
Paris, 1900
Eugène Dubois presents the first reconstruction of his "Pithecanthropus"
First Islanders

Evolution

Homo sapiens - Cro Magnon
Homo neanderthalensis
Homo erectus
Homo habilis
Australopithecus boisei
Toumai’s skull (Tchad, 6.5 million years) exhibits features related with human bipedalism, as do Orrorin tugenensis’ femur (Kenya, 6 million years). Which one is our ancestor? Gracile Australopithecus are found since 3.3 million years, while robust ones are present between 2.2 and 1 million years. They coexisted with Homo habilis and Homo ergaster. Homo habilis (2.4 to 1.5 million years) is actually bipedal. But, its recognition is often based on the behavioural context. Homo ergaster (1.8 million years) evolved towards Homo erectus and Homo sapiens. The oldest “out of Africa” Homo fossils are found in Georgia (1.8 million years).
In Asia, *Homo erectus* lasted until quite recent times (50 to 100,000 years) and were replaced by *Homo sapiens*. A probable insular evolution can be observed on *Homo floresiensis*, a fossil whose origin is still debated. The oldest European fossils (*Homo antecessor*, 0.8 million years) are found in Spain. Younger European fossil hominids continuously evolved towards *Homo neanderthalensis*, which became extinct. *Homo sapiens* left Africa via Palestina almost 100,000 years ago, then settled all the old world replacing other *Homo* species.
In Java, we observe the successive arrivals of different proboscids, most deriving from Indian forms whose fossils are found in the Siwaliks and reflecting different evolutionary processes which can be observed, among others, on their teeth: *Sinomastodon bumiajuensis*, whose teeth have cusps standing in a ridge, is part of the Satir fauna, one of the oldest recorded in Java. Then we find *Stegodon trigonocephalus*, which has low crowned molars with ridges and whose ancestor is *Stegodon insignus* from the Siwaliks. Later arrived *Elephas hysudrinicus* (high crowned molars with ridges) found along with the *Stegodon*. The last immigrant is *Elephas maximus*, whose molars are higher crowned with more ridges.
First Islanders

Evolution

Mastodon

Stegodon

Elephas
Southeast Asia underwent severe geographic and climatic changes through the last million years. The Sunda islands were often connected to mainland Asia by landbridges, and many marine channels became much narrower, allowing terrestrial animals to migrate. This explains the oldest human dispersals in the archipelagos and helps to understand the ancient settlements on remote islands.
Reaching the archipelagos
First Islanders

Migration

The oldest recovered fossils Mojokerto child skull and giant turtle bones
First Islanders

Migration

Between land and sea

During the glacial periods which occurred many times since 2.6 million years, the water concentrated on the polar ice caps and the sea level dropped several tenths of meters, implying severe palaeogeographical changes in Southeast Asia. Continental mammals migrations were paced by those palaeoclimatic events, as did human settlement of the islands. The oldest *Homo erectus* reached Java soon after the first mammals, c. 1.5 million years ago.
The tropical rainforest represents an important vegetation in the Southeast Asian archipelagos. It extended a lot during the most humid periods, especially the interglacials.
During the glacials, a large part of Southeast Asia underwent a contrasted climate, with a long and marked dry season. The open forest dominated and savannah-like grass lands could even expand in some areas.
The volcanic activity deeply influenced the mammal's and human's environment during the Quaternary. Eruptions yield specific deposits which change the morphology of the islands, the vegetation and the environment as whole.
Hexaprotodon is the Asian hippo. An almost complete and well preserved skeleton (109 bones) of an adult male Hexaprotodon sivalensis was discovered in the Pucangan clays in the Sangiran dome (Central Java), together with the fragments of a Homo erectus skullcap, cervids, bovids, and reptiles. Its age is about 1.2 million years. It shows two disabling pathologies: outgrowths on two of the lumbar vertebrae and two right metatarsals accidentally broken and subsequently fused. The hippos are good swimmers which can cross marine straits, and were among the first continental mammals which colonized the Southeast Asian archipelagos during the lower Pleistocene.
First Islanders

Hexaprotodon sivalensis
First Islanders

Axis antler and crocodile tooth
Severe changes occurred in the climatic pace from 800,000 years ago onwards. An important drop of the sea level allowed yet another faunal migration to the Sunda islands. It is even probable that humans reached remote islands such as Flores. The Ngebung site, in the Sangiran dome (Central Java) is one of the few which yielded an actual picture of island *Homo erectus'* way of life in an archaeological context at this period. We find there, on a former riverbank, the association of lithic tools and of the preys whose bones were intentionally broken.
First Islanders

Ngebung (Java) 800,000 years.
800,000 years old tektites linked to a meteoric impact represent a good marker for that period during which 'classical' *Homo erectus* (here Sangiran 17) are found in Java. Acheulian-like tools (hand axes, cleavers) like that from Arubo (Luzon, Philippines) are also found in the islands.
Lithic industries abound in the archipelagos, many of them likely to be related to the Lower Palaeolithic, and comparable for some to the typical Acheulian tools, found in Africa since more than 1.5 million years, in India more than 1 million years ago, and in Europe c. 600,000 years ago. Some of the Southeast Asian assemblages are famous, such as the one found near the town of Pacitan (East Java), and others are currently discovered (e.g. Ngebung), progressively disclosing to the researchers’ eyes the picture of a large dispersal of humans in the archipelagos during the Middle Pleistocene.
First Islanders

Migration
First Islanders

Migration

Muséum national d'histoire naturelle de Paris
François Sémah, semah@mnhn.fr
Living in a specific environment implies an adaptative behaviour, especially in the isolated context of the archipelagos. The fossils found on the islands often display anatomical characters which could be understood as the result of adaptative changes. Each island has its own evolutionary history, and often presents fossil animals having undergone spectacular dwarfism or gigantism.
First Islanders

adaptation

Dwarf Stegodon silhouette
c. 1.3 m. high
**First Islanders**

**Adaptation**

Dwarf *Bubalus cebuensis humerus* (Cebu, Philippines)

Dwarf *Stegodon* maxilla from Timor (Indonesia)
Celebochoerus is a giant suid from Sulawesi, whose tusks (upper canines) can match the dimensions of those of a hippo. It might have reached the Filipino archipelago during the Pleistocene.
The oldest human fossils, though belonging to the species *Homo erectus*, show very robust characters, which might be linked with the adaptation to the specific environment they met in Java, whose geographic reliefs were covered by a tropical rain forest. Their behaviour is still mostly unknown. We can study their diet and environment through the microwears on their teeth and, quite recently, several flake tools were discovered in the Sangiran dome (Central Java).
First Islanders

Sangiran 4

Flakes from Dayu (Sangiran)

Sangiran 6a, the so-called ‘Meganthropus’

Sangiran 31
Dated between 95,000 and c. 20,000 years ago, *Homo floresiensis* represents for many scholars a good example of endemism within the genus *Homo*. The origin of that dwarf form, which bears many archaic characters, is still under study.
First Islanders

Adaptation

Homo floresiensis
*Homo erectus* is supposed to have lasted until quite recent times in the Sunda Islands before being replaced by *Homo Sapiens*. The researchers are looking for archaeological records to understand that important period. In the karstic areas which border the Indian Ocean along the Southern coast of Java, many caves present important archaeological remains. Song Terus is the one where were discovered the oldest cave occupation floors in the Southeast Asia, dating back to 115,000 years ago.
Lithic tools and stalagmitic concretion documenting the earliest cave occupations in Song Terus cave, East Java, Indonesia c. 120,000 years ago.
First Islanders

Sapiens

Sambungmacan

Ngandong

Ngawi
Out of Africa, our species *Homo sapiens* reached Australia c. 60,000 years ago, a dispersal implying organized sea crossing. Humans had to cross the Southeast Asian archipelagos, where researchers look for their traces. Several important dispersal phases occurred since that period, which account for the present diversity of human groups between the Malay peninsula and the Pacific islands.
First Islanders

Tabon cave, Palawan, Philippines
Few sites yielded fossils of Pleistocene *Homo sapiens* in Southeast Asia: these are known on the Malay Peninsula, on Borneo Island, and in the famous cave of Tabon (Palawan, Philippines), where the fossils are dated between 16,000 and c. 40,000 years ago. They are found together with a flake lithic industry.
**Sapiens**

**First Islanders**

Song Terus, East Java, Indonesia
12,000 years ago, after the last glacial, the sea level became comparable to present, and humans migrated using navigation. Many sites are found all over the archipelagos, often with burials, which allow to understand the diverse aspects and ways of life of those people who dispersed all over the area.
c. 12,000 years ago, humans in Song Terus had to compete with predators (*Panthera maxilla*), hunted easy preys (*Macaca*, herbivores) and used fresh water resources (molluscs, turtles). They had regular contacts with the shoreline (sea molluscs) and developed besides a lithic industry, an industry on the bones of their prey.
Austronesian languages are spoken from Madagascar to South Pacific islands. They are supposed to originate from Southern China and have diffused to Southeast Asian archipelagos, together with associated neolithic traditions such as agriculture, polished stone tools, earthenware and also nephrite ornaments some 6,000 years ago. The Austronesians reached Northern Philippines via Taiwan by 5,000 years BP. They carried out complex mutual contacts with native island traditions.
Artefacts from Austronesian sites.
(Indonesia and Philippines)
First Islanders

Out of Africa, our species Homo sapiens reached Australia c. 60,000 years ago, a dispersal implying organized sea crossing. Humans had to cross the Southeast Asian archipelagos, where researchers look for their traces. Several important dispersal phases occurred since that period, which account for the present diversity of human groups between the Malay Peninsula and the Pacific islands.

Prehistoric burial excavated in Song Tunus Cave, East Java, Indonesia (c. 9300 BP).

Located at the Campus Center Bldg., 100 meters north of the main entrance (Gerbang Utama), ITB, Jl. Cina, Bandung.

Exhibit runs from September 5 - October 5, 2007 and is open daily from 8:00 AM - 6:00 PM.

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Evolution via natural selection is the natural process by which the living species give birth to a modified descent. Isolation, which naturally takes place in the archipelagos, implies important environmental pressure and therefore conspicuous evolutionary phenomena. That is why Southeast Asia represents a fantastic laboratory to study palaeobiodiversity, including the descent of the genus Homo.

Living in a specific environment implies an adaptive behaviour, especially in the isolated context of the archipelagos. The fossils found on the islands often display anatomical characters which could be understood as the result of adaptive changes. Each island has its own evolutionary history, and often presents fossil animals having undergone spectacular dwarfism or gigantism.
**First Islanders**

L'exposition « First Islanders » a été ouverte à partir du 5 septembre 2007 à l'Institut de Technologie de Bandung, pour une durée d'un mois. Elle évoque, sous divers aspects thématiques, la longue histoire de la colonisation des archipels depuis plus d'un million et demi d'années. Elle explore comment les représentants de l'espèce Homo erectus, venus d'Asie continentale, ont atteint Java et se terminant avec l'expansion des Austronesiens vers les îles du Pacifique il y a quelques milliers d'années seulement. Cette exposition fait une partie du cadre des activités du réseau européen et asiatique HOPsea (Human Origins Palaeoindonesian in Southeast Asia), soutenue par la Commission Européenne. Au-delà des divers programmes de recherche développés par ses membres indonésiens, français, philippins, allemands et néerlandais, ce réseau s'est donné pour mission de créer des ponts entre recherche et valorisation du patrimoine et d'assurer, dans une perspective de développement, l'accès à des données scientifiques et aux collections patrimoniales. C'est dans cet esprit que l'exposition First Islanders présente quelques aspects de ce précieux héritage préhistorique des archipels du sud est asiatique.

L'exposition, qui présente de nombreux objets provenant d'Indonésie et des Philippines, s'articule selon quatre thèmes :

1. **Evolution**
   - L'évolution, principalement illustrée par celle des proboscidiens asiatiques et par la place, dans l'histoire des origines de l'humanité, de la longue évolution des hominidés fossiles javanais.

2. **Migration**
   - Les migrations, illustrées par les premiers mammifères ayant colonisé Java, tels que l'Hexaprotodon (hippopotame asiatique), ainsi que par l'importante phase de diffusion des hominidés et des traditions techniques qui s'est produite il y a environ 800 000 ans.

3. **Adaptation**
   - L'adaptation, qui se traduit en milieu insulaire (isolement) par d'énormes formes de gigantisme ou de nanisme qui peuvent impliquer aussi les Hommes. Il en va ainsi de l'émouvant fossile récemment découvert à Flores, ou encore de certaines formes particulièrement robustes retrouvées dans les sédiments les plus anciens de l'île de Java.

4. **Sapiens**
   - Homo sapiens à la conquête des archipels d'Asie du sud-est, avec notamment le fossile découvert à Tabon, sur l'île de Palawan (Philippines, près de 20 000 ans), la saptique de la grotte de Song Teras (dans l'est de l'île de Java, Indonésie, environ 10 000 ans), et la dissémination des traditions techniques qui s'est produite il y a environ 800 000 ans.

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Pameran ini adalah bagian dari kegiatan kejadian ahli internasional Asia-Eropa HOPsea (Human Origins Palaeoindonesian in Southeast Asia), dengan bantuan Komite Eropa. Disingkat program-program penelitian yang dikecam dengan anggota dari Indonesia, Perancis, Filipina, Jerman dan Belanda, kejadian ini dimaksudkan untuk menjembatani penelitian dan pengisian ilmiah warisan budaya, baik untuk para peneliti maupun untuk masyarakat umum. Kejadian menghimpartakan hubungan antara dosan dan peneliti dari berbagai negara, training para mahasiswa 53 dan 33, akrias pada data dan koleksi ilmiah serta, dalam wangian perkehadaman, perbaikan hasil ilmiah untuk umum. Dalam rangka terhadap, pameran First Islanderka mempersembahkan beberapa aspek warisan budaya prasejarah yang berlima tinggi di kepulauan Asia Tenggara.

Pameran ini menampilkan banyak objek dari Indonesia dan Filipina; dan terdiri atas empat tema:

1. **Evolution**
   - Evolusi duniaan di fosil gajah dari Asia, dan juga oleh penjelajah kejadian evolusi fosil manusia di Jawa didalam sejarah asal usul manusia.

2. **Migration**
   - Migrasi, duniaan oleh mamalia pertama yang menghiup pulau Jawa seperti Hexaprotodon (kuda nil Asia) dan juga oleh tahap pertama dari penjelajah manusia budaya di kepulauan yang berlima tinggi di kepulauan Asia Tenggara.

3. **Adaptation**
   - Adaptasi, dimana pada lingkungan kepulauan yang terisolasi terjadi perubahan yang menggajian seperti binatang keril atau rakasa. Hal ini dapat terjadi pada manusia, seperti yang diamati pada fosil yang baru ditemukan di pulau Flores, atau satukinnya di fosil manusia yang sangat luas yang ditemukan di dalam lapisan yang tua di pulau Jawa.

4. **Sapiens**
   - Homo sapiens sebagai penjelajah kepulauan di Asia Tenggara, dipamerkan antara lain fosil yang ditampilkan di goa Tabon, di pulau Palawan (Filipina, hampir 20 000 tahun yang lalu), atau kuburan manusia di goa Song Teras (Jawa Timur, sekitar 10 000 tahun yang lalu).
Some articles

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An Acheulian tradition in the Archipelagos?

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Right from the first discoveries of lithic tools in Java, hand-axes, the most typical tools of the Acheulian tradition, were identified as components of the lithic assemblages, especially from Pacitan (fig. 1). Von Koenigswald, who discovered them in the Baksoka river valley, near Pacitan, published them as “Chellean” elements: at that time, Chellean meant early Acheulian (Von Koenigswald 1936).

But a few years later, when Movius studied the lithic assemblages from Pacitan, he named them Pacitanian. And in his synthesis regarding the "Early Man and Pleistocene stratigraphy in Southern and Eastern Asia" (1944), he considered the Pacitanian as different from the Acheulian. He declared that the Pacitanian hand-axes were not comparable to the typical hand-axes occurring in other parts of the Old World, especially in India, the closest region yielding Acheulian assemblages (fig. 2). Therefore he assigned the Pacitanian lithic industry to the "chopping-tool cultures" like those found in China, Myanmar (Burma) and Malaysia, while the "hand-axe cultures" were spread in Africa, South-western Europe and Peninsular India. Since then, despite some critical arguments against Movius' theory (Khatri 1973), commonly known as "Movius' line", the Pacitanian has been for long distinguished from the Acheulian tradition.

However, the discoveries of the last 50 years have shown the high diversity of the Acheulian assemblages and their occurrence in many parts of the world, including Eastern Asia (but excepting Northern and Central Eurasia).

Actually, the concept of Acheulian is usually taken with an extensive meaning, although some scholars may be more limitative. Any assemblage that includes at least a few hand-axes (on nodules, cobbles, flakes or slabs) or some cleavers can be considered as Acheulian. The hand-axes are stone tools characterised by a bilateral symmetry and bifacial shaping, obtained by variably invasive flake removals; their shapes range from oval to pointed and the microwear analyses show that they were multipurpose tools. They are often associated with cleavers, which are large cutting tools usually made on flakes, with one unretouched sharp transversal edge and two sides more often trimmed by flaking. Although they are qualitatively very significant, these two types of large cutting tools occur in small quantities (no more than a few percents) within the Acheulian assemblages, which are mainly composed of large and small flakes along with some cores and other tool types, like choppers and chopping tools, picks, polyhedrons, scrapers, etc.
This technical tradition first emerged in Africa around 1500,000 years, and appeared later in other parts of the Old World (800,000 years ago in Eastern Asia and 700,000 years in Western Europe). It is therefore assumed that it gradually spread from Africa to the rest of the world, either by migration of people or by cultural contact between populations. However some scholars suggest a multiregional origin: Acheulian would have appeared independently in Africa, Asia and Europe (Boëda 2005). But in the actual state of knowledge this cannot be demonstrated since the geographical distribution of the Acheulian sites does not show any clear gap from South Africa to Eastern Asian or Western Europe and since the Acheulian tools, despite their technological variability (partly linked to the raw material), display a certain morphological homogeneity (McPherron 2000).

Considering the variability of the Acheulian tools, there is now no reason for the hand-axes and cleavers from Java and from the southeast Asian Archipelagos not to be regarded as belonging to the Acheulian tradition. Java, and especially the Baksoka River near Pacitan, yields a number of hand-axes (fig. 3 to 6). No proper cleavers have been yet found in this valley, only large flakes which would have become cleavers after some retouching along the sides (fig. 7). Unfortunately, in the Baksoka valley (Bartstra 1976), the tools are usually found on the surface and their original location in the terraces sequence, hence their age, is unknown.

However, in the same region but in another river valley, the Koboran, a few hand-axes have been discovered at Punung, on a residual terrace, 12 m above the present river bed (fig. 8). This terrace, also found in the form of calcified deposit, at the bottom of the Song Terus cave (Punung), has been dated between 115,000 and 300,000 years.

Further North, the site of Ngebung, on the North-western slope of the Sangiran Dome, yielded a few cleavers (fig. 9), in association with other stone implements and faunal remains (Sémah et al. 2003); although devoid of any hand-axes, the industry belongs to the Acheulian tradition. The site consists in a well stratified alluvial sequence and is dated to 800,000 years. This date also corresponds to the age of the early Acheulian sites in Peninsular India, where cleavers (fig 10) are more common than hand-axes (Gaillard 2006), and South China (Huang 1985) especially in the Yujiang Valley near Bose (Hou et al. 2000, Xie and Bodin 2007). Therefore it seems that around 800,000 years ago humans of the Sunda sub-continent started adopting the same technical tradition, as this sub-continent was emerged at that time period, and it was in continuation with South Asia and Mainland Southeast Asia.

Apart from Java, Acheulian tools have been recently reported from South Sumatra (Forestier et al. 2005). In Central Luzon (Philippines), one hand-axe (fig. 11) and one cleaver have been found at Arubo (Pawlik 2004), and in Mindanao Island, in Cagayan de Oro, a tool, very similar to a hand-axe but unifacial, has also been discovered (Dizon, personal communication).

It is interesting to observe that many of the hand-axes in the Archipelagos are not pointed but their tip is carefully shaped in a convex cutting edge. This feature is also common among the hand-axes from Bose, in South China (fig. 12). But Southeast Asia was never directly connected to South China since the sea between Luzon (Philippines) and Taiwan is very deep (Heany 1985); the Acheulian tradition probably arrived to Sunda from South Asia (India) and Mainland Southeast Asia.
The industries with hand-axes and cleavers from the island Southeast Asia do not significantly differ from the Acheulian industries known in the other parts of the Old World. For a long time, the Pacitanian industry has been confusing, and the question of its definition is not yet solved, since the artefacts grouped into it may come from different river terraces and have different ages. Anyway, the Pacitanian includes typical tools attesting that the Acheulian technic was present in Java. Moreover other sites recently discovered show that this tradition started around 800,000 years ago, like in South Asia and East Asia. It occurs in several islands of the Archipelagos, which were regularly merged into a single sub-continent, linked to the mainland, when the sea level was lower due to global climatic changes.

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Figure 1 – Hand-axe from Pacitan (from von Koenigswald, 1936)

Figure 2 – Acheulian hand-axe from the North of the Indian sub-continent

Figure 3 – Amygdaloid hand-axe from Pacitan (Senckenberg Museum collection, Frankfurt, Germany; photo M. Bakara)

Figure 4 – Oval hand-axe from Pacitan (Senckenberg Museum collection, Frankfurt, Germany; photo M. Bakara)
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Figure 5 – Lanceolate hand-axe from the Baksoka valley (Pacitan)

Figure 6 – Amygdaloid hand-axe from the Baksoka valley (Pacitan)

Figure 7 – Large flake from the Baksoka river bed (Pacitan)

Figure 8 – Hand-axe from the Koboran valley at Punung
Figure 9 – Cleaver from Ngebung, Java (drawing D. Hidayat)

Figure 10 – a) Cleaver from Peninsular India (photo S. Mishra)  
b) Cleaver from the North of the Indian sub-continent
Figure 11 – Hand-axe from Arubo, Central Luzon, Philippines (courtesy E. Dizon & A. Pawlik)

Figure 12 – Hand-axe from Damei in the Yujiang valley, near Bose, South China (photo D. Cauche)
**Dwarfing and gigantism**

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Size changes frequently occur when mammals migrate to islands. Large mammals like elephants decrease in size, whereas small mammals like mice and rats grow larger. Those effects have initially been observed on islands in the Mediterranean, but it was discovered soon after that the island archipelago between Asia and Australia illustrates this process much better. On large islands like Jawa and Sumatera, those size changes are minute and can only be recognised by specific measurements.

On smaller islands east of Jawa, Bali and Borneo the effects are remarkable. Compared with faunas from the Asian mainland they possess unbalanced endemic island faunas. Because those islands were always isolated, they could only be reached by flying, swimming, drifting or floating via sweepstake dispersal (Sondaar, 1977). This happened only every now and then. Only a selection of the mainland mammals made their way to the islands.

**Sulawesi**

2.5 million years ago, a small Stegodon (pygmy stegodon or *Stegodon sompoensis*) and a pygmy elephant (*Elephas celebensis*) occurred. During the Early Pleistocene, about 900,000 years ago, a large sized *Stegodon* possibly immigrated to south Sulawesi, as represented by the few large-sized molar fragments. This might either have been *Stegodon trigonocephalus* from Jawa or another large sized Stegodon from the Philippines or the Asian mainland. By Middle or Late Pleistocene, both pygmy proboscideans had become extinct, while the large sized Stegodon continued or, alternatively, a new immigration of a large *Stegodon* took place besides a new immigration of an highly advanced *Elephas* species (Fig.1).

Besides the proboscideans a strange pig, *Celebochoerus celebensis*, with large canines and shortened legs, is present (Bergh, 1999). Especially the shortened legs are characteristic for an island form, although we do not yet know the reason.

**Flores**

Recently the discovery of tiny fossil human beings made the island of Flores famous on a world wide scale. Those tiny humans demonstrate that humans are also subject to the dwarfing proces. Moreover, large rats and giant monitor lizards occurred. The locality Liang Bua where those astonishing finds originate from, is however among the younger sites known in Flores. In 2004 a new small-bodied hominin (*Homo floresiensis*) from the cave Liang Bua was announced (Brown et al., 2004). It was 1 m tall and possessed an endocranial volume of 380 cm$^3$. The most likely explanation for its existance is long-term isolation, with subsequent dwarfing. *Homo floresiensis* has typical island adaptations. The age is considered from 38,000 years ago until at least 18,000 years ago.
In 1982 a new locality was discovered 2.5 km east of Mata Menge and 250 m southeast of Ola Bula, yielding fossils of a giant tortoise and a pygmy stegodon. This locality, known as Tangi Talo, contained a distinct fauna (Fig.2).

The fossils were recovered from the top of a 300 mm thick white, pumice containing tuffaceous layer pertaining to subunit A. The pygmy stegodon from Tangi Talo (shown in figure 3) represents a distinct species, *Stegodon sondaari*, and differs from the pygmy stegodonts known from Jawa, Sulawesi and Timor (Fig.3).

The tortoise *Geochelone* is on average much smaller than fossil giant tortoises known from other islands. Besides those species, remains of a monitor lizard, *Varanus komodoensis*, were also recovered. No artifacts have been found in the fossiliferous layer at Tangi Talo or in the tuffaceous interval in which this layer occurs (Bergh, 1999). Humans were thus not present (Fig.4).

Fossils from Ola Bula and Mata Menge are stratigraphically younger. The large to medium sized *Stegodon florensis* from those localities is slightly more advanced than *Stegodon rigonocephalus* from Jawa. Besides, fossil remains of a giant rat, *Hooijeromys nusatenggara*, have been found. Furthermore, a few teeth of a small crocodile were found at Mata Menge, while teeth of *Varanus komodoensis* occurred at Dhozo Dhalu. Today, only the Komodo island monitor still exists. All other species became extinct. Among those remains, artifacts have been discovered. Those artifacts are described as a number of pebble tools and retouched flakes mostly made of volcanic rock, were inferred to be Middle or Late Pleistocene and indicate, that *Homo erectus* reached the Lesser Sunda islands. The colonization of the island by humans coincides with a faunal turnover. An endemic island fauna with the tortoise *Geochelone* and a pygmy stegodon is replaced by an endemic island fauna with *Stegodon florensis* and *Hooijeromys nusatenggara*.

**Timor, Sumba, and Sangihe**

From Timor and Sumba dwarf stegodonts are known. However, the stratigraphical context of the fossils is not clear. We thus do not know their age.

The small island of Sangihe lies between the northern tip of Sulawesi and the island of Mindanao in the Philippines. Stegodont material from the island includes a tusk and several molar remains. All material originates from the Pintareng Formation exposed on the southeast of Sangihe Island. The age of this formation is thought to be Pleistocene. The material was briefly described and attributed to a stegodon similar to the one from Jawa (Aziz, 1990).

**Philippines**

From the islands of the Philippines only a few mammal fossils are found and described (Vos and Bautista, A., 2003). Based on the size and morphology of the molars there is only one species of stegodon, *Stegodon luzonensis*, and a large elephant species. *Stegodon luzonensis* is slightly smaller than the continental form. Postcranial elements show that there is a small and large proboscidean. Furthermore, there is a relatively small rhino, *Rhinoceros philippinensis*, and a giant tortoise. This strange composition clearly shows that it represents an endemic island fauna. Age and
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stratigraphy are not well known. Besides, archaeological investigations have argued that the faunal remains are of Mid-Pleistocene age and that at least some of the tools are coeval with the fossils (Fox and Peralta, 1974). Probably we are dealing here with a similar succession as in Flores, characterised by a first fauna including a pygmy proboscidean and a giant tortoise, replaced by a large proboscidean and artifacts. Besides, some molars have been found which are quite similar to the strange pig of Sulawesi and are indicated as “Celebochoerus” (Fig.5).

A chrono-spatial network emerging
We can now identify a number of processes which can frequently be observed on islands. For instance, all island faunas are selected and imbalanced in terms of species composition. Compared with the faunas on the mainland, where these species originate from, only swimming and flying forms can reach islands which were never connected to the mainland via landbridges. Landbridges frequently connected the Sunda islands Jawa, Sumatera and Borneo with the mainland, but not the islands in the east. The faunas on islands in the Wallacea are quite strange in composition. Tiny proboscideans, large tortoises (which are yet smaller than the giant forms known from Jawa), strange pigs and giant rats are forms occurring repeatedly.

However, we do not yet know enough about chronological relations between faunas on the different islands. Our knowledge is not yet precise enough to identify precisely which island fauna predates which other one. In terms of migration routes a route leading from the Malayan peninsula via Jawa towards the islands in the Wallacea is quite well established. This route has apparently been followed in particular by humans during their initial colonisation of the islands in the Sunda archipelago. However, the close resemblance between faunas in the Philippines, Sangihe, Sulawesi, Flores and the other islands of Nusa Tenggara may well indicate a migration route leading from the Asian mainland southward via the Philippines. This is an alternative to the main route via Jawa.
References


Figure 1 - *Celebochoerus celebensis*

Figure 2 - Tangi Talo

Figure 3 – Molar of the pygmy stegodon, *Stegodon sondaari*. The army knife on the left represents a scale and demonstrates how tiny the cheek teeth of these small proboscideans were.

Figure 4 - The large to medium sized stegodon, *Stegodon florensis*. The large rippled piece in the middle of the picture is a molar.

Figure 5 - *Celebochoerus* from Sulawesi (top) and “*Celebochoerus*” from the Philippines (bottom).
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John de Vos, Anne Bouteaux & Angel Bautista

The mammalian faunas chronology in island Southeast Asia

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Migrations during the Early-Middle Pleistocene to Java

During the Late Pliocene - Early Pleistocene in the Indian Subcontinent there was a fauna living in an open environment. In the sediments of the Upper Siwaliks, the foothills of the Himalayas, animals, like the hippo *Hexaprotodon sivalensis*, the proboscidean *Stegodon insignus*, the elephant *Elephas hysudrindicus*, the sabre-toothed cat *Meganthereon*, the hyena *Hyaena brevirostris*, a lot of bovids, gazelles, cervids, camels and horses are found (Colbert, 1935; Hussain et al., 1992).

During the Early - Late Middle Pleistocene the Indonesian Archipelago was formed. About 1.8 Ma ago Java came above sea level. A migration took place from the Indian subcontinent, via Burma, where we also find *Hexaprotodon* and *Stegodon* in the Irrawady Beds to Java (Colbert, 1943). The first mammals that reached Java were a hippo, *Hexaprotodon*, cervids and a mastodon *Sinomastodon bumiajuensis*. The environment was a mangrove. Based on the presence of only these three taxa we may conclude that Java was not connected with the mainland (de Vos & Long, 2001). Such a fauna only consisting of a few herbivores, in which carnivores are lacking, we know from islands in the Mediterranean and in Indonesia itself. Such faunas are called unbalanced endemic island faunas (Sondaar, 1977). The unbalanced endemic island fauna from Java is found in Sangiran and the Bumiaju and is called the Satir fauna (fig. 1, tab. 1) (de Vos et al., 1982). The mammals came to Java by sweepstake dispersal.

About 1.2 Ma ago Java became better connected with the mainland, although the connection was not complete. The Satir fauna became extinct and there was a new migration from the continent. This new fauna, known from the Bumiaju and Sangiran, is called Ci-saat fauna (fig. 1, tab. 1). That the connection must have been better, we know by the presence of the tiger. Tigers do not cross large water barriers. The fauna is balanced, but still the connection was not full, probably there was also an ecological barrier, because camels, horses, antelopes did not reach Java. This kind of dispersal is called filter dispersal. Probably also *Homo erectus* reached Java. That *Homo erectus* was present about 1 Ma ago we know from the finds in the most famous locality in Java, named Trinil. It was here that the Dutch Eugene Dubois found during 1891/1892 the skullcap, with a brain capacity of 1000 cc, the femur, on which we can see that the individual to which it belonged walked up right and the molar. Dubois considered that the specimens belong to one individual and called it *Pithecanthropus erectus*, (Dubois, 1894) nowadays called *Homo erectus*. The fauna has more species than the Ci-saat fauna and is called the Trinil *Haupt Knochenschicht* fauna. Besides all kinds of mammals, there was only one proboscidean, *Stegodon trigonocephalus*. 
This species is a little smaller than his ancestor, *Stegodon insignus*, on the continent. *Homo erectus* lived about 1 Ma ago in a more open environment.

About 800,000 years ago, there was a new migration to Java. Another proboscidean, *Elephas hysudrinicus*, came to Java. Besides the elephant, also hyena, tapir and a scaly anteater reached Java. The fossils we are talking about are coming from the site Kedung Brubus and the fauna is also called Kedung Brubus fauna (fig. 1, tab. 1). Only a piece of mandible of *Homo erectus* is found here (de Vos et al., 1982). This association was found too in Sangiran dome at Tanjung site (Bouteaux et al., 2007).

If there is a new migration or local evolution is not known, but in the next fauna, the Ngandong fauna there is a *Homo erectus* whose brain size is larger than the one from Trinil. Eleven skulls are found at the site of Ngandong (fig. 1, tab. 1). Probably the so-called Solo Man, lived till about 200,000 years ago. There is a vivid discussion about the precise dating of Solo Man. The dispersal from the Siwaliks via Malaysia is called the Sivamalayan route (fig. 1).

Figure 1 - The Siva- and Sino Malayan routes (de Vos et al., in press).

**Migration during the Late Pleistocene to Java**

In China, Vietnam, Laos, and all over continental Southeast Asia, there was during the Middle Pleistocene a tropical rainforest (de Vos, 1995). In that forest lived the orang-utan, gibbons, tigers, etc. During the Late Pleistocene there was a sea level lowering and the Sunda Shelf felt dry. Because of this Java, Sumatra and Borneo were connected with...
the mainland. The environment changed and the archaic fauna with Stegodon, Hexaprotodon became extinct. A migration of a tropical rainforest fauna with recent mammals via a corridor took place from the continent to Sumatra, Borneo and Java. The dispersal from China via Malaysia is called the Sino-Malayan route (fig. 1). Elements of the tropical rainforest fauna, like the orang-utan, on the continent became extinct. The site in Java where the fossils are found is Punung (Storm et al., 2005). This site is dated about 120,000 years ago. In this site also Homo sapiens is found, which means that also Homo sapiens might have reached Java by that time. In caves on Sumatra we find also the same tropical rainforest fauna as in Punung (tab. 1). Here also Homo sapiens is present. A similar fauna is known from Borneo, the famous cave of Niah, with an age of about 40,000 years (Medway, 1979). It is remarkable to notice that on the continent as well as on the islands the fossils of the tropical rainforest are found in caves (de Vos, 1995). No bones, or hardly any, are found. The only things that are found are molars, owing to porcupines gnawing (including the teeth roots). It is likely that all the material was brought into the cave by porcupines.

The Holocene
During the Holocene, about 10,000 years ago, the Sunda Shelf broke up. First Java became isolated and then Sumatra was separated from Borneo. Java became dryer; the tropical rainforest fauna disappeared. What was left on Java was more or less the fauna we can find today. In the Holocene also the Mesolithic-Neolithic started, represented by Wajak Man (Storm, 1995) (tab. 1). In Sumatra and Borneo the tropical rainforest survived till today.

<table>
<thead>
<tr>
<th>WAJAK</th>
<th>Panthera, Presbytis, Tapirus</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUNUNG</td>
<td>Elephas maximus, Sus vittatus, Pongo pygmaeus</td>
</tr>
<tr>
<td>NGANDONG</td>
<td>More advanced forms</td>
</tr>
<tr>
<td>KEDUNG BRUBUS</td>
<td>New arrivals: Hyaena, Tapirus, Epileptobos and Elephas</td>
</tr>
<tr>
<td>TRINIL H.K.</td>
<td>Few species: Axis and Duboisia, big bovids</td>
</tr>
<tr>
<td>CI SAAT</td>
<td>Hexaprotodon sivalensis, Sus stremmi, cervids, Bubalus, Panthera</td>
</tr>
<tr>
<td>SATIR</td>
<td>Hexaprotodon simplex, Sinomastodon bumiajuensis, Cervus, Geochelone</td>
</tr>
</tbody>
</table>

Table 1 - Synthesis of the biostratigraphical successions in Java.

References


Outline of climate and vegetation changes in Java during the Quaternary

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The earliest inhabitants of central and eastern Java, archaic Homo erectus, probably arrived between 1.7 and 1.2 million years ago (see Sémah, 1986; Kadar & Watanabe, 1985; Swisher et al. 1994; Sémah et al., 2000). The question still arises regarding their behaviour, their adaptation to the forest environment, and the development of correlative morphological characters. To reach the southernmost part of the Sunda shelf where Java is located, they crossed land bridges which formed within the changing palaeogeographical pattern of the area throughout the Pleistocene. This equatorial region was, to some extent, covered by tropical forests, and underwent drastic environmental changes during the climatic oscillations that characterize the Quaternary period.

Although drier climatic conditions during glacial periods resulted in more open landscapes (e.g. grasslands or monsoon forests, see for instance Caratini & Tissot, 1985), it seems that the tropical rain forest persisted in galleries (Hooghiemstra, 1997) and on the highlands (Stuijts, 1993). The rain forest certainly prevented some animals to reach Java during the Pleistocene, and the interglacial high sea levels resulted in the development of isolated mammalian faunas (de Vos et al., 1982). Those events must have played a significant part in hominins’ behaviour and adaptation. Several hypotheses have been published regarding the latter issue. Some scholars (Bartstra, 1982; 1983; Bartstra & Basoeki, 1989) assumed that the use of small flake tools by Javanese Homo erectus could predate the use of the larger pebble tools used by Homo sapiens. Others emphasized the possibility that a specific rain forest environment could have triggered a significant reliance on bamboo implements rather than lithic ones.

Java is located at a present climatic and ecological boundary, that of a ‘seasonal’ eastern Indonesian domain where the climatic pattern is characterized by a marked dry season (musim kemarau) and a hyper humid evergreen forest domain that extends over west Java and Sumatra. That situation makes the palaeoenvironmental studies even more interesting beyond the above-mentioned consequences of the major Quaternary climatic changes on the landscape. It is likely that slighter climatic oscillations (even ENSO-like events) could be recorded in the sites, and have impacted the geographical extent of the forest cover.

We shall consider mostly the Sangiran dome, the famous World Heritage hominid-bearing site in the Solo depression, which offers diverse sedimentary facies ranging from marine, to palustrine, lacustrine and fluviatile. Most of the series predate the period when the island reached a shape somewhat similar to the present one (at the end of the Lower Pleistocene, see Djubiantono, 1992). The knowledge gathered since many years about this site allows to consider the trend that has to be followed by palaeoecological researches in order to contribute to the understanding of hominin migrations, adaptations an evolution in island Southeast Asia. But we shall also briefly mention other works on more recent sites which either address other important periods of human history (e.g. the subsequent
replacement of *Homo erectus* by *Homo sapiens*, followed by the huge dispersal of anatomically modern humans in the archipelagos and the diffusion of Neolithic traditions), or to describe, with a higher resolution, the consequences of the major climatic oscillations on the landscapes.

**The Sangiran dome: a fair description of Central Java palaeoenvironmental evolution during early Quaternary times**

At Sangiran (Fig.1; 2), the stratigraphical series starts with late Pliocene deposits, when open marine *Globigerina* marls where replaced by blue clays deposited in a shallow sea. The installation of regressive conditions can be linked with the oldest eustatic drops in sea level, but also with the volcanic activity of the extant Sunda arc (Sémah, 1986; Djubiantono, 1992). The weathering of the abundant volcanic ashes resulted into thick clay deposits. At this time, c. 2.6 million years ago, a tropical rain forest covered the emerged reliefs, and mangrove forests began to extensively border the shoreline. The pollen record, with significant highland taxa such as *Dacrycarpus* (Sémah, A.-M. 1982; 1984; 1986) suggests a drop in the temperature. Coastal facies developed during the beginning of the Quaternary period (2.6 to 1.8 million years), as pointed for example by the development of *Balanus* limestones at Sangiran (van Es, 1931; von Koenigswald, 1940). The pollen record allows to follow the development of the mangrove forests (Sémah, A.-M., op. cit.).

A severe volcanic phase accumulated laharic flows in the Solo basin c. 1.7 million years ago (Sémah, 1986; Swisher et al., 1994; Sémah et al., 2000). G.H.R. von Koenigswald (1940) found the oldest continental mammals from Sangiran (cervid teeth) precisely in these flows; a discovery confirmed by recent fossil finds (Zaim, personal communication). It seems that the vegetation was repetitively disturbed during those long periods of volcanic activity, which picture open grasslands with taxa like *Imperata cylindrica* and *Casuarina* trees (pioneer taxa adapted to fastly recolonize the land after major disruptions, see van Steenis, 1972).

Clayey sedimentation resumed after this stage in a swampy basin that was occasionally invaded by the sea. These series are called Pucangan (or Sangiran, see Watanabe & Kadar, 1985). Yet, it is clear that hominins had already arrived in Sangiran between c. 1.7 (age of the lowermost Pucangan beds) and c. 1.2 M yrs (age of a tuff within the Pucangan layers, Sémah, 1986; Kadar & Watanabe, 1985; Swisher et al. 1994; Sémah et al., 2000; Saleki, 1997). Throughout that long period represented by the Pucangan series, *Homo erectus* faced various environments. Lowlands presented different ecosystems such as mangrove and swamp forests, often disrupted and disturbed by both volcanic activity and marine transgressions. With regards to the surrounding slopes and hills, they were covered by a rain forest with *Podocarpus*, Fagaceae, Dipterocarpaceae, and *Altingia* during ‘interglacials’; and by more open forest formations during ‘glacial’ periods. The tropical forest never disappeared: significantly, the pollen record shows a sustained presence over time of trees like *Podocarpus*, *Castanopsis*, *Quercus*, *Myrica*, *Casuarina* which appear as both mature forest taxa and also pioneer ones after volcanic disruption (Sémah, A.-M. 1996a; van Zeist, 1984).
The top part of the Pucangan series comes with more gracile Homo erectus (like the Hanoman 1 skull, Widianito et al., 1994) that resemble the well-known Trinil skullcap (Dubois, 1894) and are dated to c.1 million years. The uplift of the Kendeng hills at the north and of the Southern Mountains contributed to the complete filling up of the Solo basin and to the disappearance of marine influence. This is the time when conspicuous fluviatile sediments appear at Sangiran, as synorogenic deposits that mix marine and continental elements. This episode is called Grenzbank (“boundary bed”) by Ralph von Koenigswald (1940). It is first characterized by pollen and spores assemblage reflecting volcanic disruptions, then by a diversification of the flora with many more tree species, in which the still high percentage of non-arboreal taxa indicates open vegetation.

The Grenzbank episode was followed by the deposition of clay, sand, and tuffaceous cross-bedded alluvia, called the Kabuh (or Bapang) beds. This part of the Sangiran series, dated c. 0.8 million years ago (Jacob, 1975; Saleki, 1997) yielded the majority of the hominin fossils. Pollen analysis documents a somewhat drier climate and open vegetation with Poaceae, Asteraceae, Fabaceae, and Mimosaceae. Nevertheless, especially at the basis of the Kabuh layers, there still are humid forest taxa with Fagaceae, Altingia excelsa, Engelhardia and Podocarpus. It is worth to notice that those lower Kabuh layers, near the Early to Middle Pleistocene boundary, reflect both the faunal turnover which took place in island Southeast Asia at the time (de Vos et al. op. cit.), and begin to yield actual archaeological contexts regarding Javanese Homo erectus’ way of life. Following von Koenigswald, Soejono (1982) and Bartstra (1985) mentioned, at Ngembang (NW part of the Sangiran dome), the presence of artefacts which was confirmed by evidence of occupation floors and correlative extensive excavations by an Indonesian-French team (Sémah et al., 1992). The excavations documented massive artifacts, including bolas and cleavers, together with freshly broken bones with butchery traces and associated human remains. There, the Kabuh layers are dated to c. 0.8 million years by Argon methods (Saleki, 1997) on pumices, then onto single grains taken from homogeneous tuff layers that overly the excavated horizon. The stratigraphy records thick greyish clays that underwent erosion and were covered by the typical cross-bedded Kabuh sands. The occupation floors are located at the boundary between the clay and the sands, and the archaeological finds are embedded in a sandy and clayey matrix. The preservation seems exceptional, with prints of bamboo, bark, and leaves. The sediment itself did not yield much pollen (except for Mimosaceae and Poaceae).

**Conclusion: towards accurate Quaternary palaeoenvironmental reconstructions in Southeast Asian islands**

The results obtained in the Sangiran dome are quite promising in terms of interdisciplinary approach of the hominins’ way of life. Further palaeobotanical interpretations for such ancient periods will especially rely on progresses made in the absolute chronology of the site in order to complete the general frame of the Early Pleistocene environmental evolution and correlative hominin adaptation.

But comparative studies on much younger sequences (Fig.2), mostly in lake and swamp records, allow a more precise idea of the impact of a global change on the landscape. The Ambarawa basin (Fig.1) for example, at c. 460 m above
sea level, presents a continuous record of the last 20,000 years with a quite high, c. 2 mm/year sedimentation rate which can be easily chronologically controlled by means of $^{14}$C dating (Sémah, A.-M. et al., 1992; 2004). During the last glacial maximum (LGM), some 20,000 to 18,000 years ago, the pollen analysis indicates a downward shift of altitudinal vegetation belts as suggested by the presence of taxa such as Dacrycarpus, Altingia, and Engelhardia, adapted to cooler conditions; Poaceae are abundant. It documents open and herbaceous landscapes with patches of rain forest during a drier and cooler period. The rather open vegetational cover (and correlative soil weathering) implied a sedimentation dominated by clays and sands. Then, the sedimentation changes to peat deposits, and we find first an increase of Typha, suggestive of more swampy (= more humid) conditions in the depression. More abundant arboreal pollen still include many seasonal, open forest taxa, and point to a still marked dry season. Arboreal pollen dominates the sequence near the Pleistocene to Holocene boundary, with local swamp forest trees and taxa indicative of rain forest landscape on the neighbouring hills.

Palaeoecological descriptions tend also to be applied to more difficult, poorer in pollen deposits (i.e. less significant from a palaeoenvironmental modelling point of view) such as cave deposits, but which allow the correlation with the successive human groups. Interesting preliminary results, matching those of Ambarawa (especially regarding the Pleistocene to Holocene transition), have been obtained in the Song Terus cave (Fig.1), near Pacitan (East Java) whose filling covers more than the last 300,000 years.

The future of a research oriented, beyond pure palaeoecology and palaeoclimatology, towards prehistoric behaviour and human adaptation concerns, will have to develop those parallel studies, to include comparisons between climatic contrasted areas (e.g. northern Philippines vs eastern and western Indonesia) and, rather than discarding archaeological sites as less significant, to consider as much as possible the specificities of pollen taphonomy in such deposits.

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Figure 1 - Java Island - Sites
Figure 2 – Palaeoenvironmental and palaeoclimatic comparisons
The Geological Background of Hominid Colonization of Java

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Introduction
Hominid and vertebrate fossils as well as artifacts and/or stone tools were discovered in the Indonesian Archipelago, particularly in sediments deposited in terrestrial, fluvial and/or lacustrine environments. They were found on the islands of Sumatra and Nias, Java, Kalimantan (Borneo), then across the Wallace Line, on Sumbawa, Sumba, Flores, Timor, Sulawesi, Seram, Halmahera, and Sangihe.

Evolution of hominids and vertebrates in Indonesia was influenced by the development of geological conditions in the Indonesian regions. Tectonic activity and glacio-eustatic sea level changes during the Quaternary are closely related with dispersal and evolution of the hominids and vertebrates, as well as the modes of their migration from the Asian mainland into the Indonesian Archipelago.

Hominid remains in Indonesia
First hominid fossils in Indonesia (and Southeast Asia) have been discovered by Dubois between 1890 and 1891 from outcrops on the river bank of Bengawan (meaning river) Solo, at Trinil, East Java; the fossil remains then were attributed to Pithecanthropus erectus Dubois, later on taxonomically known as Homo erectus. The Trinil area is also known as type locality for the Middle Pleistocene faunal stage of the Trinil Fauna (von Koenigswald, 1934), also called Trinil H.K. Fauna of early Middle Pleistocene (de Vos, 1985; de Vos et al., 1982; de Vos and Sondaar, 1994). The latter one replaced the Jetis Fauna attributed to the Early Pleistocene, formerly established by von Koenigswald (1934).

The oldest sediments exposed in the Trinil area are black clays and belong to the Pucangan Formation with a Early Pleistocene age (Figure 1). The Pucangan Formation comprises medium to very coarse cross-bedded conglomeratic sandstones. It is covered by the Kabuh Formation and contains remains of Pithecanthropus erectus (Homo erectus). Vertebrate fossils belong to the Trinil H.K. Fauna from the early Middle Pleistocene. Pucangan and Kabuh Formations are covered by river deposits of Old Solo Terraces.

Hominid and vertebrate fossils also occur in Ngandong, Kedungbrubus, Sambungmacan, Perning, Patiayam, and Sangiran.

The deposits in Sangiran display a dome structure and are therefore called Sangiran dome. The Sangiran dome is located about 20 km north of Solo. It is one of the most important hominid and vertebrate fossils site in Indonesia and Southeast Asia.
In Java, the marine environments which occurred during Tertiary emerged above sea level thereby forming a “proto-island of Java” (Figure 2). In Sangiran, terrestrial sedimentation was influenced by volcanic activity.

The oldest sediments in the Sangiran area belong to the Puren (formerly Kalibeng) Formation of Pliocene age. They consist of marine marls being deposited in a shallow marine environment. This formation is unconformably covered by the Sangiran (Pucangan) Formation of Early Pleistocene age. The Sangiran Formation comprises lahar deposits at the base, which is known as Lower Lahar Unit (LLU according to Watanabe and Kadar, 1985) and is characterized by the matrix supported of lahar deposits as the product of volcanic activity (Zaim et al., 1999). $^{40}$Ar/$^{39}$Ar dating recently carried out by Bettis et al. (2004) yielded an age of $1.90 \pm 0.02$ Ma for the Lower Lahar Unit (LLU).

The LLU again is covered by marine sediments consisting of thin layers of diatomite. This indicates that the area was inundated by a shallow water body due to transgressions during short-term sea level rises. These marine sediments are covered by black lacustrine clays intercalating with thin layers of tuff. The presence of the tuff layers indicates the existence of reactivated volcanoes during the deposition of the black clays.

The Sangiran formation is covered by fluvial deposits of the Bapang (Kabuh) Formation of Middle Pleistocene age. It contains alternating clays, medium to very coarse-grained conglomeratic sandstones with cross cutting troughs and planar cross-bedding structures, and conglomerates; they were deposited in meanders and point bar channels. Very hard, compacted and calcareous layers of conglomerate occur at the base of Bapang (Kabuh) formation, 0.5 – 2.5 m thick, as a boundary layer between Sangiran (Pucangan) and Bapang (Kabuh) formations. This boundary layer is well known as Grenzbank layer. It is rich in homininid and vertebrate fossils and has also yielded older ages ($1.51 \pm 0.08$ Ma, Larick et al., 2001).

The Upper Lahar Unit or Pohjajar (Notopuro) formation (Watanabe and Kadar, 1985) overlying the Bapang (Kabuh) formation contains large boulders of andesite within a tuffaceous matrix. The Pohjajar formation was deposited during the Late Pleistocene based on its stratigraphic position on top of the Middle Pleistocene Bapang (Kabuh) formation.

The youngest rock unit in the Sangiran Dome consists of river terraces unconformably overlying the Upper Lahar Unit of the Pohjajar Formation. Its deposits were formed during Holocene.

Early Pleistocene hominid specimens (S-6b, S-8, S-27, S-31) obtained from this area, formerly known as Meganthropus paleojavanicus (von Koenigswald, 1968; Sartono, 1986; Indriati, 2004) were collected from the black clays of Sangiran (Pucangan) formation. Based on $^{40}$Ar/$^{39}$Ar dating on pumice samples taken from the Bapang/Sangiran formation contact, just at the top of the black clays (Larick et al., 2001) they are older than $1.51 \pm 0.08$ Ma. The vertebrate association consists of Hexaprotodon simplex, Sinomastodon bimaijensis, Cervidae and Geochelone. It is related to the Satir fauna with respect to the mammalian biostratigraphy of Java (Sondaar, 1984; Sondaar et al., 1996; Leinders et al., 1985; de Vos, 1996).
The Middle Pleistocene Homo erectus were collected from the Bapang Formation, ranging according to Larick et al. (2001) from 1.51 + 0.08 Ma to 1.02 + 0.06 Ma. Human fossils have been discovered along with Hexaprotodon sivalensis, Stegodon trigonocephalus, Elephas hysudrindicus, Axis lydekkeri, Duboisia santeng, Bos (Bibos) palaeondaicus, Bos (Bubalus) palaeokarabau, Rhinoceros sondaicus, Sus brachygnathus, Sus macrognathus, Semnopithecus auratus, and Macaca fascicularis. Some of these vertebrates are attributed to the Cisaat Fauna (collected from Sangiran Formation below the Grenzbank layer). Others belong to the Trinil H.K. fauna which is collected from Bapang formation above the Grenzbank Layer (Sondaar et al., 1996). Some artifacts have also been discovered in the Bapang (Kabuh) formation, deposited in a non-marine palaeoenvironment and associated with fresh-water molluscs such as Melanoides sp., Brotia sp. Brotia testudinaria scalaroidea, Brotia sp. aff. Brotia testudinaria testudinaria, Physa sp., and Pilsbryoconcha sp. cf. P. exilis (Aswan et al., 2006).

In East Indonesia, terrestrial sediments from the Quaternary have been observed in Timor, Flores, and other islands. They contain vertebrates and artifacts. Although there is no evidence of hominid fossils in the regions as yet, the existence of artifacts, indeed, indicates that Homo erectus lived outside Java in the islands mentioned above.

In the Late Pleistocene, the vertebrates as well as hominids migrated from Asia through different dispersal routes. The western route leads from the Asian mainland through the Sunda Shelf to Java and then to Nusa Tenggara islands (Lesser Sunda islands, i.e. Bali, Lombok, Sumbawa, Sumba, Flores, and Timor). An alternative route from the North leads from Asia, China in particular, through Taiwan to the Philippines, passing Sulawesi, continuing to Flores, until it finally reaches Timor (Figure 3).

At the end of Late Pleistocene – Holocene Homo sapiens entered Java, simultaneously with vertebrate communities found in Punung and Wajak. They lived in humid forests and in open woodland (van den Bergh et al., 2004). Homo sapiens in East Indonesia coexisted with Homo floresiensis which has been recently found on Flores. It is dated to 18,000 BP. An evolutionary trend leading from Homo erectus to Homo sapiens and Homo floresiensis is suggested in Figure 4.

Conclusion
During the Quaternary, sedimentation in the Indonesian regions occurred mostly in non-marine environments and is frequently associated with fossil freshwater molluscs. Quaternary sediments are well exposed in some islands, e.g. in Java, Flores, Sumbawa, Sumba, and Timor. All Quaternary non-marine sediments in Java, Timor, and Flores unconformably cover marine sediments of Late Pliocene age.

The Quaternary sediments contain hominids (restricted to Java), vertebrate fossils, and artifacts. Up to now, most of the hominid specimens in Java – Homo erectus – are found in the Kendeng Zone from several locations in Central and East Java. Vertebrate fossils, however, can be collected from almost all Indonesian islands in Early to Late Pleistocene deposits.
First Islanders

Yahdi Zaim, Yan Rizal & Aswan

Early hominids – *Homo erectus cf. palaeojavanicus* (*Meganthropus palaeojavanicus*) arrived in Java in the Early Pleistocene (1.6 – 1.0 Ma), after the arrival of Satir and Ci Saat Faunas to Indonesia through the Sunda Land at the end of Late Pliocene. Later on, during Middle to Late Pleistocene (1.0 – 0.125 Ma) another hominid arrived in Java as indicated by the presence of *Homo erectus* (including *Homo erectus trinilensis* and *Homo erectus ngandongensis/soloensis*).

Small-bodied hominins were discovered in eastern Indonesia, at Liang Bua, Flores island. Their fossil remains are attributed to *Homo floresiensis* (orang pendek – pygmy man) dated as 18,000 BP or end of Late Pleistocene (Brown et al., 2004; Morwood et al., 2004, 2005). They were most probably coexistence with *Homo sapiens*.

**References**


First Islanders

Figure 1 – Hypothetical map of Java Island during Quaternary

Figure 2 – Quaternary stratigraphy of Java (sources from various authors)
Figure 3 – Hominid and Vertebrate pathways in Java during Quaternary
The origin of *Homo sapiens* or anatomically modern humans has been a long concern of many scientists. Its occurrences in Africa, Asia, Europe, Australia, America and Island Southeast Asia provide a number of questions rather than answer regarding its evolution, migration and adaptation in each of the particular environmental conditions in these areas of the world. Its relationship with the presently known fossil record can be traced back to the early African representatives of the genus *Australopithecus*, and *Homo* (*Homo habilis* and *Homo ergaster*), and other widespread and more recent species such as *H. erectus*, *H. neanderthalensis*, and more directly to the so called “archaic” forms of *Homo sapiens*. The evolution of *Homo sapiens* has been a big question especially if we look at the human fossil record available. Perhaps, the species *Homo sapiens* made its first appearance during the Pleistocene, and chronologically around 180,000 to 100,000 years ago, in Eastern Africa based on the fossils discovered in Omo Kibish and Herto Bouri in Ethiopia.

In Island Southeast Asia, which is the subject of this *Human Origins Patrimony in Southeast Asia* (HOPsea), attempts have been made to trace the origin and evolution of *Homo sapiens* from its local predecessor *Homo erectus*. *Homo erectus* may have its first appearance in Java more than 1.5 millions years ago in Sangiran and Modjokerto; and may have ultimately become extinct by around 18,000 years ago only in the island of Flores as a pygmy form, known as *Homo floresiensis* (Morwood, et al. 2004). However, according to our present state of knowledge, there seems to be no direct biological or genetic link yet established between *Homo erectus* and *Homo sapiens*, although they may have lived side by side in time and perhaps in the same places or areas of similar environment. There is just no transitional fossil found yet so far that could demonstrate local evolutionary changes of the salient characteristics of *Homo erectus* into those of *Homo sapiens*. As for the whole present human population, the roots of Southeast Asian *Homo sapiens* were certainly in African.

What happened in between 1.5 million years ago to 18,000 years ago regarding the appearance of *Homo sapiens* which is the subject matter of this HOPsea valorization? From the present knowledge, human presence and activities are attested from more than 250,000 to 80,000 years ago on the basis of lithic industries left at Song Terus Cave in the Pumung area of Pacitan, Gunung Sewu, Java, Indonesia (Simanjuntak 2002; Semah et al. 2004; Hameau et al., 2007). Those industries, discovered in remnants of fluviatile terraces preserved in the cave, are characterized by rather crude artifacts with large irregular shaped flakes. Then more recent but actual human occupation layers inside the cave are found. The oldest archaeological level, dated around 50,000 years ago, is characterized by an assemblage
of faunal remains and flake tools. Nevertheless, the biological identity of the manufacturers of these tools is not known since no fossil hominid remains has been found so far from those archaeological layers. Another cave in the Punung area, the Tabuhan Cave, preserved also the indices of a true cave habitation with notable flakes and flake-tools, with several cores and percutors indicating knapping activities inside the cave. Based on the dating of the cave, this was from the period 60,000 to 12,000 years ago, suggesting the oldest cave habitation in Southeast Asia by humans, but again no Homo sapiens fossil was found here so far.

In Mainland Southeast Asia, the first modern humans were potentially ancestors to the so-called Australo-Melanesian stock, and were probably of various biological populations. In peninsular Malaysia, lithic assemblages from Kota Tampan dated to around 74,000 years ago, were interpreted as products of early Homo sapiens (Majid, 2003). This would be consistent with the results obtained from mitochondrial DNA studies of Andaman Islanders (Thangaraj, et al. 2005) and the Orang Asli in the Malaysian Peninsula (Macaulay, et al. 2005) indicating genetic lineages with time depths of 65-60,000 years ago (Barker, et al. 2007). However, the earliest most complete Homo sapiens skeleton known so far from continental Southeast Asia, AMS-dated on associated charcoal to 25,800 +/− 600 BP, comes from Moh Khiew site in southern Thailand (Matsumura and Pookajorn 2005; Detroit, 2002).

For the earliest Homo sapiens in Island Southeast Asia, actual fossil evidences and associated direct dates are from: 1) The Tabon Cave, Palawan, Philippines with the date of 47,000 +/- 11/10,000 years ago (Dizon, et al. 2002; Detroit et al. 2004); 2) The Niah Cave, Sarawak, Borneo, Malaysia, on the “Deep Skull” with a date of 37-35,000, but with a more probable date now of 45-39,000 years ago (Barker, et al. 2006). During the 1950s and 1960s the so-called “Deep Skull” even has the earliest date for anatomically modern human remains anywhere else in the world.

In Tabon Cave at least three secured dates from the direct dating of human fossils have demonstrated of their presence from about 47,000, 31,000 and 16,000 years ago. Niah Cave has also a very long occupational period of about 5000 years of human activities inside the cave. This would suggest a very long period of biological, cultural and behavioral adaptation in the tropical environment for these early Homo sapiens. There is no evidence though that the anatomically modern human remains found in both Tabon and Niah caves were intentional burials.

Perhaps the earliest human burials in Island Southeast Asia are those found in Braholo Cave, western part of Gunung Sewu, in flexed position with dates from around 13,000 to 9,000 years ago. Other flexed burials were also found in Song Terus and Song Keplek, in the eastern part of Gunung Sewu, from about 10,000 to 7,000 BP. Based on the morphological characteristics of the skeletal remains, these individuals were apparently more closely related to an “Australo-Melanesian” palaeo-population rather than to present days inhabitants of the region (Détroit, 2002 and 2006; Widianto, 2002). In the Tabon Cave areas, Holocene human burials were found in Duyong Cave as well.
The coming of the true Neolithic Period in the Holocene of Island Southeast Asia can be traced back to the movement of the Austronesian people, who may have been colonizing out of Taiwan, by around 4,500 years ago (Bellwood and Dizon 2005). These people had horticulture, red slipped pottery with diagnostic circle stamp designs, used stone adzes and axes, had spindle whorl and obviously sailors who traveled across the South China Sea and the vast Pacific Ocean. It seems that the present archaeological evidence suggests that there were a number of modern human populations who had occupied and some are continuously occupying Island Southeast Asia and the rest of the Pacific.

References


**Austronesians**

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There is no doubt that anatomically modern humans were already inhabiting both mainland and island Southeast Asia, including the Australian continent from the late Pleistocene at least 60,000 years ago to the Holocene period. Although these people from the Palaeolithic period had their own lithic traditions of the chopper-chopping tools and flake industries and survived by hunting and gathering strategies even during the Mesolithic period, about 10,000 years ago, they must have had developed their own language and culture prior to the Austronesian languages. During the Holocene and by around 6,000 years ago a proto-Austronesian language evolved in a population somewhere in the southern-most part of China and may have gone through Taiwan. The Austronesian culture comes in a package of a Neolithic assemblage with grinding, drilling and polishing stone technology (a completely new lithic industry that is adapted to boat-building and sea faring); developed pottery making, horticulture, agriculture and domestication of animals and of course a distinctive language in which many of its evolved forms and dialects are still spoken today in most of Southeast Asia and the Pacific.

Austronesian is a language family, previously known also as the Malayo-Polynesian group of languages. It is composed of around 1,200 languages, spoken by a widely distributed people of about 350 million spread across Mainland and Island Southeast Asia, including Madagascar to the west, New Guinea to New Zealand and in some of the Pacific Islands to the east and south. There are debates regarding the origin and homeland of the Austronesians. These include that of Solheim (1985), who argued for an Austronesian homeland in Mindanao, Philippines and/or in northeastern Indonesia, a northern route movement; where the speakers of the language have spread through out Southeast Asia and the Pacific. The opposite of this is that of Bellwood (1985), who argued for the Austronesian homeland somewhere in southern China through Taiwan and an “Out of Taiwan” hypothesis, or a north to south movement to the Philippines across Southeast Asia and the Pacific.

The reconstruction of the Austronesian speaking peoples was basically culled from the anthropological linguistic data (Blust 1995), some comparative material culture, and from the genetic mitochondrial DNA studies of peoples in Southeast Asia and Oceania. In more recent time substantial archaeological data have been accumulating in support of Bellwood’s “Out of Taiwan” model (Bellwood and Dizon, 2005) Accordingly, the movement may have started by around 5500 years ago where the Austronesian speakers have brought with them aspects of their Neolithic culture including stone polished adzes and axes for boat-building and very distinctive red slipped potteries with circle stamped decorations, stone bark cloth beaters, spindle whorls, fishing implements among others. Once they reached the Philippines, they could have improved further their boat-building technology which allowed them to travel for long distance navigation, colonizing the coastal areas of mainland Southeast Asia, the Indonesian archipelago and the rest of the Pacific.
Archaeological evidences have shown that polished-adze technology is very similar between Taiwan and Philippines including the red slipped wares of earthenware pots with circle stamped designs and some cord marked impressions by around 5000 - 4500 BP in the Batanes Islands, northernmost part of the Philippines and Cagayan Valley in northern Luzon. A series of C-14 dates from archaeologically excavated sites in the Batanes group of islands and in the Lallo area of Cagayan Valley have shown this Austronesian occupation up to 2000 years ago and in later times (Ogawa 2002; Bellwood and Dizon 2005; Hung 2005).

At least, by 5000 years ago cultivation arrived in Taiwan, and the Austronesian farming communities moved, through the Islands and Mainland Southeast Asia all the way to the islands in Oceania. These people “carried a Neolithic suite of artefacts and crops, such as plain and red-slipped pottery sometimes with perforated ring feet, stone adzes, spindle whorls, barkcloth beaters, stone and shell ornaments” (Mijares, 2007). Furthermore, fishing communities in coastal areas and island environments grew in numbers.

Fengtian nephrite, exploited in Taiwan around 4500 BP was brought in the Philippines around 3800-3500 BP, and manufactured for the Lingling-O or split earrings and other ornaments is another characteristic of the Austronesian presence all over Southeast Asia. It could have been traded with pottery also may have been exchanged for forest products collected by the natives. Some nephrite artefacts coming from Taiwan have been found from various sites in the Philippines like Batanes, Palawan and Batangas, and in Vietnam, Thailand, and Niah in Sarawak, Kalimantan Borneo showing the importance and spread of their trade activities.

The Austronesian speaking people may not actually have replaced the original indigenous inhabitants of Pleistocene Southeast Asian Mesolithic population, but a kind of assimilation of cultural and language traits with these surviving inhabitants, such as the pygmies and the various groups of Negritos which are still spread throughout the region of both Mainland and Island Southeast Asia, may have taken place.

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First Islanders

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4. Adi Bin Taha, Malaysia
5. Pisit Charoenwongsa, Thailand
6. Rasmi Shooongdej, Thailand
7. Vu The Long, Viet Nam

The next islanders......